Medico-Legal Update
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Study of Lip Prints in Medical Students in Relation to Personality Traits

Atal DK¹, Bhasin K², Das S³

¹Associate Professor, ²MBBS Student, ³Professor, Department of Forensic Medicine, HIMS, SRH University, Jolly Grant, Dehradun, Uttarakhnad

ABSTRACT

The paper presents the study of lip prints and their relation to personality traits in medical students of Himalayan Institute of Medical Sciences, Dehradun. Lip prints were analysed and classified according to the various Lip prints Types (Type I, Type I', Type II, Type III, Type IV, Type V). The personality traits of the students were analysed with the help of predesigned ‘Personality Traits assessment Questionnaire’ based on Cattell’s 16 Factor Key. The findings were divided into 6 categories based on the Lip print types and a correlation was then made between the lip prints and the personality traits scores. In present study, percentage of cases falling above average score and percentage of cases above 75th percentile were taken into consideration. It was observed that trait T1 (warmth) and T8 (i.e. sensitivity) were associated with Lip print type II. Trait T5 (i.e. Liveliness) with lip print type III and trait T2 (i.e. intellect) with lip print type IV respectively. However, on the basis of 25th percentile, it was observed that Lip print type I was associated with trait T9 (Paranoia) and T12 (Anxiety) on its lower score. Trait T11 (Introversion), T12 (Anxiety), T14 (Independence) and T16 (Tension) were associated with Lip print type III on its lower score. Trait T9 (Paranoia), T11 (Introversion) and T14 (Independence) were associated with lip print type IV. Knowledge about this relation can be useful in forensic studies and criminal investigations for identification of a person.

Keywords: Lip prints, Personality traits.

INTRODUCTION

Forensic identification has been necessary to identify individuals who are either missing or are perpetrators of crime and hiding their identity, or unknown deceased persons in case of accidents, homicides or suicides. It is well established that finger prints are unique for an individual. Similarly, each individual has unique pattern of lip prints. Lip prints are characteristic patterns present on labia mucosa in the form of wrinkles and grooves which are formed by the normal lines and fissures. Moreover, personality is made up of the characteristic patterns of thoughts, feelings and behaviours that make a person unique. It arises from within the individual and remains fairly consistent throughout life. The trait approach to personality is commonly used to study personality of an individual. The combination and interaction of various traits forms a personality that is unique to each individual.¹

There are many studies on personality traits, few studies showing correlation of personality traits with other parameters like blood group, stature, gender, etc. However, no specific research in relation to lip prints and personality traits was found. The current work was an endeavour to study lip prints of medical students and relate it with their personality traits and thus to find out any existing correlation between them.

MATERIALS & METHOD

The study was conducted as a part of Short Term Research Project at the Himalayan Institute of Medical Sciences (HIMS), Dehradun. The study sample
comprised of 100 medical students of HIMS, 50 girls and 50 boys aged between 18-25 years. Care was taken to select individuals who neither have any lesions on the lips nor suffer from any hypersensitivity from the lipstick which was used. The material used for the present study was Red lipstick, cellophane tape, A4 sheets, magnifying lens and predesigned ‘Personality Traits Assessment Questionnaire’. The method used is a simple method done with the help of cellophane tape and red lipstick. Lipstick was applied on the lips of the individuals and the prints were obtained on a cellophane tape piece and were then stuck on an A4 sheet for permanent record. The prints were then analyzed with the help of a magnifying glass and categorized on the basis of different types of lip prints (Based on Suzuki and Tsuchihashi Classification). To analyse the personality traits, a questionnaire was prepared and the traits were analysed according to Cattell’s 16 Factor Key. A correlation was then made between the lip prints and the personality traits scores based on predesigned ‘Personality Traits assessment Questionnaire’.

Cattell’s 16 Factor Key

<table>
<thead>
<tr>
<th>Personify Trait</th>
<th>Low Score</th>
<th>High Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1 Warmth</td>
<td>Cold, selfish</td>
<td>Supportive, comforting</td>
</tr>
<tr>
<td>T2 Intellect</td>
<td>Instinctive, unstable</td>
<td>Cerebral, analytical</td>
</tr>
<tr>
<td>T3 Emotional Stability</td>
<td>Irritable, moody</td>
<td>Level headed, calm</td>
</tr>
<tr>
<td>T4 Aggressiveness</td>
<td>Modest, docile</td>
<td>Controlling, tough</td>
</tr>
<tr>
<td>T5 Liveliness</td>
<td>Somber, restrained</td>
<td>Wild, fun loving</td>
</tr>
<tr>
<td>T6 Dutifulness</td>
<td>Untraditional, rebellious</td>
<td>Conforming, traditional</td>
</tr>
<tr>
<td>T7 Social Assertiveness</td>
<td>Shy, withdrawn</td>
<td>Uninhibited, bold</td>
</tr>
<tr>
<td>T8 Sensitivity</td>
<td>Coarse, tough</td>
<td>Touchy, soft</td>
</tr>
<tr>
<td>T9 Paranoia</td>
<td>Trusty, easy going</td>
<td>Wary, suspicious</td>
</tr>
<tr>
<td>T10 Abstractness</td>
<td>Practical, regular</td>
<td>Strange, exploratory</td>
</tr>
<tr>
<td>T11 Introversion</td>
<td>Open, friendly</td>
<td>Private, quiet</td>
</tr>
<tr>
<td>T12 Anxiety</td>
<td>Confident, self assured</td>
<td>Fearful, self-doubting</td>
</tr>
<tr>
<td>T13 Open-mindedness</td>
<td>Close-minded, set-in-ways</td>
<td>Curious, exploratory</td>
</tr>
<tr>
<td>T14 Independence</td>
<td>Outgoing, social</td>
<td>Loner, craves solitude</td>
</tr>
<tr>
<td>T15 Perfectionism</td>
<td>Disorganized, messy</td>
<td>Orderly, thorough</td>
</tr>
<tr>
<td>T16 Tension</td>
<td>Relaxed, cool</td>
<td>Stressed, unsatisfied</td>
</tr>
</tbody>
</table>

OBSERVATIONS AND RESULTS

Table 1: Average scores

<table>
<thead>
<tr>
<th>Type</th>
<th>Cases</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
<th>T5</th>
<th>T6</th>
<th>T7</th>
<th>T8</th>
<th>T9</th>
<th>T10</th>
<th>T11</th>
<th>T12</th>
<th>T13</th>
<th>T14</th>
<th>T15</th>
<th>T16</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>28</td>
<td>3.82</td>
<td>2.6</td>
<td>3</td>
<td>0.5</td>
<td>1.96</td>
<td>3.53</td>
<td>1.46</td>
<td>4.07</td>
<td>0.28</td>
<td>1.96</td>
<td>1.78</td>
<td>0.71</td>
<td>1.03</td>
<td>2.28</td>
<td>0.46</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>12</td>
<td>3.83</td>
<td>3.67</td>
<td>3.16</td>
<td>0.5</td>
<td>1.83</td>
<td>3.5</td>
<td>1.08</td>
<td>4.25</td>
<td>0.25</td>
<td>2.5</td>
<td>1.5</td>
<td>0.41</td>
<td>1.34</td>
<td>0.91</td>
<td>3.17</td>
<td>0.75</td>
</tr>
<tr>
<td>III</td>
<td>16</td>
<td>4.68</td>
<td>2.87</td>
<td>2.5</td>
<td>0.43</td>
<td>2.87</td>
<td>3.37</td>
<td>1.12</td>
<td>3.75</td>
<td>0.25</td>
<td>2.62</td>
<td>0.87</td>
<td>0.31</td>
<td>1.87</td>
<td>0.5</td>
<td>2.18</td>
<td>0.18</td>
</tr>
<tr>
<td>IV</td>
<td>11</td>
<td>4.09</td>
<td>4.45</td>
<td>2.72</td>
<td>0.81</td>
<td>2.63</td>
<td>4</td>
<td>2</td>
<td>3.36</td>
<td>0.27</td>
<td>3</td>
<td>1.54</td>
<td>1</td>
<td>1.27</td>
<td>1.09</td>
<td>3</td>
<td>0.81</td>
</tr>
<tr>
<td>V</td>
<td>6</td>
<td>3.67</td>
<td>2.5</td>
<td>2.33</td>
<td>0.5</td>
<td>1.5</td>
<td>2.83</td>
<td>0.5</td>
<td>3.17</td>
<td>0.34</td>
<td>1.67</td>
<td>2.67</td>
<td>1</td>
<td>1.83</td>
<td>2</td>
<td>2.17</td>
<td>1.5</td>
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</tbody>
</table>

On analyzing average scores, it was observed in the present study that Trait T8 (i.e. sensitivity) is dominant in individuals with lip print types I and II. The trait T1 (warmth) is dominant in individuals with lip print types...
III and trait T2 (i.e. intellect) is dominant in individuals with lip prints type IV.

**Table 2: Percentage of cases above average:**

<table>
<thead>
<tr>
<th>Type</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
<th>T5</th>
<th>T6</th>
<th>T7</th>
<th>T8</th>
<th>T9</th>
<th>T10</th>
<th>T11</th>
<th>T12</th>
<th>T13</th>
<th>T14</th>
<th>T15</th>
<th>T16</th>
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<tr>
<td>I</td>
<td>50.00</td>
<td>53.57</td>
<td>25.00</td>
<td>42.86</td>
<td>64.29</td>
<td>57.14</td>
<td>46.43</td>
<td>35.71</td>
<td>10.71</td>
<td>60.71</td>
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<td>35.71</td>
<td>42.86</td>
<td>25.00</td>
<td>39.29</td>
<td>32.14</td>
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<tr>
<td>II</td>
<td>66.67</td>
<td>66.67</td>
<td>25.00</td>
<td>50.00</td>
<td>58.33</td>
<td>41.67</td>
<td>33.33</td>
<td>50.00</td>
<td>8.33</td>
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<td>33.33</td>
<td>41.67</td>
<td>33.33</td>
<td>66.67</td>
<td>41.67</td>
<td>58.33</td>
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<tr>
<td>III</td>
<td>62.50</td>
<td>43.75</td>
<td>37.50</td>
<td>37.50</td>
<td>50.00</td>
<td>37.50</td>
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</tbody>
</table>

**Table 3: Percentage of Cases above 75th Percentile**

<table>
<thead>
<tr>
<th>Type</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
<th>T5</th>
<th>T6</th>
<th>T7</th>
<th>T8</th>
<th>T9</th>
<th>T10</th>
<th>T11</th>
<th>T12</th>
<th>T13</th>
<th>T14</th>
<th>T15</th>
<th>T16</th>
</tr>
</thead>
<tbody>
<tr>
<td>II</td>
<td>66.67</td>
<td>16.67</td>
<td>8.33</td>
<td>50.00</td>
<td>16.67</td>
<td>25.00</td>
<td>33.33</td>
<td>50.00</td>
<td>8.33</td>
<td>16.67</td>
<td>8.33</td>
<td>41.67</td>
<td>8.33</td>
<td>8.33</td>
<td>25.00</td>
<td>16.67</td>
</tr>
<tr>
<td>III</td>
<td>25.00</td>
<td>12.50</td>
<td>12.50</td>
<td>6.25</td>
<td>50.00</td>
<td>18.75</td>
<td>6.25</td>
<td>18.75</td>
<td>0.00</td>
<td>18.75</td>
<td>6.25</td>
<td>6.25</td>
<td>12.50</td>
<td>12.50</td>
<td>16.67</td>
<td></td>
</tr>
<tr>
<td>V</td>
<td>33.33</td>
<td>33.33</td>
<td>16.67</td>
<td>50.00</td>
<td>16.67</td>
<td>33.33</td>
<td>50.00</td>
<td>33.33</td>
<td>33.33</td>
<td>33.33</td>
<td>33.33</td>
<td>33.33</td>
<td>33.33</td>
<td>16.67</td>
<td>16.67</td>
<td></td>
</tr>
</tbody>
</table>

**Table 4: Correlation on the basis of percentage of cases above average score and percentage of cases above 75th percentile [Data is considered significant if 50% cases fall above average score or above 75th percentile]**

<table>
<thead>
<tr>
<th>Personality Trait</th>
<th>On the basis of cases above average score</th>
<th>On the bases of percentage of cases above 75th percentile</th>
<th>Personality Trait</th>
<th>On the basis of cases above average score</th>
<th>On the bases of percentage of cases above 75th percentile</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>II &gt; III</td>
<td>II</td>
<td>T9</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>T2</td>
<td>II &gt; IV</td>
<td>IV</td>
<td>T10</td>
<td>I &gt; III</td>
<td>--</td>
</tr>
<tr>
<td>T3</td>
<td>--</td>
<td>--</td>
<td>T11</td>
<td>V &gt; I &gt; III</td>
<td>--</td>
</tr>
<tr>
<td>T4</td>
<td>II &gt; V</td>
<td>II = V</td>
<td>T12</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>T5</td>
<td>I &gt; II = III = V</td>
<td>III</td>
<td>T13</td>
<td>III &gt; V</td>
<td>--</td>
</tr>
<tr>
<td>T6</td>
<td>I &gt; V</td>
<td>--</td>
<td>T14</td>
<td>II</td>
<td>--</td>
</tr>
<tr>
<td>T7</td>
<td>V</td>
<td>T15</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>T8</td>
<td>II = III</td>
<td>II</td>
<td>T16</td>
<td>II &gt; IV</td>
<td>--</td>
</tr>
</tbody>
</table>

On analyzing both percentage of cases above average score [Table 2] and 75th percentile [Table 3] simultaneously, it was observed that trait T1 (Warmth), T8 (Sensitivity) and T4 (Aggressiveness) were associated with Lip print type II. Trait T5 (Liveliness) with lip print type III and trait T2 (Intellect) with lip print type IV respectively. Lip print type V was associated with trait T7 (Social Assertiveness). [Table 4]
Table 5: Percentage of Cases below 25th Percentile

<table>
<thead>
<tr>
<th>Type</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
<th>T5</th>
<th>T6</th>
<th>T7</th>
<th>T8</th>
<th>T9</th>
<th>T10</th>
<th>T11</th>
<th>T12</th>
<th>T13</th>
<th>T14</th>
<th>T15</th>
<th>T16</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>7.14</td>
<td>21.43</td>
<td>7.14</td>
<td>57.14</td>
<td>35.71</td>
<td>14.29</td>
<td>25.00</td>
<td>10.71</td>
<td>92.86</td>
<td>0.00</td>
<td>46.43</td>
<td>85.71</td>
<td>21.43</td>
<td>35.71</td>
<td>32.14</td>
<td>67.86</td>
</tr>
<tr>
<td>II</td>
<td>0.00</td>
<td>8.33</td>
<td>0.00</td>
<td>50.00</td>
<td>8.33</td>
<td>8.33</td>
<td>25.00</td>
<td>0.00</td>
<td>91.67</td>
<td>0.00</td>
<td>8.33</td>
<td>59.33</td>
<td>8.33</td>
<td>33.33</td>
<td>16.67</td>
<td>41.67</td>
</tr>
<tr>
<td>III</td>
<td>0.00</td>
<td>12.50</td>
<td>12.50</td>
<td>62.50</td>
<td>12.50</td>
<td>12.50</td>
<td>12.50</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>50.00</td>
<td>75.00</td>
<td>6.25</td>
<td>62.50</td>
<td>25.00</td>
<td>81.25</td>
</tr>
<tr>
<td>IV</td>
<td>9.09</td>
<td>0.00</td>
<td>9.09</td>
<td>45.45</td>
<td>9.09</td>
<td>0.00</td>
<td>45.45</td>
<td>18.18</td>
<td>81.82</td>
<td>0.00</td>
<td>54.55</td>
<td>36.36</td>
<td>0.00</td>
<td>81.82</td>
<td>0.00</td>
<td>45.45</td>
</tr>
<tr>
<td>V</td>
<td>16.67</td>
<td>0.00</td>
<td>0.00</td>
<td>50.00</td>
<td>33.33</td>
<td>16.67</td>
<td>50.00</td>
<td>16.67</td>
<td>66.67</td>
<td>0.00</td>
<td>33.33</td>
<td>33.33</td>
<td>16.67</td>
<td>16.67</td>
<td>33.33</td>
<td>66.67</td>
</tr>
</tbody>
</table>

Table 6: Correlation on the basis of percentage of cases falling below 25th percentile [Data is considered significant if 50% cases fall below 25th percentile]

<table>
<thead>
<tr>
<th>Personality Trait</th>
<th>On the bases of percentage of cases below 25th percentile</th>
<th>Personality Trait</th>
<th>On the bases of percentage of cases below 25th percentile</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>--</td>
<td>T9</td>
<td>I &gt; II &gt; IV &gt; V</td>
</tr>
<tr>
<td>T2</td>
<td>--</td>
<td>T10</td>
<td>--</td>
</tr>
<tr>
<td>T3</td>
<td>--</td>
<td>T11</td>
<td>IV &gt; III</td>
</tr>
<tr>
<td>T4</td>
<td>III &gt; I &gt; II = V</td>
<td>T12</td>
<td>I &gt; III &gt; II</td>
</tr>
<tr>
<td>T5</td>
<td>--</td>
<td>T13</td>
<td>--</td>
</tr>
<tr>
<td>T6</td>
<td>--</td>
<td>T14</td>
<td>IV &gt; III</td>
</tr>
<tr>
<td>T7</td>
<td>V</td>
<td>T15</td>
<td>--</td>
</tr>
<tr>
<td>T8</td>
<td>--</td>
<td>T16</td>
<td>III &gt; I &gt; V</td>
</tr>
</tbody>
</table>

On analyzing 25th percentile [Table 5, 6], it was observed that Lip print type I was associated with trait T9 (Paranoia) and T12 (Anxiety) on its lower score. Trait T4 (Warmth), T11 (Introversion), T12 (Anxiety), T14 (Independence) and T16 (Tension) were associated with Lip print type III on its lower score. Trait T9 (Paranoia), T11(Introversion) and T14 (Independence) with lip print type IV. In addition Trait T7 shows association with Lip print type V.

However, 75th percentile and 25th percentile values of trait T4 shows conflict relation with Lip print type I, II III and VIN both extremes. Similarly, 75th percentile and 25th percentile values of trait T7 also shows conflict relation with Lip print type V in both extremes. So, findings of Trait T4 and T7 should be excluded from significant zone.

On analyzing 25th percentile [Table 5, 6], it was observed that Lip print type I was associated with trait T9 (Paranoia) and T12 (Anxiety) on its lower score. Trait T4 (Warmth), T11 (Introversion), T12 (Anxiety), T14 (Independence) and T16 (Tension) were associated with Lip print type III on its lower score. Trait T9 (Paranoia), T11(Introversion) and T14 (Independence) with lip print type IV. In addition Trait T7 shows association with Lip print type V.

DISCUSSION

Lip prints are one of the common evidence that is found at the scene of crime. On the glass of water or wine, on the body of the deceased or on a spoon, lip prints are easy to find. Analyzing these lip prints and identifying the lip print type of the person is an easy task. Suzuki et al conducted a study and concluded that lip prints are dissimilar among different individuals. It has already been shown by previous studies that lip prints can be used for identification of individuals, just like fingerprints. In the past, some researchers have found gender differences in lip print type. Sonal et al concluded that Type I and Type I’ patterns were found to be dominant in females, while Type III and Type IV pattern was dominant in males.

Bajpai et al also observed that in males the predominant type was found to be Type III (66%). In females, Type I and Type I’ were common. However, research studies and information regarding the use of lip prints as evidence in personal identification and criminal investigations are few.
The forensic expert always looks for clues that could lead him to solve a case of unnatural death. In cases of suicidal or homicidal deaths, the investigators also wish to understand the psychology of the person who committed it. Thus, understanding the personality and the psychology of the person in question is a major clue towards understanding the motive behind the homicidal death or suicide.

In addition, an idea about the personality or most probable psychology of the person who committed suicide may be utilised to prevent further attempts in future. In homicidal cases, having an estimate about the personality of the runaway accused can actually narrow out the search and may lead to faster identification.

Unlike physical characteristics, personality cannot be directly measured and must be inferred from checklist or questionnaire statements based on overt or covert human behaviour. Few limitation were associated with most studies, including that cultures and subcultures have not been exhaustively studied, they have relied exclusively on self-report methods and have used college student samples, whose members may be relatively Westernized. However, college students may be more familiar and comfortable with questionnaire methods than general population, yielding more meaningful data.

There are many approaches to study personality traits. Gordon Allport's Trait Theory, Cattell's Sixteen Personality Factors, Eysenck's Three Dimensions of Personality and The Five Factor Model were frequently used in earlier studies. In the present study, questionnaire was prepared and the traits were analysed according to Cattell's 16 Factor Key. Raymond B. Cattell believed that human characteristics such as creativity, authoritarianism, altruism, or leadership skills could be predicted from the fundamental personality traits. Over several decades, Cattell and his colleagues carried out comprehensive research using three different methodologies: observation of natural, in-situ life behaviour or L-data (Life record data e.g., academic grades, number of traffic accidents, or social contacts); questionnaire or Q-data from the self-report domain; and objective behaviour measured in standardized, experimental settings or T-data (e.g., number of original solutions to problem presented, responses to frustrations). Eventually, on the basis of these finding, he identified 16 basic behaviour clusters and developed widely used personality test called the 16 Personality Factor Questionnaire (16PF). 16PF traits combine to provide a comprehensive, in-depth understanding of an individual’s personality.

Though there have been no studies done previously on the correlation between lip prints and personality traits, the present study was conducted to establish any correlation between lip prints and personality traits of a person. The findings of the present study suggest that to some extent, personality traits of a person can be determined by the lip prints type. However, an overlap of traits was also observed between the different types of lip prints.

In the present study, percentage of cases falling above average score and percentage of cases above 75th percentile were taken into consideration. It was observed that trait T1 (warmth) and T8 (i.e., sensitivity) were associated with Lip print type II. Trait T5 (i.e., Liveliness) with lip print type III and trait T2 (i.e., intellect) with lip print type IV respectively.

On the basis of 25th percentile, it was observed that Lip print type I was associated with trait T9 (Paranoia) and T12 (Anxiety) on its lower score. Trait T11 (Introversion), T12 (Anxiety), T14 (Independence) and T16 (Tension) were associated with Lip print type III on its lower score. Trait T9 (Paranoia), T11 (Introversion) and T14 (Independence) were associated with lip print type IV.

CONCLUSIONS

The present study thus shows that there is some correlation between the lip print types and the personality traits of an individual. Knowledge about this relation can be useful in forensic studies and criminal investigations. If a forensic expert can assess the personality of an individual by observing the lip prints of an individual, it can be a major breakthrough in identification of a person.

Acknowledgment: The authors thank Mr Sati (Statistician), Miss Gargi Gupta (MBBS Student) and Dr. Yogesh Ahuja (Intern), Himalayan Institute of Medical Sciences, Dehradun for providing statistical support and assistance.

Ethical Clearance: The study was carried out after obtaining proper consent and ethical clearance from the University.

Source of Funding: Nil
Conflict of Interest: Nil

REFERENCE

A Five Year Retrospective Epidemiological Study of Burn Deaths

Jitender Jakhar¹, Tarun Dagar², S K Dhattarwal³, Vijay Pal Khanagwal⁴

¹Assistant Professor, ²Demonstrator, ³Senior Professor & Head, ⁴Professor, Department of Forensic Medicine
Pt. B.D. Sharma Post. Graduate Institute of Medical Sciences, Rohtak, Haryana

ABSTRACT

Burn injury cases are one of the common medical emergencies admitted to any hospital in India. There are several factors, which play role in the treatment, management, autopsy and investigations of burns death cases. This study is conducted with the aim to study the epidemiology of the burn deaths. All the records of the autopsies which were performed between January 2008 and December 2012 were analysed with respect to burn death, the age-gender distribution of burn death and manner of death. It was observed that total 7606 cases of unnatural death occurred at PGIMS Rohtak and brought to mortuary of Forensic Medicine Department between January 2008 and December 2012. It was analysed that most common cause of death was road side accident (32.78%) followed by burns (22.13%), poisoning (21.54%), murder (4.67%), railway accident (3.02%), drowning and other asphyxial deaths (2.59%), fall from height (1.42%), electrocution (1.36%), excess of alcohol (1%), snake bite (0.24%) and 9.23% of the deaths were described as miscellaneous deaths.

It was analysed that out of 7606 deaths, 1683 were the burn deaths. Majority of the burn victims were female i.e. 62%. The maximum number of the victims belonged to age group of 21 to 30 years i.e. 46%, followed by the age group of 31 years to 40 years i.e. 23.35%, with the least number of victims from the age group of less than ten years i.e. 1.48% followed by the age group of more than fifty years i.e. 2.14% cases. Manner of the burns was accident in majority of cases i.e. 73% followed by suicide i.e. 21% and homicide was found in 6% cases.

Keywords: Burn case, burn death, epidemiology.

INTRODUCTION

Fire has been known to mankind for about 400,000 years. Most of the communities believe that the whole universe is made up of five essential elements: Water (Jal), Air (Vayu), Earth (Prithwi), Sky (Aakash) and Fire (Agni). In this way fire or burns have great importance in our life.¹ Burns constitute a major role in mortality and morbidity of patients admitted to the hospital in the whole world, especially in the developing countries whether accidental, suicidal or homicidal. Burn injuries are among the most devastating of all injuries and a major global public health crisis. Burns are the fourth most common type of trauma worldwide, following traffic accidents, falls, and interpersonal violence. In India, thermal injury is one of the major causes of death, especially in females. The problem of burns in developing countries like India is more due to various socio-cultural & economic factors present in the country. Some of these factors may be poor housing conditions, poor maintenance of electric appliances, customs of wearing sarees or dupatta, dowry, illiteracy, ignorance and poverty.

The exact estimation of burns incidence is very much difficult due to large population and lack of proper reporting. The loads of over population, illiteracy, low socio-economic status, poor standards of safety at home and at industry, corruption etc has caused a significant rise in burns cases.² A ‘burning’ topic in India is the burn deaths of young females. This method of ending life is peculiarly common in our country. Many young newly married females die from burn injuries, the most common reasons given in inquest reports therefore being that she caught fire (a) while cooking; (b) after an oil explosion in a stove; or (c) when a chimney fell on her at night. These are the usual explanations given in post-mortem requisition.
documents furnished by the police, but on enquiry from relatives and neighbours most were not found to be true.\(^3\)

A number of studies on various aspects of burn have been reported from various part of India, but there is lack of information especially on fatalities ascribed to thermal injuries from the Post Graduate Institute of Medical Sciences, Haryana being the premier tertiary care centre receives burn cases from all parts of Haryana and give the representative picture of state wise scenarios.

**MATERIAL & METHOD**

The retrospective epidemiological study was carried for the period of January 2008 to December 2012 in Forensic Medicine Department at PGIMS, Rohtak, Haryana. The study included 7606 medico-legal post mortems performed in PGIMS, Rohtak during the five year period. Out of these 7606 cases, 1683 cases of burn death were taken for this detailed study. Data were collected from the autopsy records of the Department this record also incorporate the informations provided by police and relative regarding the cause of death. The information regarding cause of death, manner of death, age and sex wise distribution of cases of burn death and other details were taken from medical record section of Department of Forensic Medicine PGIMS, Rohtak. All the data was thus collected by preparing pre-tested structured Performa and were analysed systemically.

**OBSERVATION**

The present study comprised of 1683 autopsy cases of burns out of total 7606 autopsies during the period of January 2008 to December 2012. (Table 1)

<table>
<thead>
<tr>
<th>Years</th>
<th>Death due to burns (%)</th>
<th>Death due to other unnatural death causes (%)</th>
<th>Total unnatural death cases (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>308(23.87%)</td>
<td>982(76.13%)</td>
<td>1290(100)</td>
</tr>
<tr>
<td>2009</td>
<td>244(16.08%)</td>
<td>1273(83.92%)</td>
<td>1517(100)</td>
</tr>
<tr>
<td>2010</td>
<td>416(24.62%)</td>
<td>1274(75.38%)</td>
<td>1690(100)</td>
</tr>
<tr>
<td>2011</td>
<td>358(23.07%)</td>
<td>1194(76.93%)</td>
<td>1552(100)</td>
</tr>
<tr>
<td>2012</td>
<td>357(22.93%)</td>
<td>1200(77.07%)</td>
<td>1557(100)</td>
</tr>
<tr>
<td>Total</td>
<td>1683(22.13%)</td>
<td>5923(77.87%)</td>
<td>7606(100)</td>
</tr>
</tbody>
</table>

The average of the annual incidence burn death was 22.11% and the highest percentage of burn related death was in the year 2010(24.62%) and lowest in year 2009(16.08%). There was an increasing trend observed in unnatural deaths each year with a spurt in 2010.

Among all 7606 cases, burns were the second commonest cause of unnatural death (22.13%) after the road side accident(32.78%), followed by poisoning (21.54%), murder (4.67%), railway accident (3.02%), drowning and other asphyxial deaths (2.59%), fall from height (1.42%), electrocution (1.36%), excess of alcohol (1%), snake bite (0.24%) and 9.23% were miscellaneous deaths.

**Table 2: Distribution of Burn death cases according to Sex.**

<table>
<thead>
<tr>
<th>Years</th>
<th>Male (%)</th>
<th>Female (%)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>117(37.99%)</td>
<td>191(62.01%)</td>
<td>308</td>
</tr>
<tr>
<td>2009</td>
<td>92(37.70 %)</td>
<td>152(62.30%)</td>
<td>244</td>
</tr>
<tr>
<td>2010</td>
<td>168(40.38%)</td>
<td>248(59.62%)</td>
<td>416</td>
</tr>
<tr>
<td>2011</td>
<td>134(37.43%)</td>
<td>224(62.57%)</td>
<td>358</td>
</tr>
<tr>
<td>2012</td>
<td>131(36.69%)</td>
<td>226(63.31%)</td>
<td>357</td>
</tr>
<tr>
<td>Total</td>
<td>642(38.15%)</td>
<td>1041(61.85%)</td>
<td>1683</td>
</tr>
</tbody>
</table>
Among 1683 cases of burns, 61.85% were females and 38.15% were males. (Table 2)

Majority of the cases (45.93%) were in the age group between 21 to 30 years in both sexes followed by age group of 31 years to 40 years i.e. 23.35%, with the least number of victims were seen in the age group of less than ten years (1.66%) . (Table 3)

<table>
<thead>
<tr>
<th>Years</th>
<th>0-1</th>
<th>2-10</th>
<th>11-20</th>
<th>21-30</th>
<th>31-40</th>
<th>41-50</th>
<th>51-60</th>
<th>&gt;60</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>0(0)</td>
<td>5(1.62)</td>
<td>49(15.91)</td>
<td>149(48.38)</td>
<td>74(24.03)</td>
<td>16(5.19)</td>
<td>7(2.27)</td>
<td>8(2.60)</td>
<td>308</td>
</tr>
<tr>
<td>2009</td>
<td>1(0.40)</td>
<td>7(2.87)</td>
<td>47(19.26)</td>
<td>102(41.80)</td>
<td>61(25.01)</td>
<td>13(5.33)</td>
<td>6(2.46)</td>
<td>7(2.87)</td>
<td>244</td>
</tr>
<tr>
<td>2010</td>
<td>1(0.24)</td>
<td>5(1.20)</td>
<td>72(17.31)</td>
<td>191(45.91)</td>
<td>91(21.88)</td>
<td>33(7.01)</td>
<td>12(2.88)</td>
<td>11(2.64)</td>
<td>416</td>
</tr>
<tr>
<td>2011</td>
<td>1(0.27)</td>
<td>4(1.12)</td>
<td>64(17.88)</td>
<td>165(46.09)</td>
<td>81(22.63)</td>
<td>29(8.10)</td>
<td>6(1.68)</td>
<td>8(2.33)</td>
<td>358</td>
</tr>
<tr>
<td>2012</td>
<td>0(0)</td>
<td>4(1.12)</td>
<td>63(17.65)</td>
<td>166(46.50)</td>
<td>86(24.09)</td>
<td>27(7.56)</td>
<td>5(1.40)</td>
<td>6(1.68)</td>
<td>357</td>
</tr>
<tr>
<td>Total</td>
<td>3</td>
<td>25</td>
<td>295</td>
<td>773</td>
<td>393</td>
<td>118</td>
<td>36</td>
<td>40</td>
<td>1683</td>
</tr>
<tr>
<td>% 0.18</td>
<td>1.48</td>
<td>17.53</td>
<td>45.93</td>
<td>23.35</td>
<td>7.01</td>
<td>2.14</td>
<td>2.38</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Manner of the burns was accident in majority of cases i.e. 72.43% followed by suicide i.e. 20.92% and homicide was found in 6.65% cases.

Table 4: Distribution of Burn death Cases According to Manner.

<table>
<thead>
<tr>
<th>Years / manner of burns</th>
<th>Homicidal (%)</th>
<th>Suicidal (%)</th>
<th>Accidental (%)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>21(6.82%)</td>
<td>67(21.75%)</td>
<td>220(71.43%)</td>
<td>308</td>
</tr>
<tr>
<td>2009</td>
<td>19(7.79%)</td>
<td>47(19.26%)</td>
<td>178(72.95%)</td>
<td>244</td>
</tr>
<tr>
<td>2010</td>
<td>26(6.25%)</td>
<td>89(21.39%)</td>
<td>301(72.36%)</td>
<td>416</td>
</tr>
<tr>
<td>2011</td>
<td>24(6.70%)</td>
<td>76(21.23%)</td>
<td>258(72.07%)</td>
<td>358</td>
</tr>
<tr>
<td>2012</td>
<td>22(6.16%)</td>
<td>73(20.45%)</td>
<td>262(73.39%)</td>
<td>357</td>
</tr>
<tr>
<td>Total</td>
<td>112(6.65%)</td>
<td>352(20.92%)</td>
<td>1219(72.43%)</td>
<td>1683</td>
</tr>
</tbody>
</table>

DISCUSSION

In the present study which was spread over a period of five years, it was found that out of total 7606 cases of unnatural death 1683 were deaths due to burn.

Burn injuries have been a major cause of concern since pre-historic days to the present era of modern medicine. However, the general belief that burns usually occur at the two extreme of age, indicating the accidental nature of infliction does not hold true in the present Indian setup where the majority of the reported cases belong to third decade of life. Despite of the modernization, the domestic fire is the major cause of the burns with maximum involvement of females.

This may have to do with the fact that Indian rural & economically underprivileged section still uses primitive cooking & heating methods at home. Another factor is poor safety standards across all levels of society and ignorance of masses regarding safety of others and of first aid knowledge.

In the present study, there is a predominance of female victims( 61.85%) compared to males (38.15%) and majority of them were in the reproductive and productive age groups i.e. 21-30 Years (45. 93%). Similarly, in an earlier study, Chawla et al had observed 64% cases belonging to females and 52% cases were in the age group of 21-30 years. These observations are confirmatory with other studies also from various regions of India. This may be due to gender difference, socio-cultural factors and dowry problems.
The most common manner of burns was accidental (72.43%) followed by the suicidal (20.92%) and homicidal types (6.65%). Memchoubi Ph. and H. Nabachandra observed that majority of victim were died accidentally, which is supported by other studies also. The female predominance in accidental burn deaths revealed from present study is probably because of the fact that about 60-70% of our total Population lives in villages (in rural area) where females are mostly responsible for the household work which includes working with fire in kitchen and other domestic chores. The high incidence of burn deaths, especially among the young females is often attributed to cooking on open unguarded flames on chulhas accompanied with loose, voluminous, highly inflammable, synthetic garments / saris which catch fire easily & suddenly while cooking.

Self immolation is a preferred method of suicide in households due to the fact that kerosene oil, match sticks, and other cooking material, being easily available in houses and as for homicide, it helps to hide not only the torture and other means of violence but also helps to tamper with or even destroy the circumstantial evidence.

In India, many deaths are not registered as suicide due to fear of social and legal consequences associated with the same (IPC 306 and IPC 309).

Memchoubi Ph. and H. Nabachandra observed that majority of victims died accidentally, which is supported by other studies also.

In the present study, burns are the second commonest cause of death after accident in the age group of 21 - 30 years, most of the newly married females are also in the same age group which helps to emphasize the fact that epidemic of the burn fatalities in India go beyond the meaning implied in the term ‘accident’ and could be aptly termed as a ‘Social Calamity’. These deaths in general and homicidal and suicidal burn deaths in particular have genuinely been termed as ‘Bride Burning’ or ‘Dowry Deaths’.

As mentioned in above table no. 3 higher incidence of suicidal deaths is seen in age group of 21-30 years (45.93%) followed by 31-40 years (23.35%). Our finding coincides with Sahoo P. C. (1999), Chavan K. D. (1999), Shinde Jayant (2000), Sandeep S. Kadu (2011). It occurs due to different Social, Economical and Psychological problems faced by this age group.

Suicidal act is committed frequently as a “Cry for help” rather than with a clear desire to die. It would appear that where this cry for help can be answered, and the help can be continued in an attempt to solve outstanding problems leading to the act, much suffering may be relieved and renewed attempts may be prevented. The result of this study shows that the burn death is the second common cause of death, burn deaths are mostly accidental in nature and involve reproductive and productive age groups i.e. 21-30 years. this study also indicates that, by not only a strong legal support network but also safety precautions, opportunities for essential education and awareness, alternative accommodation and a change in attitude and mind set of society, judiciary, legislature, executive, men and the most importantly women herself can lower or prevent such deaths.

Acknowledgement: Nil.

Source of Funding: Self.

Conflict-of-Interest Statement: There is no conflict of interest as it was a retrospective study based on the already available record.

Statement of Informed consent: This study is based on the available record so there is no matter of consent.

Statement of Human and Animal Rights: No human right and animal right is violated in this case.

No ethical violation is done.

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Estimation of Stature from Hand Length in Jhalawar Region Rajasthan

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¹Associate Professor, ²Professor & Head, Department of Forensic Medicine & Toxicology, S R G Hospital & Medical College, Jhalawar, Rajasthan

ABSTRACT

Stature is one of the primary characteristics of identification. It’s estimation is especially important in medico-legal cases where the dead body is found in skeletonised or dismembered state. In present study attempts are made to find out the correlation between the stature and hand length. 160 healthy medical students (80 male & 80 female) of Jhalawar medical college are included in study. All these students were measured for stature and hand length. The data obtained were analyzed statistically. Regression equations were derived for right and left hand separately in both male and female. With the help of these regression equations stature can be estimated when mutilated or dismembered portion of upper limb is found. Using the regression equations formulae derived in present study, stature can be estimated within the error of 3.76 to 4.07cm from the hand length.

Keywords: Stature, Hand length, Regression Equations.

INTRODUCTION

Stature is one of the important criteria to establish the identity of an unknown person. A forensic expert is often required to estimate the stature from dismembered body parts or long bones especially in cases of mass disaster like bomb blast, plane crash & train accidents etc. Such estimation is based on the fact that length of different body parts and bones bears some more or less constant relationship with the body length.

Many studies has been conducted by different researchers to estimate the stature using long bones such as Pearson k.¹, Nath B S², Trotter M. & Glesser G. C.³, Albrow D.⁴, Athwale N. C.⁵ etc.

Later on studies has been conducted to find out the correlation between different body parts & stature. Such studies has been conducted by different researchers like Thakur S. D. & Rai K. S.⁶, Bhatnagar et.al.⁷, Saxena S. K.⁸, Abdel Malek et al.⁹, Krishan K.& Sharma A.¹⁰ and Kumar et al.¹¹ etc.

The present study is an attempt to find out correlation between the stature and hand length. This study will help to estimate the stature of an unknown dead body found in mutilated or dismembered state with intact hand.

MATERIAL & METHOD

The present study has been conducted on 160 (80 male and 80 female) healthy medical students of medical college, Jhalawar. All students belongs to age group 18-25 years. Their informed consent were taken and then their measurements were taken. Stature was measured in standing position on stadiometer without shoes with head oriented in eye to eye (Frankfort) plane. The hand length was measured using the sliding caliper from the proximal crease of wrist to the tip of middle finger when the hand was held straight and stretched. All these measurements were taken by author no 1 on the same time on each day. After that these data were analyzed statistically and regression equations were derived for right and left hand separately in both male and female.

Observation and Discussion: The height of the male varies from 158cm to 185cm with mean height is of 172.1cm and standard deviation is 5.791cm.
The length of right hand of the males varies from 18.4 cm to 22.2 cm with mean hand length is 20.181 cm and standard deviation is 0.937 cm and correlation coefficient with stature is 0.713. The length of left hand of the males varies from 18.6 cm to 22.5 cm with mean hand length is 20.126 cm and standard deviation is 0.934 cm and correlation coefficient with stature is 0.760 (see Table-1).

<table>
<thead>
<tr>
<th>Measurements</th>
<th>Height</th>
<th>Right hand length</th>
<th>Left hand length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum</td>
<td>185</td>
<td>22.2</td>
<td>22.5</td>
</tr>
<tr>
<td>Minimum</td>
<td>158</td>
<td>18.4</td>
<td>18.6</td>
</tr>
<tr>
<td>Mean</td>
<td>172.1</td>
<td>20.181</td>
<td>20.126</td>
</tr>
<tr>
<td>Standard deviation (S D)</td>
<td>5.791</td>
<td>0.937</td>
<td>0.934</td>
</tr>
<tr>
<td>Correlation coefficient (r)</td>
<td>0.713</td>
<td>0.760</td>
<td></td>
</tr>
<tr>
<td>Standard error</td>
<td>4.07</td>
<td>3.76</td>
<td></td>
</tr>
</tbody>
</table>

The height of the females varies from 149 cm to 173 cm with mean height is of 158.831 cm and standard deviation is 5.395 cm. The length of right hand of the females varies from 16.6 cm to 21 cm with mean hand length is 18.296 cm and standard deviation is 0.901 cm and correlation coefficient with stature is 0.663. The length of left hand of the females varies from 16.4 cm to 21 cm with mean hand length is 18.236 cm and standard deviation is 0.920 cm and correlation coefficient with stature is 0.670 (see Table-2).

<table>
<thead>
<tr>
<th>Measurements</th>
<th>Height</th>
<th>Right hand length</th>
<th>Left hand length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum</td>
<td>173</td>
<td>21</td>
<td>21</td>
</tr>
<tr>
<td>Minimum</td>
<td>149</td>
<td>16.6</td>
<td>16.4</td>
</tr>
<tr>
<td>Mean</td>
<td>158.831</td>
<td>18.296</td>
<td>18.236</td>
</tr>
<tr>
<td>Standard deviation (S D)</td>
<td>5.395</td>
<td>0.901</td>
<td>0.920</td>
</tr>
<tr>
<td>Correlation coefficient (r)</td>
<td>0.663</td>
<td>0.670</td>
<td></td>
</tr>
<tr>
<td>Standard error</td>
<td>4.05</td>
<td>4.00</td>
<td></td>
</tr>
</tbody>
</table>

For estimation of stature from hand length regression equations is derived using the formulae

\[
y - y' = r \frac{SD_y}{SD_x} (x - x')
\]

Here \(y\) = Stature, \(y'\) = mean stature, 
\(r\) = Correlation coefficient, 
\(SD_y\) = Standard deviation of height 
\(SD_x\) = Standard deviation of hand length, 
\(x\) = hand length, \(x'\) = mean hand length

Using this formulae stature is calculated in females as-

\[
\text{Stature} = 3.97x \text{ Right hand length } + 86.22
\]

\[
\text{Stature} = 3.93x \text{ left hand length } + 87.17
\]

Conclusion: In the present study, a significant correlation between stature and hand length has been observed in both males and females.
Measurements of right hand length were greater than the left hand but the difference is marginal and statistically insignificant.

By using the regression equations in present study the stature can be estimated within the error of 4.07 cm and 3.76 cm for right & left hand respectively in males. (Table-1)

In females the stature can be estimated within the error of 4.05 cm and 4.00 cm for right & left hand respectively by using the regression equations in present study. (Table-2)

The present study will be helpful to estimate the stature, if an unknown mutilated or dismembered body part (upper limb especially hand) is recovered.

Acknowledgement:- We are thankful to Mrs. Anju Jain for helping us to derive statistical data.

Conflict of Interest:- Nil

Source of Funding:- Self

Ethical Clearance:- Taken

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Pattern of Suicide in Adolescents and Youth at a MGH, Khammam, Telangana

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ABSTRACT

The present study evaluating suicide among adolescents and youth victims in Khammam for a period of one year June 2014 to May 2015 in the dept. of forensic medicine at Mamata Medical College; MGH, Khammam; Telangana. There were 45 cases with male 30 victims and females 15 victims, between ages 15 and 24 years, male to female ration is 2:1, suicide rate 13.97%. The highest incidence was amongst the 25 [55.55%] cases were from adolescent age from 15 years to 18 years, 35 [77.77%] belonged to the Hindu religion from urban population 38 [84.44%]. Highest numbers of cases literate 41 [91.11%], 24 [53.33%] were seen in middle socio economic class, 33 [73.33%] living as nuclear family. Highest number of 22 [48.88%] cases encounter in summer season, in day time, and preferred at their homes. Reasons for committing suicide, may include mental stress, unemployment, domestic quarrels, loss of employment, financial difficulties, poor performance, and chronic illness, substance abuse. Hopelessness with life was the most common motive for suicide. The method of suicide was different between male and female victims, as male victims tried to use more violent methods than females 24 [53.33%] were poisoning used chemicals for terminating their lives and only 21 used physical methods. Amongst those who chose for physical methods, hanging was the most common hanging 13 [28.88%]. Among the poisoning cases, organophosphorus poisoning 24 was the most commonly used method. Our objective was to determine the socio-demographic profile, suicide patterns among the youth persons, suicidal behavior, risk factors, and reasons, methods for commit suicide their prevention measures.

Keywords: Attempted Suicide, Patterns of Suicides, Adolescent, Youth, Risk factors.

INTRODUCTION

The age range was set with reference to the Indian law which regards persons up to 14 years as children, up to 18 years as adolescents and persons up to 24 years as youth. The youth are strength to the country, but in modern India these youth are helplessly, suddenly losing their lives before middle age without completion of their goals, dreams in spite of having golden bright feature. Suicide is currently the second leading cause of death for youth between the ages of 15 and 24. Young people are often uncomfortable in discussing it, this tradition of silence perpetuates harmful myths and attitudes on suicides, prevent people from taking openly about the pain they feel or the need they need and finally this impassive act make them a tendency to get away from the problems that is so crushing by feeling that only death will stop it. These warning signs directed at a friend. According to World Health Organization, India has one of the highest suicide rate and India alone contributes to more than 10% of suicides in the world. According to NCRB, in India the number of suicides, 34,799 and rate of suicides was 11.0 during this year. Around 46368 [34.4%] suicide victims were youths in the age group of 15-29 years and 289 [12.1%] of children up to 14 years and constitute about 28% of population in India. The causal mechanisms underlying youth suicide and suicidal behavior is needed to inform early identification and prevention efforts, learning about the warning signs and make use of it in favor.

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of the adolescent and youth is the first step in the prevention. Present study focus on epidemiology, risk factors for adolescent and youth suicide, and patterns of suicides, suicidal behavior

MATERIALS & METHOD

The present study was carried out during the period of June 2014 to May 2015 in the dept. of forensic medicine at Mamata Medical College, Khammam; Telangana. The materials comprised 45 suicidal persons of adolescents and youth of ages 15 years to 24 years out of 322 suicide cases brought to MGH. A Proforma prepared, data were obtained from victims, accompanied, inquest papers, p m reports, and case dairies and analyzed with previous studies.

AIMS & OBJECTIVES

To study socio-demographic profile, frequency, patterns of suicide methods adopted and behavior in adolescent & youth

To find out the causes, risk factors for suicides of youth and various reasons associated with them, prevention by crisis management and psychotherapy for suicide attempts

RESULTS

45 cases of youth suicides, 45[31.46%] cases were adolescent and youth from age group 15 years to 24 years, of 28[62.22%] victims were successful in committing suicide and 17 [37.77%] victims were attempted suicides.

Males 30[66.66%] predominate females 15[33.33%] victims

Majority 25[55.55%] cases were from adolescent age up to 18 years followed by 20 [44.44%] youth persons up to 24 years age group. Adolescents 25[55.55%] cases including 17 years 8[17.77%] cases, 18 years 7 [15.55%] cases, age group 15 years and 16 years are each one 5 [11.11%] cases. As depicted in table no.1

35 [77.77%] victims were from Hindu community. As depicted in table no.2

38 [84.44%] victims were constituted from urban population than 7 [15.55%] rural population. All most female 15 [33.33%] victims were constituted from urban areas as compared to males 27 [60.00%]

33[73.33%] victims were living as nuclear family whereas 12[26.66%] compound family

Highest number of cases 24 [53.33%] were seen in middle class followed by low 14 [31.11%] and 7[15.55%] high class respectively.

Most of victims were literate 41 [91.11%] who become victims in such suicides in which 20 [44.44%] studied up to higher secondary school, 12 [26.66%] up to secondary, 6 [13.33%] up to graduation and only 3 [6.66%] were primary education. Rest victims were illiterates 4 [8.88%].

Students constituted the largest single category amounting nearly 99 percent and only 1 % were working

Weeks are concerned, 10[22.22%] suicides on Monday, 9 [20.00%] on Tuesday, 6[13.33%] on Wednesday, 8[17.77%] on Thursday, 5[11.11%] on Friday, 3[6.66%] on Saturday and 4 [8.88%] on Sunday committed suicides

Maximum 22[48.88%] cases encountered during summer season followed by 16 [35.55%] winter and 7[15.55%] least were during rainy season

Most of 28 [62.22%] victims were committed suicides in day time [6 am to 6 pm] then during night time [6 pm - 6 am] 17 [37.77%]

Most of 40 [88.88%] victims preferred in their homes than outdoors 5 [11.11%]

33 [73.33%] victims reached the hospital within one hour followed by 8[17.77%] cases 1-2 hours and 2 [4.44%] cases up to four hours. 2 cases were brought dead. 17 [37.77%] victims dead in the hospital and 28[62.22%] victims were survived.

Youth persons age group 15-24 was categorized as 24[53.33%] poisoning followed by hanging 13[28.88%] next drowning 4[8.88%] and each 2[4.44%] cases of burning and run over by train

Methods was different between male and female victims, as male victims tried to use more violent methods than females. 24[53.33%] victims were poisoning and only 21 used physical methods for committing suicides. Amongst those who chose for physical methods, hanging was the most common hanging 13[28.88%]. Among the poisoning cases, op poisoning 24 was the most common method. As depicted in table no.3
Choice of method, 2 females were choose burns and 2 males were run over by train. Both genders were chooses soft [chemical] and hard [physical] different methods such as poisoning 24[53.33%], hanging 12[26.66%] and 4[8.88%] cases drowning. This study reveals that females use burns more often than males, and poisoning & hanging is the most common methods for both genders. Attempted suicide 8[17.77%] victims consumed poisoning and one hanging.

Table no.4-commonest motive was mental stress 16[35.55%], followed by academic failures 10[22.22%], family quarrel 6[13.33%], broken family relationships 4[8.88%], depression due chronic illness 3[6.66%].

Suicide farewell notes are found in 12 cases and 8 victims are repeaters of suicide.

In death cases psychological autopsy, post mortem examination done and attempted youth were psychotherapy counselling was given.

### DISCUSSION

Total 45 youth suicidal, out of which 28[62.22%] victims were dead and remaining 17[37.77%] were attempted suicides. These are consistent with other authors\(^4\),\(^5\). The incidence of suicide among the youth has been an increasing prevalence was encountered due to changes takes place during in these age group.

Maximum victims 25[55.55%] were from adolescent age from 15 years to 18 years followed by 20 [44.44%] youth persons from 19 years to 24 years age group. These are consistent with authors\(^4\),\(^5\). Young people often feel tremendous pressure to succeed at school, at home and in social groups, at the same time lack of life experience that lets them know that difficult situations such as depression disturb young people.

Males30 [66.66%] outnumbered female 15[33.33%] in committing suicides. Similar findings are observed by other studies\(^3\),\(^5\). The reasons for male preponderance in society their needs vary with their sex, stage of development, life circumstances, socioeconomic conditions of their environment, behavioral patterns and activities that impact their present and future health.

Males30 [66.66%] outnumbered female 15[33.33%] in committing suicides. Similar findings are observed by other studies\(^3\),\(^5\). The reasons for male preponderance in society their needs vary with their sex, stage of development, life circumstances, socioeconomic conditions of their environment, behavioral patterns and activities that impact their present and future health.

35 [77.77%] cases were from Hindu community. These are consistent with authors\(^6\). Majority of Indian
population were from Hindu community and follows Hinduism as their religion.

38[84.44%] victims were constituted from urban population. Female 15 [33.33%] victims were constituted from urban areas as compared to males 27 [60.00%]. Same results are observed by author. The reason might be youth socio cultural changes that are taking place in the increasingly globalized and urban India.

33 [73.33%] victims were living as nuclear family as compared to compound family. These are consistent with authors. The parents are not observing the daily activities, lack of grandparents in their houses, children what they doing every day and whom they are meeting every day.

Majority of victims 26 [57.77%] were belonged to middle socio-economic income than low 14 [31.11%]. Similar results are made by author. The youth are adapting more luxurious living life styles while using mobiles, internets.

43 [95.55%] victims were literates, including primary education 22 [48.88%], secondary 12 [26.66%], intermediate 6 [13.33%] and above graduation 3 [6.66%]. These are consistent with authors. The sudden removal of excessive regulation or control as a result of social change will trigger behavior.

Students constituted the largest single category amounting 99 percent. Similar observations made by authors.

Weeks are concerned, 10 suicides on Monday, 9 on Tuesday, 6 on Wednesday, 8 on Thursday, 5 on Friday, 3 on Saturday and 4 on Sunday committed suicides. These are consistent with authors. This might be the reason is on Sunday victims are getting flash back of the whole week days events with force which are provoking them.

Highest numbers 22 [48.88%] reported in the winter months, summer season which accounted for 16 [35.55%], rainy season witnessed the least number of incidents 7 [15.55%]. Similar results are observed by authors. In India youth suicide was seen more during the winter months and in other parts of world, a spring peak.

28 [62.22%] cases were reported in day time than night 17 [37.77%]. These are consistent with other authors. The reason is that when the victims are decided in the house others are not observed them while the others are busy with daily activities.

38 [84.44%] victims preferred their homes. Same findings are made by author. Victims are chosen their house is ideal place because of the requirements are easily available.

The method of choice by youth ages 15-24 was categorized as 24 [5.33%] poisoning, hanging 13 [28.88%] next burning 6 [13.33%], drowning 4 [8.88%] and least run over by train 2 [4.44%] cases. These are consistent with authors. Pattern of suicides of youth is reflection of the prevailing social set up and mental health status of the region, cultural and socio-economic factors of a country are responsible for the causation.

The method was different between male and female, as males tried to use more violent methods than females. 24 [53.33%] cases were poisoning and only 21 used physical methods. Persons who chose physical methods, hanging was the most common 13 [28.88%]. Among the poisoning, opc was the most commonly used. Similar findings are made by authors. The chemical and physical methods used by victims which are available easily and reflecting the socio cultural factors.

Gender wise choice, 2 females were choose burns more often than males and 2 males were run over by train. Youth persons were chooses soft and hard different methods such as poisoning 24 [53.33%], hanging 13 [28.88%] and 4 [8.88%] cases drowning are the most common methods for both genders. Similar findings are observed by author. We reveals that females use burns more often than males, and poisoning & hanging is the most common methods for both genders.

17 [37.77%] attempted suicide, 11 [24.44%] victims were consumed poison and 4 hanging and 2 drowning. Similar results are observed by authors. Attempted suicide is a non-fatal, self-directed, potentially injurious behavior with an intent to die as a result of thoughts of and plans for suicide.

Commonest motive for suicide was mental stress 16 [35.55%], followed by academic failures due to poor performance 10 [22.22%], family quarrel 6 [13.33%], broken family relationships 4 [8.88%], depression due chronic illness 3 [6.66%], ill treatment 2 [4.44%] and sudden loss of family member 2 [4.44%], love failure.
2. These are consistent with authors\textsuperscript{15,16}. We reveal that struggles, stresses, unbearable pains, mental health problems, relationship problems and substance abuse are prevalent challenges for youth suicide from their environment, family, school, the community and society in which they are living growing up.

Suicide farewell notes are found in 12 cases and 8 repeaters of suicide. These are consistent with authors\textsuperscript{15}. Youth who are contemplating suicide frequently giving warning signs of their distress.

33\textsuperscript{[73.33\%]} victims reached the hospital within one hour. Females were much more likely to effort suicide than males. Similar findings are made by authors\textsuperscript{21}. The survival period reflecting the fatal dose of poison, and method of suicide by age, gender of victims.

In death cases post mortem examination and also psychological autopsy done and in attempted suicide were psychotherapy counselling given. These are consistent with authors\textsuperscript{22}. The victims brought to hospital where the cause & manner of suicide can be ascertained were assessed.

\textbf{Prevention measures}: Awareness, identifying of risk factors and suicidal behaviors, in the school /college community are committed to making suicide prevention, provide stress relieving psychotherapy counseling centers, relationshiphs,daily activities are monitor by parents, teachers.

\textbf{CONCLUSION}

45 cases with male 30 and females 15, male to female ration is 2:1, highest incidence in 15-18 years, 22\textsuperscript{[48.88\%]} cases encounter in summer season, and preferred at their homes, hopelessness with life was the most common motive for suicide.

The method of suicide was different between male and female victims

\textbf{Acknowledgement}: I would like to express my warm gratitude towards Dr Sheik Khaja, Professor for giving valuable information to complete this paper.

\textbf{Ethical Clearance}: Taken

\textbf{Conflict of Interest}: None

\textbf{Source of Funding}: Self

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A Study of Canal Body Ratio of the Lumbar Vertebrae Measured in Antero-posterior Radiographs

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ABSTRACT

For present study, anteroposterior radiographs of lumbar spine of three hundred adult subjects of Sonepat District were utilized. These radiographs were of known sex i.e. hundred & fifty males and hundred & fifty females and of known age group (between twenty five and forty years of age).

The parameters used in the study are transverse diameters of spinal canal, antero-posterior diameters of vertebral bodies. Making use of these parameters canal body ratio is calculated. The values less than the lower limits of the calculated range may be suggestive of spinal canal stenosis, while the values more than the upper limits of the calculated range may be suggestive of intraspinal tumor at that particular segmental level for males and females respectively.

Keywords: Anteroposterior radiographs, canal body ratio.

INTRODUCTION

The etiology in many of low backache complaining patient is narrowing of lumbar canal. The lumbar part of spinal canal encloses the cauda equina. Narrowing of the canal which can be either developmental or acquired will lead to compression of the cauda equina and subsequent pain; it may be associated with neurological symptoms and signs. Hence it is of great clinical value to measure the dimensions of spinal canal.

Many workers have studied various dimensions of lumbar vertebrae, especially the dimensions of spinal canal (Hinck et al., 1966; Eisenstein S., 1977 etc.).

In the lumbar region the spinal canal is triangular in shape and is limited anteriorly by posterior surfaces of vertebral bodies of lumbar region, intervertebral discs and posterior longitudinal ligament covering them; laterally by pedicles; posterolaterally by laminae and ligamenta flava and posteriorly by junction of laminae with spinous processes. (Williams P. L. and Warwick R., 1978). Therefore, use of plain radiography is made in the present work to study canal body ratio of lumbar vertebrae for population of sonepat district.

MATERIAL & METHOD

For present study, radiographic measurements were obtained from normal anteroposterior radiographs of lumbar spine of 300 adult subjects (150 males & 150 females) between 25 to 40 years from Radiology Department of B.P.S.G.M.C. for women khanpur kalan sonepat. These radiographs were diagnosed as normal by experienced radiologists. The radiographs showing any obvious abnormality were excluded from the study.

The measurements were made by using a scale calibrated to 0.5 mm. The dimensions of all lumbar vertebrae were studied. The interpedicular distance was obtained from the antero-posterior radiographs of lumbar spine. This corresponds to transverse diameter of spinal canal and was obtained by measuring the minimum distance between the shadows of pedicles of same vertebra. Transverse diameter of vertebral body is the minimum distance across the waist of the vertebral body. We calculated canal body ratio by dividing interpedicular distance with transverse diameter of vertebral body.
OBSERVATIONS AND RESULTS

Table no.1: canal body ratio at each segmental level in both sexes.

<table>
<thead>
<tr>
<th>Level</th>
<th>Canal body ratio (male)</th>
<th>Canal body ratio (female)</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1</td>
<td>0.55</td>
<td>0.56</td>
</tr>
<tr>
<td>L2</td>
<td>0.56</td>
<td>0.57</td>
</tr>
<tr>
<td>L3</td>
<td>0.56</td>
<td>0.57</td>
</tr>
<tr>
<td>L4</td>
<td>0.54</td>
<td>0.57</td>
</tr>
<tr>
<td>L5</td>
<td>0.57</td>
<td>0.58</td>
</tr>
</tbody>
</table>

This observation table shows that the canal body ratio is almost constant for each level of lumbar spine. It is approximately 0.6 at all lumbar levels. This means that the transverse diameters of spinal canal and vertebral body go on increasing proportionately from above downwards.

Table no.2: Comparison of canal body ratio between previous studies and present study at each segmental level in both sexes.

<table>
<thead>
<tr>
<th>Authors</th>
<th>Male</th>
<th></th>
<th>Female</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Amonoo Kuofi H. S. 1982 (Nigerians)</td>
<td>0.55</td>
<td>0.53</td>
<td>0.52</td>
<td>0.54</td>
</tr>
<tr>
<td>Sudha Chhabra et al. 1991 (North Indians)</td>
<td>0.61</td>
<td>0.61</td>
<td>0.63</td>
<td>0.63</td>
</tr>
<tr>
<td>Present study (Sonepat District)</td>
<td>0.55</td>
<td>0.56</td>
<td>0.56</td>
<td>0.57</td>
</tr>
</tbody>
</table>

The deviation of canal body ratio from its approximate value of 0.6 to one or the other side indicates the possibility of either spinal canal stenosis or intra-spinal tumor. On comparison of “canal–body ratio” between different races, it is found that irrespective of varying canal body measurements the ratio of C/B is remarkably constant (approx 0.6).

DISCUSSION

Diagnosis and management of vertebral column disorder like congenital malformations, deformities, degenerations, trauma and malignant processes got advancement by various imaging techniques like CT Scan, MRI. Even after this revolution radiography remains the mainstay of investigative procedure particularly in rural setup. The knowledge of normal values of canal body ratio in various ethnic groups could be of importance in detecting isolated segmental changes. In the present study attempt has been made to determine standard normal canal body ratio as a preliminary to clinical investigation of transverse spinal canal stenosis as it is suggested that thickening of lamina causes narrowing of spinal canal which reduces the IPD of the spinal canal and is the second most common cause of narrowing of spinal canal. (Saches B. Frankel J.)
CONCLUSION

In the present study normal antero-posterior radiographs of lumbar spine of three hundred adult subjects (150 males and 150 females) of Sonepat District are studied.

The parameters used in the study are transverse diameters of spinal canal and transverse diameters of vertebral bodies. Making use of these parameters canal body ratio is calculated.

Thus, this study has presented a set of radiographic measurements and results obtained by evaluating normal radiographs of Sonepat District Subjects.

It is found that the canal body ratio remains constant for all lumbar vertebrae all over the world.

Furthermore, careful study of these parameters and indices may be useful in radiological detection of clinical conditions like bony spinal canal stenosis, some cases of intraspinal tumors, vertical compressions of vertebral bodies and prolapsed intervertebral discs.

Acknowledgement: Nil
Conflict of Interest: Nil
Ethical Clearance: Obtained from ethical committee of B.P.S.G.M.C. for women, Sonepat
Source of Funding: Nil

REFERENCES
Analysis of Custodial Death - 4 yrs Retrospective Study

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ABSTRACT

A meticulous autopsy is needed from forensic pathologist in custodial death cases, due to involvement of public emotions and allegation of violation of human rights of deceased prisoners from higher investigating agencies as well as from media to rule out any act of commission or omission. This post-mortem examination based retrospective study analyses 56 cases of custody related deaths occurred over the period of 4 years. Sex wise male 53 (94.64%) predominance over female. 18 (32.14%) cases were declared dead at custody while 38 (67.85%) cases were admitted to hospital & died in hospital. In present study, 39 (69.94%) cases having therapeutic wounds most commonly comprising of puncture wound of intravenous catheter followed by 16 (27.96%) cases having non-therapeutic injuries most commonly comprises minor abrasions.

Keyword: Custodial death, custody, human rights.

INTRODUCTION

A death in custody is a death of a person in the custody of the police, prison service or other authorities1.

Legally, custody is defined as, any point in time when a person’s freedom of movement has been denied by law enforcement agencies, such as during transport prior to registering a case, or during arrest, prosecution, sentencing, and correctional confinement.

Death in custody is defined as death occurring in some form of custodial detention, such as police cell or prison.

Death occurring in custody is considered to be a very sensitive matter, as many of these deaths can be prevented with proper care & treatment. Deaths in custody usually considered as unnatural death by public at large, in spite of this general belief; manner of death in most of custodial death cases is natural. In some cases of unnatural deaths presence or advancement of disease in deceased, while going in to custody or aggravated into custody due to overcrowding, poor condition of prison cells where prisoners are kept. Sudden and unexpected death in custody is commonly associated with allegations on police for mishandling prisoner, media conjecture, and intense community concern. As per the NHRC guidelines, all custodial deaths are to be reported within 24 hrs and post-mortem examination is to be conducted by a panel of doctors with videography has been made mandatory4.

Hence an exhaustive and unbiased investigation by the forensic pathologist is crucial to provide indisputable facts regarding the cause of death. This study is an attempt to analyze & to provide mortality pattern of custodial deaths in the region of North Maharashtra, zone of Maharashtra, India.

MATERIAL & METHOD

It is a retrospective demographic study conducted during the period of 4 years from December 2014 to January 2011 at Department of Forensic Medicine & Toxicology at SBH Government medical college & General (civil) Hospital, Dhule. We analyzed all accidental death report papers provided by police at the time of post-mortem examination along with reports from forensic science laboratory & histo-
pathological examination report from pathology department of same institute. A standard pro-forma was prepared and detailed information noted down such as age, sex, religion, marital status, place of death, hospital treatment record & injury etc. In this study all custodial death cases are included, no exclusion criteria is kept. Ethical clearance obtained from institutional ethical committee.

RESULTS

During this period, total 56 medico-legal autopsies of custodial death cases were conducted, of which maximum cases were reported in the year of 2013, (fig no 1).

1) Age and sex ratio

The highest incidence was seen with males 53 (94.64%) and females 3 (5.35%). Male to female ratio in the study was 17.6:1, indicating male predominance in custodial death cases (fig no 2). In the age group analysis, maximum incidence was in age group of 41-50 years comprising 19 (33.92%) cases, followed by 31-40 years comprising 11 (19.64%) cases. Age groups least affected were 11 to 20 years comprising of 2 (3.57%) cases. (Table No 1)

2) Place of Death and duration of survival

In present study out of 56 cases, 18 (32.14%) cases were declared dead at custody while 38 (67.85%) cases were admitted to hospital & died in hospital (Table No 2). Out of 38 cases, 19 (50%) cases were died in within 24 hrs of admission to hospital, 10 (26.31%) cases within 5 days & 9 (23.68%) cases died after 5days of admission to hospital respectively. Duration of hospital admission shows deceased was admitted to hospital in last stage of illness or suffering from non-curable chronic illness.

3) Religion & marital status

By religion, in present study 47 (83.92%) cases were reported from Hindu religion & 9 (16.07%) cases reported from Muslim (fig no 2). As per as marital status is concerned 51 (91.07%) cases were married & 5 (08.92%) cases were unmarried.

4) Educational status:

In present study, maximum deceased were studied below SSC comprising of 17 (30.35%) cases followed by 9 (16.07%) deceased were illiterate and 6 (10.71%) deceased was studied above SSC. No educational details of 24 cases were available.

5) Injuries

In present study, 39 (69.94%) cases having therapeutic injury most commonly comprising of puncture wound of intravenous catheter followed by 16 (27.96%) cases having non- therapeutic injuries most commonly comprising of minor abrasion in 15 cases & firearm wound to a prisoner admitted and died in to hospital by police at the time of riots. (Table No 3)

6) Manner of Death

In present study, maximum numbers of cases reported were natural comprising of 43 (76.78%) cases, followed by unnatural cases comprising of 9 (16.07%) cases and 4 cases were having opinion as reserved. Unnatural cases distribution consisting of multiple injuries over body in 3 cases, head injury in 2 cases, 2 cases of hanging & single case of strangulation & firearm respectively. (Pie diagram of manner of death)

7) System-wise cause of death

In present study, 43 (76.78%) cases comprises natural manner of death in which most commonly affected system was respiratory system comprising of 16 (37.2%) cases (8 cases of pulmonary tuberculosis & 6 cases are of disseminated tuberculosis & 2 were other causes involving respiratory system) followed by cardiovascular system comprising of 12 (27.9%) cases. (Table No 4)

DISCUSSION

Legally, custody is defined as, any point in time when a person’s freedom of movement has been denied by law enforcement agencies, such as during transport prior to registering a case, or during arrest, prosecution, sentencing, and correctional confinement2. A meticulous autopsy is needed from forensic expert in such cases due to involvement of public emotions, media and higher investigating agencies to rule out act of commission or omission of the custodian.

Various studies have been done by international agencies and authors on this topic but very few studies have been conducted on this topic in India. They have analyzed custody related deaths according
to demographic data, their manner of death and roles played by the various authorities into the cause of deaths and found most common cause of death either natural or unnatural.

In present study, death of male prisoners noted in 53 (94.64%) cases and female prisoners in 3 (5.35%) cases & male to female ratio in the study was 17.6: 1, showing male pre-dominance. This finding is consistent with other studies of other authors [5, 6, 7, 8].

The maximum incidence was in age group of 41-50 years comprising 19 (33.92%) cases, followed by 31-40 years comprising 11 (19.64%) cases. Our findings are contradictory to findings of other authors mentioning maximum incidence noted in the age group of 31 to 40 yrs [5, 7].

In present study out of 56 cases, 18 (32.14%) cases were declared dead at custody while 38 (67.85%) cases were admitted to hospital & died in hospital. These findings are consistent with other authors [5]. Out of 38 cases, 19 (50%) cases were died within 24 hrs of admission to hospital, 10 (26.31%) cases within 5 days & 9 (23.68%) cases died after 5 days of admission to hospital respectively. No author noted down the survival period of inmates after admission to hospital till he/she expired. On which we conclude either inmates were admitted to hospital during last stage of his illness or prisoner might be suffering from non-curable illness.

By religion, in present study 47 (83.92%) cases were reported from Hindu religion & 9 (16.07%) cases reported from Muslim. This finding is consistent with author [5].

The present study shows, 51 cases were married & 5 cases were unmarried. The limited data available to the departmental files, the education of prisoner died in custody shows 17 (30.35%) cases of prisoner were studied below SSC and 9 cases (16.07%) were illiterate.

In present study, 39 (69.94%) cases having therapeutic wound most commonly comprising of puncture wound of intravenous catheter followed by 16 (27.96%) cases having non-therapeutic injuries most commonly comprising of minor abrasion in 15 cases & firearm wound to a prisoner admitted and died in to hospital by police at the time of riots.

No other author noted down the marital status, education status & injury status which we included in our study.

In present study, maximum numbers of cases reported were natural comprising of 43 (76.78%) cases, followed by unnatural cases comprising of 9 (16.07%) cases and 4 cases were having opinion as reserved. These findings are consistent with other authors [5, 6, 7]. Unnatural cases distribution consisting of multiple injuries over body in 3 cases, head injury in 2 cases, 2 cases of hanging & single case of strangulation & firearm respectively.

In present study, 43 (76.78%) cases comprises natural manner of death in which most commonly affected system was respiratory system comprising of 16 (37.2%) cases followed by cardiovascular system comprising of 12 (27.9%) cases. These findings are consistent with Indian author [5, 6, 8] while it is contradictory to other author [9, 10, 11].

**Table No 1: Age wise distribution of cases:**

<table>
<thead>
<tr>
<th>Age</th>
<th>No of cases</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>11 to 20</td>
<td>2</td>
<td>3.57</td>
</tr>
<tr>
<td>21 to 30</td>
<td>6</td>
<td>10.71</td>
</tr>
<tr>
<td>31 to 40</td>
<td>11</td>
<td>19.64</td>
</tr>
<tr>
<td>41 to 50</td>
<td>19</td>
<td>33.92</td>
</tr>
<tr>
<td>51 to 60</td>
<td>9</td>
<td>16.07</td>
</tr>
<tr>
<td>61 &amp; above</td>
<td>9</td>
<td>16.07</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>56</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

**Table no 2: Place of Death**

<table>
<thead>
<tr>
<th>Place of Death</th>
<th>No of cases</th>
<th>percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Custody</td>
<td>18</td>
<td>32.14</td>
</tr>
<tr>
<td>Hospital</td>
<td>38</td>
<td>67.85</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>56</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

**Table No 3: Pattern of Injuries**

<table>
<thead>
<tr>
<th>Type of Injury</th>
<th>No of cases</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Therapeutic</td>
<td>39</td>
<td>69.64</td>
</tr>
<tr>
<td>Non-Therapeutic Mechanical</td>
<td>15</td>
<td>26.78</td>
</tr>
<tr>
<td>Firearm</td>
<td>1</td>
<td>1.78</td>
</tr>
<tr>
<td>No injury over body</td>
<td>1</td>
<td>1.78</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>56</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>
CONCLUSION

- This study shows urgent implication of routine medical checkup from time to time of all prisoners for different communicable & non-communicable disease as per NHRC guidelines while going in to custody or aggravated into custody due to overcrowding, poor condition of cells where prisoners are kept.

- There should be improvement in provision of medical facility, well ventilated and adequately spaced prison cells without overcrowding, with good quality of food.

- Guidance needs to be given to prison staff as well as to prisoner about their own health.

- Good quality educational facility or training to setup small budget business should be provided to the prisoner so that to live a life happily after completing their tenure of punishment as most of the prisoner are having lower socio-economic background.

Conflict of Interest: None.

Source of Funding: None. As author don’t have monetary or other relationship with other people or organization that may inappropriately influence the author’s work.

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filming of post-mortem examinations in cases of custodial deaths by Justice Ranganath Misra, Chairperson, NHRC. August 10, 1995.


Forensic Importance of Bite Marks: An Overview

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1Professor & Head, 2Associate Professor, 3Senior Resident, 4Demonstrator, Department of Forensic Medicine, Hamdard Institute of Medical Sciences & Research, Jamia Hamdard, New Delhi

ABSTRACT

Bite marks have been used to identify victims and assailants’ from the beginning of recorded history. It comprises of a crop of punctuate haemorrhages varying from small petichea to large ecchymosis. Bite marks can be taken by photographing, or by taking impression of bite mark and also by removing and preserving the skin carrying the bite mark. Bite marks most often are seen in cases of rape, murder, child abuse and spousal abuse etc. It can also be self inflicted or accidental. While almost no one dies from a human or even animal bite, such injuries may lead to loss of function, infection and gross disfigurement. Bite marks however may place an assailant who performed rape, murder, child abuse or spousal abuse in proximity of the victim.

Keywords: Bite Mark; forensic; Medico-legal importance.

CLASSIFICATION

Mac Donald (1974) has defined a bite mark as a mark made by the teeth either alone or in combination with other mouth parts.1 Bite marks can be Antemortem because the injury is inflicted while the heart is still beating, a great deal of bruising will be found around the bite mark pattern which is usually diffuse. Peri-mortem bite marks occur within five minutes of death, since the injury is inflicted near the time the heart stops, a well defined bruising pattern is associated with bite mark. In Post mortem bite marks because heart is not beating and blood is coagulated, the mark has well defined indentations but no evidence of bruising. Offensive bite marks has well defined biting pattern while defensive bite marks has ill defined biting pattern with possible tearing, usually multiple.2

Normal bite is known as Balidontia, the scissor like bite occurs in 70% of cases, when cutting edges of upper teeth overlap the cutting edges of lower anterior teeth. Where tongue like bite occurs, when the cutting edges of upper anterior teeth meet the cutting edges of lower anterior teeth, as is normally met in case of children and elderly on the face of attrition of teeth is known as Labidodontia. When a gap remains between upper and lower anterior teeth are known as Hiatodontia. When the upper incisors protrude forward covering up the lower incisors like the slope of a roof is known as Stegodontia. When the upper anterior teeth are behind the lower anterior teeth is known as Opisthodontia.3

Another classification is:

Class 1: no individual tooth marks identified as human bite marks, but only a diffused bruised ring, may be of great value in other regards such as saliva, DNA, arch forms. Love bites are typical example of class 1 bite marks.

Class 2: has both class and some individual characteristics. Upper and lower arches can be identified, used more for exclusion than for inclusion of a suspect.

Class 3: shows excellent tooth morphology at least in one arch, specific teeth shapes and their positions can be identified, can produce a dental profile of the bite (as in Ted Bundy case) and is used for both inclusions as well as exclusions, the third dimension or indentation may be present and can help estimate the time of bite was inflicted in relation to the time of death.

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Class 4: takes the form of an incision or excision of the tissue, blood is present on the surface and DNA may be contaminated, paradoxically it is difficult to get a profile of teeth from this class of bite because of excessive destruction of tissues, almost always produce a permanent injury or disfigurement, the loss of finger or an ear or a permanent scar.

**INTERPRETATION OF BITE MARKS**

Bite marks can be found in food, flesh or in a miscellaneous group of materials. Detailed study of bite mark cases investigated in Glasgow indicated that these could be characterised by positive features or negative features. By positive features is meant the presence of particular teeth or abnormalities in the position or shape of these teeth. Negative features are for example the absence of particular teeth. Some food will give clear marks of teeth; cases have been quoted of convicions from apple, chocolate, cucumber and cheese. Any fruit would have been photographed as found, swabbed for saliva typing, examined for fingerprints, washed in water and placed in Campden Solution: fruit preserving tablets), which may bleach the colour, or 5% acetic acid. Bite from animals is inevitably bizarre and they do form a remarkable collection. The nicest case is that of a horse accused of biting a man, but Rotzsche(1972) proved conclusively and dentally that the animal was innocent. Goldsmith wrote of a man bitten by a mad dog- the man recovered but the dog died. A deep parabolic or U shaped is characteristic of animal bite. Bite from human is the worst bite. All the places that can be kissed are also the places that can be bitten. These are the words of love from Kama –Sutra.

**NATURE OF BITE MARKS**

Bite mark comprises of a crop of punctuate haemorrhages varying from small petechiae to large ecchymoses merging in to a confluent central bruise. Human bites are usually semicircular or crescentic, caused by the front teeth (incisors and canines) with a gap at either side due to separation of upper and lower jaw. Teeth may cause clear separate marks that run in to each other as continuous or intermittently broken lines. Bite marks may be abrasions, contusions and lacerations or a combination of any two or three. Bite from adults will often only mark clearly from one arch, while a child who has bitten will frequently mark with both arches. If the bite is human and intercanine distance is <3cms, the bite is probably produced by a child.

**FACTORS AFFECTING THE BITE MARK**

The current evidence suggests that biting involves the application of multiple forces which include biting and a combined sucking and tongue thrusting force. In 1959 Kunvery measured the lingual force of the tongue as 8-10 lb in woman and 2-5 lb in children with occasional presser of 8-14lb; these were independent of the size of tongue. Information on the magnitude of the sucking force is scanty and the only measurements of it are reported by Harvey et al (1973) The appearance of bite marks are also modified by mechanical properties of tissue which vary from site to site. The skin on the back for example is stiffer than that of breast. There are directional variations at given site, axial direction show greater extension for a given load than do specimens cut in cirumferential direction. The mechanical properties of the skin and underlying tissue will also modify the distortions subsequent to the production of bite mark. Movement of body segments ex. arms, alteration in postural and gravitational forces ex. on breast (Harvey et al, 1968) will cause movement of skin over the subcutaneous tissue. Flexion, extension and rotation of surface skin marking would be expected to follow the patterns of Langer (1861).

**METHOD OF ANALYSIS OF BITE MARK**

Dental photography: coloured and black & white photographs should be taken. It is essential to have a scale. In mortuary routinely dental photographs should be taken in close view. Colour and swelling change daily in bite marks in live and dead bodies, and in the latter post mortem changes alter the colours. It has been found essential to photograph bite marks for at least five days, in the same position as when first found. Photographs of teeth may be required to show particular characteristics of individual teeth or they may be needed for superimposition studies in comparison with a bite mark. Photographs of plaster model of teeth are less satisfactory for showing individual tooth details but are required in living persons where superimposition studies are to be attempted. If no dental facilities are available then a specially shaped intra oral mirror is essential, used with a 35mm camera and a ring flash. Distortions arise from three factors in photographic analysis:

1) Inherent distortions within the mark itself due
to mechanics of biting and the physical and biological properties of skin and underlying structures.

2) Distortion produced by trying to represent a three dimensional mark on a two dimensional photograph.

3) Distortion produced in printing the negative to a live size or preset magnification.

Specialized techniques:

Xero radiography and transillumination as described by Rawson et al(979) and Dorion (1987) respectively, are specialized techniques that have been used in bite mark analysis. Both these techniques require the removal of bitten tissue.

Biopsy and histological examination of bite marks is confined to the deceased.

Finally Ultraviolet photography is been used.

In the living subject the indentations soon become indistinct and obscured by bruising of the underlying tissues.

However, by using ultraviolet lamps slight injuries sometimes become visible (Cameron et al) this may be due to migration of melanocytes to the margins of wounds.

Swabs of the bite mark should be taken immediately, using a swab moistened with sterile water. A swab of control area adjacent to the mark and a swab of victim’s saliva should also be taken using swab moistened with sterile water. If there is a delay in sending the swabs to the laboratory they should be kept in the freezer compartment of the fridge. The whole area of skin carrying the bite marks removed and preserved in formalin.

The bite mark swabbed with a sterile swab that is analysed for traces of saliva (amylase, ABO blood group). A second swab is collected for DNA analysis since saliva contains traces of DNA. A third sterile swab is collected and placed in an anaerobic microbiologic tube and analyzed for aerobic, facultative, anaerobic and yeast microorganisms. In a very interesting case, the microorganism in the bite mark and the suspect’s mouth were so unique that the suspect definitely could not be eliminated as the biter. More recently digital imaging has been suggested as an alternative to the more traditional use of photos.

Impression of bite mark is made using plastic substance that is laid over the bite mark that hardens and produces permanent negative cast of the lesion. Plastic substance is made of rubber or silicone based medium containing a catalytic hardner or plaster of paris. Skin carrying the bite is removed and preserved in formalin for future examination.

Matching the bite mark with suspect’s dentition:

Full informed consent before examination of the subject in writing to be taken. Oral consent with at least one witness. Points to be noted in bite mark are:

1) Presence of full or partial denture and were they worn at the time of incidence

2) Number of teeth in the upper and lower jaw

3) Charting of missing teeth

4) Estimation of bite overhang, whether there is an edge to edge occlusion or an undershoot projection of lower teeth

5) Recording of any broken teeth or teeth with any significant individual abnormalities are charted and described.

6) Any irregularity or marked variation in cutting edge profile of any teeth.

7) Evaluation of size and prominence of any teeth especially canines and incisors.

8) Any developmental anomaly.

9) Recording of any abnormality in orientation of any tooth such as twisting, antero posterior tilting, double row of teeth or any gap or irregular spacing

For this six upper and six lower front teeth give the most information, canines may provide particular help, premolars and molars are rarely useful due to being posteriorly positioned in the jaw.

**DISCUSSION**

**MEDICOLEGIS ASPECTS OF BITE MARK**

Self inflicted bite marks seen at accessible parts of the body such as shoulders or arms etc usually seen in psychiatric patients, teenage girls and old children.
Bite marks can be accidental at times resulting from falls on to the face and during fits where biting of tongue and lips may be there. In cases of child abuse the marks are seen anywhere on the body such as arms, hands, shoulders, cheeks, buttocks and trunk.22 Bites are examined whether the size of the mark is same as of adult dentition, if it is of small size, could be due to bite by the sibling. Sexual oriented bites can be found on any parts of the body mainly breast, neck, shoulder, thighs, pubis or vulva. Bite marks can be found in sporting events like football, and wrestling. Bites can also be found on police officers by offenders. Bite marks can be found in cases of assault anywhere on the body. They are useful in identification because the alignment of teeth is peculiar to the individual.

**Cases where bite marks gave a lead:**

Ted Bundy – the famous bite mark: January 15, 1978. Murder of Lisa Levy and Martha Bownaan was reported. An odd bite mark was found on left buttock of Lisa Levy. The verdict was called and Ted Bundy was announced, in the form of electric chair.

Bite mark was undoing of ex-policewoman in murder: March 9, 2012: there were no witness, no fingerprints, no guns and a little forensic evidence, but there was a human bite mark on her arm, that bite would be analyzed by a tool known as DNA testing and Lazarus faces a sentence of 25 years to life after a jury found her guilty.

Mississippi death row case faults bite mark forensic: disputed bite mark identification is at the centre of an appeal that was filed Monday with the Mississippi Supreme Court. Eddie Lee Howard Jr., 61, has been on death row for two decades for the murder and rape of an 84 years old woman, convicted largely because of what many experts call a farfetched match of his teeth to purported bite wound, discerned only after the woman’s body had been buried and exhumed.

**CONCLUSION**

Bite mark evidence are not utilized till recently in crime solving in India. However they can be a crucial piece of evidence in establishing the identity of the accused/suspect in a particular crime. Careful observation and collection of them at crime scene is very important.

**Conflict of Interest:** Nil

**Source of Funding:** Nil

**Ethical Clearance:** None. (Not required).

**Acknowledgement**: Nil

**REFERENCES**

2) James Stuart H,Nordby, J. Forensic Science, 89.


Study of Occupational Health Problems among Workers in a Glass Manufacturing Plant at Puducherry

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ABSTRACT

Background: Recent industrialization and globalization are changing the Indian occupational morbidity drastically. Traditionally labor-oriented markets are on change towards more automation and mechanization. General awareness about occupational safety and hazards has to be spread in the society. Very few studies are there dealing with the occupational health problems among the glass factory workers. Objectives: To know the magnitude of work-related health problems among the workers in a glass manufacturing plant in Puducherry. Study design: Cross sectional study with a comparison group. Methodology: The study was carried out over 184 glass factory workers and 184 subjects who were matched for the socio-demographic factors residing in the same area. The purpose of the study was discussed with the workers as well as the comparison group & the time schedule was prepared as per their convenience. The predesigned, structured questionnaire was used for data collection. Data was collected by interview method. Details about the socio-demographic factors, health problems related to their work in the last one year like injuries, burns, respiratory disorders like cough, breathlessness, chest pain, any hearing defect and cataract etc. were enquired. Statistical analysis was done by percentages and chi-square test. Study Population: 184 workers from a glass factory which is situated around 8 km from Aarupadai Veedu Medical College, Puducherry & 184 subjects as comparison group. Results: The prevalence of health problems was more among the glass factory workers than in the comparison group. Among the total 184 workers, 148 (80.43%) had some or other health problem while in the comparison group 69(37.5%) were having some morbidity. This difference was statistically significant (χ²=70.09, d.f=1, p<0.0001). The total health problems were 342 among the workers in the glass factory while; it was 111 for the comparison group. Among the factory workers; 33.04% had prick injuries, 14.91% musculoskeletal problems, 10.81% burns & 9.64% were having hypertension, 5.26% ENT problems like noise-induced hearing defects, earache etc & ocular injuries were reported by 4.09%, while 3.8% had chronic irritant cough, difficulty in breathing, chest pain. Conclusion: Proper health education and awareness among the public about the morbidities at the work place will definitely reduce the burden of health hazards in industries.

Keywords: Glass manufacturing plant, work-related health problems, factory workers, comparison group.

INTRODUCTION

The modernization and innovation in industries and the rapid increase in hazardous and polluting chemical industries in recent years has not only resulted in unsafe working conditions but also created problems of occupational health hazards. The incidence of occupational diseases is much higher in developing countries than developed ones, although no region of the world is immune from this. In developing countries, the workers are most exposed to occupational risks such as variable temperature (excessive heat or cold), humidity of air, dampness inducing chill, low air movements and

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defective lighting in the work place. The gravity of this situation may be gauged from the observation made in 1992 by Justice Ramaswamy that “In every three minutes somewhere in the world one worker dies and in every second that passes at least three workers are injured and in India on an average every day 1,100 workers are injured and three are killed”. The International labour organization has observed that an estimated 50 million work-related injuries occur every year or 160,000 every day. During the past several years attention has been focussed sharply on occupational health of workers both at the national and international levels. In recent years it has opened the eyebrow of the world community to take immediate and effective measures to protect the workers and community from such a risk. 

The history of glass industry is quite old one. Glass was discovered by Syrians 5000-7000 years ago, later this art reached Egypt in 2000 BC and from Egypt this technique was taken to Rome then spread across Europe and world. Glass Industry started flourishing in India after the arrival of Mughals. Firozabad is “Glass City of India” which started the production of glass back in 17th century. The modern Indian glass industry is around 100 years old. The first glass plant was set up in August 1908 by Lokmanaya Balangadhar Tilak at Talegaon, Maharashtra. This industry has made a steady progress since India’s independence. The glass manufacturing consists of batch preparation from raw materials, melting, forming, annealing, quality inspection and packing. These operations involve increased temperature levels and possibility of heat exposure to workers. Throughout the furnace section molten glass is maintained at a temperature of 1590°C at all points. Working in such hot environments can produce strain on workers that may lead to discomfort, loss in performance and productivity, heat illness and death. Heat disorders and health effects of individuals exposed to hot working environments include (in increasing order of severity), skin disorders (heat rash, hives etc.), heat syncope (fainting), heat cramps, heat exhaustion and heat stroke. Heat syncope (fainting) results from blood flow being directed to the skin for cooling, resulting in decreased supply to the brain. The workers in the glass factory are also at increased risk of injuries, respiratory morbidities, ocular problems, hearing loss due to exposure to noise, musculoskeletal problems and nephrolithiasis.

Keeping in mind the above points, the study was conducted to know the various occupational health problems & possible reasons for morbidities among the workers of a glass manufacturing plant in Puducherry.

**MATERIAL & METHOD**

The study was conducted in a glass manufacturing unit at Manapet around 8 km from Aarupadai Veedu Medical College, Puducherry. The factory was established about 20 years ago in the field practice area of Rural Health Centre attached to Department of Community Medicine, Aarupadai Veedu Medical College, Puducherry. The present study was designed as a cross-sectional study with comparison group, which was matched for age, sex and socio-economic status, unexposed to similar working environment and who were resident of the adjacent area. The permission to conduct the study was obtained from the owner and general manager of the factory. A written consent was obtained from the study subjects before data collection. After collecting data for 30 workers the comparison group was selected from the community area of Manapet & necessary changes were done in the proforma. Matching was done for age, sex and socioeconomic status. The data was collected on the similar proforma, which was used for workers. There were total 227 employees in the factory. We excluded 43 employees like administrative staff, office employees & security personnel. Total 184 workers were studied along with 184 subjects as in comparison group. Detailed information was collected about the socio-demographic factors, any injuries or burns in the last one year at the work place. We also enquired whether they are suffering from any morbidities like hearing loss, earache, ocular injuries, cataract, recurrent cough, renal stones, musculoskeletal problems, skin problems due to exposure to excessive heat & chemicals like dermatitis, hypertension, diabetes and use of any personal protective measures by them. **Statistical analysis:** After doing appropriate coding for the data, it was analysed using Statistical Package for the Social Sciences (SPSS, Version 17.0). All values are expressed in the form of percentages, mean and standard deviation and the Chi-square test was applied wherever necessary.

**RESULTS & DISCUSSION**

The majority of the workers belonged to the age group of 20-39 years, the mean age being 28.54+/−7.24 years and 68.34% belonged to class IV while
31.66% were in class V socio-economic status according to Modified B. G. Prasad Classification.6

### Table 1 Distribution of study population according to health problems.

<table>
<thead>
<tr>
<th>Health problem</th>
<th>Factory workers (%)</th>
<th>Comparison group (%)</th>
<th>Total (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
</tr>
<tr>
<td>Present</td>
<td>148</td>
<td>80.4</td>
<td>69</td>
</tr>
<tr>
<td>Absent</td>
<td>36</td>
<td>19.6</td>
<td>115</td>
</tr>
<tr>
<td>Total</td>
<td>184</td>
<td>100</td>
<td>184</td>
</tr>
</tbody>
</table>

$\chi^2=70.09, \text{ d.f}=1, p<0.0001$, Highly Significant.

We observed that the prevalence of health problems was more among the glass factory workers than the comparison group. Among the total 184 workers, 148 (80.43%) had some or other health problems while in the comparison group 69(37.5%) were having some morbidity. This difference was statistically significant as shown in Table no. 1 ($\chi^2=70.09, \text{ d.f}=1, p<0.0001$). Similar findings were observed in a study conducted at Nagpur, Maharashtra stating that 92.8% workers had one or other morbid condition and in comparison group it was 39.2% & the difference was statistically significant.7 Higher prevalence of heat related respiratory problems and auditory manifestations were also observed in a study conducted in Egypt among glass industry workers.8

As shown in Table no. 2, total health problems were 342 among the workers in the glass factory while it was 111 for the comparison group. All health problems like injuries, ocular problems, musculoskeletal problems, respiratory & skin problems, burns, and hypertension were predominant among the factory workers than the general population. Among the total 342 health problems, 33.04% were prick injuries due to contact with glass which was the most common problem followed by 14.91% of musculoskeletal problems, 10.81% of burns & 9.64% of hypertension. Injuries were very common, which included cuts and lacerations. Higher values were reported in a study conducted at Nagpur, Maharashtra observing that injuries constituted 56.9% out of the total morbidities.7 Another study conducted at Pondicherry reported that among the 341 workers in glass factory 377 injuries were recorded in 1 year, which gives the incidence as 1105.5/1000 workers/yr. which is much higher than our study findings (614.13 / 1000 workers/yr.).9 In a study conducted in Japan involving small-scale industries, the prevalence of occupational injury was 35.6% while at North Carolina it was found to be 39.9% which is similar to our findings.10,11 The musculoskeletal problems among the factory employees were chronic lower backache (58.27%), upper backache (36.87%), and pain in shoulders (29.4%). With symptoms pertaining to the respiratory tract, irritant cough and cold was complained by 54.63% followed by breathlessness (32.6%). Similar study conducted at Thailand observed high prevalence of respiratory symptoms as well as skin problems among the factory workers.12

In the present study some of the workers (4.09%) had history of injuries to eyes while skin rashes, dermatitis was reported by 4.97% & ENT problems like hearing defect or earache were experienced by 5.27% of the workers. In our study the prevalence of hypertension among the factory workers was little higher (9.64%) than comparison group (6.30%). Heat exposure increases the risk of cardiovascular diseases which was also observed in a study conducted at Egypt.13 About 4.65% of the workers complained of excessive fatigue, irritability and weakness while working in hot environment which reduced their working capacity to a great extent. The heat stress is also a factor which is responsible for accidents and injuries at work place. Measures to reduce the heat stress like adequate gap in between work, duty hours not exceeding 8 hours, good ventilation in factory as well as provision of coolers; all these will help to protect the employees from heat related health problems like burns, accidents or injuries, skin problems, cardiovascular disorders. The majority of the workers in our study belonged to lower socio-economic status which may be a factor which indirectly increases workers proneness for injuries due to psychological factors. Similar findings were observed in a study conducted at Philadelphia.14
Table 2: Distribution of health problems among the factory workers.

<table>
<thead>
<tr>
<th>Health problem</th>
<th>Factory workers</th>
<th>Comparison group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>Prick injuries</td>
<td>113</td>
<td>33</td>
</tr>
<tr>
<td>Musculoskeletal problems</td>
<td>51</td>
<td>14.9</td>
</tr>
<tr>
<td>Burns</td>
<td>37</td>
<td>10.8</td>
</tr>
<tr>
<td>Hypertension</td>
<td>33</td>
<td>9.64</td>
</tr>
<tr>
<td>Diabetes</td>
<td>29</td>
<td>8.47</td>
</tr>
<tr>
<td>ENT problem</td>
<td>18</td>
<td>5.26</td>
</tr>
<tr>
<td>Skin problems</td>
<td>17</td>
<td>4.97</td>
</tr>
<tr>
<td>Ocular problem</td>
<td>14</td>
<td>4.09</td>
</tr>
<tr>
<td>Respiratory problem</td>
<td>13</td>
<td>3.8</td>
</tr>
<tr>
<td>Urinary problem</td>
<td>9</td>
<td>2.63</td>
</tr>
<tr>
<td>Anaemia</td>
<td>8</td>
<td>2.33</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>342</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

When we studied the factory workers with respect to use of personal protective measures we found that majority of the workers (44.56%) used gloves in order to protect them from injuries while handling the glass followed by use of goggles by 16.84%; similar findings were observed by a study done at Nigeria stating that the most common device used was gloves which was used by 37.38% workers.15

Table 3: Use of protective devices among the factory workers.

<table>
<thead>
<tr>
<th>Protective device</th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gloves</td>
<td>82</td>
<td>44.56</td>
</tr>
<tr>
<td>Goggles</td>
<td>31</td>
<td>16.84</td>
</tr>
<tr>
<td>Boots</td>
<td>27</td>
<td>14.67</td>
</tr>
<tr>
<td>Helmet</td>
<td>16</td>
<td>8.69</td>
</tr>
<tr>
<td>Mask</td>
<td>19</td>
<td>10.32</td>
</tr>
<tr>
<td>Ear muffs</td>
<td>9</td>
<td>4.89</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>184</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

In our study workers reported that they were provided with personal protective devices but they use it only for a few hours or sometimes they don’t use it at all. Similar results were obtained in a study done at North Carolina.11 Lack of awareness and ignorance about the proper use of personal protective measures are responsible factors for a variety of health problems among the factory workers. Same results were reported in a study conducted in Northern Nigeria.15

CONCLUSION

It is necessary to carry out further research for the prevention of occupational accidents and ill health caused by harmful factors in the workplace. Equally important is the creation of working condition and an environment that maintains and promotes the health of workers. Awareness regarding use of personal protective devices would enhance the efficiency of the workers and will definitely protect them from work-related health problems.
Acknowledgment: Authors would like to thank all the workers and the participants who generously agreed to participate and co-operate for the study also to the administrative staff, security personnel and HR of the factory for their kind support during the repeated visits to the factory.

Conflict of Interest: None declared

Ethical Clearance: Obtained from Institutional Ethical Committee

Funding Source: Self

REFERENCES

Assessment of Role of Didactic Lectures and Interactive Sessions in Small Group Discussions

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ABSTRACT

This study was conducted to assess the impact of small group teaching in Forensic medicine among the second phase students. Didactic lectures play an important role as a method of student instruction in Forensic medicine in India. The interactive sessions are gaining lot of importance in aiding students to assimilate & retain knowledge. An attempt has been made to analyze these to teaching types in a small group of 18 students. Didactic lectures are a useful method not only to improve students' cognitive knowledge, but also help to assess their performance in the University theory examination. Interactive sessions help to develop self-motivation, deep learning, and are of great help in sharpening psychomotor & communication skills by active learning. A judicious blend of both methods is essence of effective teaching undergraduate students to enable them to excel.

Keywords: Didactic lectures, Interactive sessions, Passive learning, Active learning

INTRODUCTION

There are various teaching methods, to name a few, Lectures, Tutorials, Seminars, Group Discussions, Small Group Teachings etc. In didactic lectures, student participation is minimum; it is teacher centered and monotonous. Students retain hardly 10-20%.¹ Small group teaching has a good interaction. It is problem based with active participation of student. Researchers have found many advantages in teaching in small groups. Importance is given to skill analysis and sharpening. Some even say that “smaller classes are a key ingredient in student’s success”. Many studies have demonstrated that small group teaching facilitates better performance of the students. Similar results have been reported by J. Thirunavukkarasu et.al, Dunnington et.al and Curtis et.al.²³

SPECIFIC OBJECTIVES

To study, analyze the acceptance, preference and knowledge gained.

To study the effectiveness of two teaching methods.

To compare two teaching methods.

MATERIAL & METHOD

A topic titled age estimation of subject by radiological examination will be taught by the didactic lecture & by interactive sessions method in five consecutive classes of one hour each to a batch of 18 students. The task is completed by the same facilitator. An effort is made in this study to look into the effectiveness of didactic lectures and interactive sessions, both in a small group of students (5-20 students) of 2nd MBBS. In India, didactic lectures, is the usual mode of teaching in theory.⁴⁵ According to some research projects such as Tennessee’s STAR, reducing the size of the class will produce many benefits for facilitators and students. In small group, students receive more individual attention; facilitator will be able to manage the students better. The student shall be more responsive and inquisitive. The interactive sessions are mainly based on plenty of interactions between the students and the facilitator. The lesson plan will be given to students well in advance of each class. Each student is encouraged to present a small
portion of the lesson plan. The students are evaluated unbiased by multiple choice type of questionnaire prepared by teachers who are not involved in the study. There are fifteen questions with five choices for each question. Students of didactic lecture have to answer these questionnaires individually and GD students in groups. Group answering sessions are introduced to convey the importance of group discussion among students. The same set of fifteen questions was given to evaluate student’s perception of two teaching techniques.

**ASSESSMENT PLAN**

At the end of each class, the students are tested by a multiple choice type of questionnaire. Data analysis is by simple arithmetic mean, median and standard deviation. The suggestions of statistician of Community medicine department shall be taken. In our study of comparison simple tabular & percentage analysis is adopted.

**RESULTS & ANALYSIS**

An informed consent was obtained by 36 students after fully and lucidly explaining the purpose of this study. The elaborate briefing was done about the didactic lecture and small group discussion types so that students are well oriented about two types of teaching.

They were divided into two groups of 18 each for the study.

Group A- Didactic lecture (DL)

Group B- Group discussion (GD)

The response of each group was taken for didactic lecture and small group discussion.

Response from students was taken for each questions separately as:

- **Strongly Agree**
- **Somewhat Agree**
- **Agree**
- **Strongly Disagree**
- **No Comments**

**QUESTIONNAIRE**

A: General perception of students about teaching technique adopted.

1. This teaching technique is good and good understanding is achieved.
2. As a student I was comfortable with this teaching technique.
3. As a student I was satisfied with this teaching technique.
4. There was repetition of some points during the session.

B: Student-student and Student teacher interaction

5. Discussions were held during / and after the session.
6. Time allocated for discussion was adequate.
7. Discussions held in class helped in understanding the subject better.
8. The session was interactive.
9. Students were given an opportunity to clear their doubts.

C: Benefits perceived by the students from the teaching technique

10. I expect to score better as a result of this type of teaching.
11. The knowledge and skills acquired via this teaching technique shall help me in clinical practice.
12. This teaching technique encouraged & stimulated my intellectual curiosity.

D: Role of teachers as facilitators

13. For this teaching technique, teacher had taken collaborative efforts.
14. Teacher provided guidance for self learning.
15. Teacher paid enough personal attention to the students.
Table 1: Responses from students for didactic lectures:

<table>
<thead>
<tr>
<th>Q. No</th>
<th>a</th>
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<th>c</th>
<th>d</th>
<th>e</th>
<th>Total</th>
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<tr>
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<td>71</td>
<td>89</td>
<td>81</td>
<td>19</td>
<td>15</td>
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</tr>
</tbody>
</table>

The response to each questions analyzed. Total of 71 ‘strongly agree’ response was received for all queries put together. The 89 response were somewhat agree. The 81 response were for ‘agree’. Another 19 response were for ‘strongly disagree’. And only 15 response of ‘no comments’ was received.

This highlights though didactic lecture is an age old method, it is still popular. It can be retained in part and used for teaching theoretical topics.

SUGGESTION FOR ENHANCING QUALITY OF DIDACTIC LECTURES

1. Make it lively by effective use of AV aids.
2. Use modern electronic gadgets.
3. Begin class with random queries on previous class.
4. Give practical examples as and when required.
5. Animations, photographs boost & enhance retaining power.

Table 2: Responses from students for small group interactions

<table>
<thead>
<tr>
<th>Q. No</th>
<th>a</th>
<th>b</th>
<th>c</th>
<th>d</th>
<th>e</th>
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<tbody>
<tr>
<td>01</td>
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<td>03</td>
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<td>03</td>
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</tr>
</tbody>
</table>
The response to each question analyzed. Total of 103 ‘strongly agree’ response was received for all queries put together. The 70 response were somewhat agree. The 88 response were for ‘agree’. Another 03 response were for ‘strongly disagree’. And 06 response of ‘no comments’ was received. There is clear inclination towards small group discussion to some extent. It can be adopted in topics where interactive sessions help in sharpening practical skills.

**SUGGESTION FOR ENHANCING QUALITY OF SMALL GROUP DISCUSSIONS**

1. More live incidents to be shared.
2. More images encourage interactions.
3. Role play method is more interactive. Arrange and guide.
4. Case based like in clinical subjects more useful.
5. Animations, photos leave a better impact.

**Table 2: Responses from students for small group interactions**

<table>
<thead>
<tr>
<th>Question</th>
<th>DL</th>
<th>GD</th>
</tr>
</thead>
<tbody>
<tr>
<td>05-06-07</td>
<td>06</td>
<td>00</td>
</tr>
<tr>
<td>08-09-10</td>
<td>08</td>
<td>05</td>
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<tr>
<td>11-12-13</td>
<td>09</td>
<td>07</td>
</tr>
<tr>
<td>14-15</td>
<td>10</td>
<td>08</td>
</tr>
</tbody>
</table>

**Table 3: Comparison in percentage of perception of students to didactic lecture (DL) & group discussion (GD):**

<table>
<thead>
<tr>
<th>Q. No</th>
<th>DL</th>
<th>GD</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>66.6% (b)</td>
<td>61.1% (a)</td>
</tr>
<tr>
<td>02</td>
<td>50% (b)</td>
<td>50% (a)</td>
</tr>
<tr>
<td>03</td>
<td>38.8% (b)</td>
<td>50% (a)</td>
</tr>
<tr>
<td>04</td>
<td>44.4% (c)</td>
<td>44.4% (c)</td>
</tr>
<tr>
<td>05</td>
<td>50% (a)</td>
<td>44.4% (a)</td>
</tr>
<tr>
<td>06</td>
<td>38.8% (a)</td>
<td>38.8% (c)</td>
</tr>
<tr>
<td>07</td>
<td>33.3% (a,c)</td>
<td>44.4% (a)</td>
</tr>
<tr>
<td>08</td>
<td>38.8% (a)</td>
<td>38.8% (a,c)</td>
</tr>
<tr>
<td>09</td>
<td>44.4% (a)</td>
<td>50% (a)</td>
</tr>
<tr>
<td>10</td>
<td>33.3% (b,c)</td>
<td>38.8% (b)</td>
</tr>
<tr>
<td>11</td>
<td>61.1% (b)</td>
<td>38.8% (c)</td>
</tr>
<tr>
<td>12</td>
<td>55.5% (b)</td>
<td>44.4% (c)</td>
</tr>
<tr>
<td>13</td>
<td>44.4% (a)</td>
<td>44.4% (a)</td>
</tr>
<tr>
<td>14</td>
<td>44.4% (c)</td>
<td>38.8% (b)</td>
</tr>
<tr>
<td>15</td>
<td>38.8% (a)</td>
<td>33.3% (a,b,c)</td>
</tr>
</tbody>
</table>
DISCUSSION

Teaching methods which increase student motivation and enhance learning have evolved throughout history. However, the introduction of an interactive student-centered approach in medical education has dramatically changed the way students learn and face exams and practicing life. Didactic lecture still play a major role in teaching in Anatomy in India with advantages & disadvantages (Moni, 2000). In this study, students appreciated marginally more didactic lecture (DL) (66.6% b). But 61.1% strongly agreed that group discussion (GD) is better. The students were comfortable with both methods of teaching (50% each) but strongly agreed for GD. The students were more satisfied with GD (50% a). Some were of the opinion that in both, repetition of information was there (44.4% c). For discussion held during teaching, strongly agreed for both type (DL marginally more 50%). Response to time spent for discussion was same (38.8% c). Discussion was more fruitful in GD (44.4% a). Both the session were interactive (38.8% a,c GD-a). Adequate opportunity was given to clear doubts, more in GD (50% a). Students marginally felt that one can score better with GD (38.8% b) A surprising finding was that 61.1% somewhat agreed that DL is helpful in future, clinical practice while as 38.8% agreed firmly that GD is better. For stimulation of intellectual curiosity, 44.4% agreed for GD and 55.5% somewhat agreed for DL. Facilitators guidance in self learning was agreed in DL (44.4%) and 38.8% somewhat agreed in GD! For teacher paying personal attention, there was mixed response, for DL 38.8% strongly agreed while as for GD, a mixed response of 33.3% of strongly agree, somewhat agree & agree was received! Our analysis shows that GD is marginally better necessitating multiple surveys are required for coming out with concrete answers. However the response of the subjects involved cannot be ignored. GD shall improve their cognitive, psychomotor & affective domains of learning. But it involves small group of students, (usually 5-20), time consuming and may go off the track in the hands of an inexperienced facilitator. The small group can be fertile environment for both individual and group development. A major responsibility of a teacher is to promote and nurture the invisible teacher within each student. Active role of facilitator and group dynamics is key to the success of small group teaching and to enhance effective & efficient learning environment by encouraging students. Facilitator should stimulate inquisitive mind and make students probe & gather more information. There is a general consensus about better learning in small groups in terms of deeper understanding, critical thinking, problem solving skills and better student satisfaction but not in terms of factual knowledge and assessment scores. There should be sincere effort to pick up slow learners and try to bring them to main stream. This type of active teaching is not possible by didactic lectures because of the fact that they are aimed at large group. GD teaching approach helps in building confidence for amicable interaction with patients in future. Nayak et al. (2006) are of the opinion that a hybrid method, incorporating features of both methods, would be the most suitable method for teaching Anatomy. Even when lectures are used as a method of instruction, there has been an attempt to incorporate active learning elements into it to make it more effective (Richardson, 2008). We are also of the same opinion. But five students expressed GD can tax & put pressure on students especially when all subjects adopt interactive session. One should know that in second year students are studying as many as ten subjects. Some workers have brought out this issue in their study. In our study, students felt that group discussion is more time consuming and it is not possible to concentrate on topics of various subjects in detail. Eight students felt that to achieve higher scores in exams didactic lectures, a traditional teaching method is more reliable. It is not a pressure mounting method and students can set their own schedule giving ample time for subjects on priority basis. Some were of the opinion that didactic lectures are better as they are teacher centered, one can be relaxed.

CONCLUSION

"The learning outcome from a badly conducted group discussion would still be better than that from a good lecture." Bloom

There is a general consensus about better learning in small groups in terms of deeper understanding, critical thinking, problem solving skills and better student satisfaction but not in terms of factual knowledge and assessment scores (Ref 9). Didactic lecture is well tried and commonly used teaching tool in medical education from ages that suits present
The curriculum. The study shows short term gains from didactic lectures as far as assimilation of knowledge is concerned. The facilitator may give all the information on a particular chapter and students tend to mug up and lose interest to learn on their own. They may do well in theory examination. Interactive sessions are considered as a tool to develop psychomotor and communication skills and for better grasping of subject. The results of our study had a mixed response with no clear cut indication of GD being better teaching tool than DL. Guidelines for the effective interactive session include adequate preparation, assignment of topics, role of facilitator, etc. Prior intimation to students is beneficial. Teachers must be technically trained to act as facilitators to guide and not dictate. This can be done by periodic ‘training of trainer’s sessions’ to the teachers. MCI must totally revamp the curriculum and give sufficient time to adopt small group discussion to each department. The institutes must provide adequate faculty, Demonstration halls and AV aid for effective implementation. While as in didactic lectures, a large class room, relatively less number of facilitator shall suffice. But for the success of effective teaching & training, one should prepare teaching methodology keeping in mind student and teacher perspective. In Indian scenario, judicious use of hybrid techniques shall be more beneficial. For success of any system involvement of student & teacher must be unequivocal.

From student angle….Thirst to learn.
From facilitator angle….Thrust to teach.

Acknowledgement: We duly acknowledge students who are the source for statistical work through their valuable responses to questionnaire.

Ethical Clearance: Not required as it is a student based questionnaire study

Conflicts of Interest: Nil

Source of Funding: Self

REFERENCES

Anaesthetic Deaths: Medico-legal Aspects

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ABSTRACT

Anaesthesia is almost an integral part of surgery. Almost each and every surgery needs anaesthesia. Sometimes mishaps will occur which leads to death of patient who undergone surgery. An anesthetic death is one of them. It is defined as death occurring within 24 hours of administration of anaesthesia due to causes related to anaesthesia. Since there is little interaction between the patient and the anaesthesiologist, people are not much aware about the anaesthesia & the risks involved in it. In perioperative deaths, anaesthetists are also blamed and relatives of the deceased approach to the police or court of law. To avoid this mess, the anaesthetist must do pre-anaesthetic checkup, take informed consent, check the equipment/monitors/drugs, attends the patient till he comes out from the effect of anaesthesia.

Since in this modern era of information & technology, every health personnel including the anaesthetist should update their knowledge and skill to avoid unnecessary litigations. This paper will throw some light on the medico-legal aspects related to the anaesthetic deaths.

Keywords: Anaesthetic death, Pre-anaesthetic check-up, informed consent, Medical Negligence.

INTRODUCTION

Anaesthesia is almost an integral part of surgery. Almost each and every surgery needs anaesthesia. Sometimes mishaps will occur which leads to death of patient who undergone surgery. An anesthetic death is one of them. It is defined as death occurring within 24 hours of administration of anaesthesia due to causes related to anaesthesia. However, death may occur even afterwards due to its complications.¹,² However, death due to anesthesia is very less. According to one study the estimated death rate is as low as 1 in 200,000 to 300,000 cases.³ Despite these commendable record, question remain about surgical patient safety related to types of anaesthesia provider. In the current era, the risk of anesthesia in the immediate perioperative period appears to be quite small.⁴⁵ Another study done by Lunn & Mushin, it was found that only 1 in 166 surgical patients die within 6 days, only 1 in 10,000 was actually due to the effects of the anesthesia alone. Further this study also concluded that the causes in anesthetic death had not changed significantly in the last 30 years in spite of marked changes in anaesthetic technology.⁶,⁷ In another study of peri-operative deaths, the most common (56%) cause of death is disease/injury for which the operation was done, which is followed by shock & inevitable risks of the operation (30%).

However, little is known about the effect of anesthetic management on long-term outcomes. Although no consistent long-term benefit has been shown to be related to a specific anesthetic, a recent study has suggested that regional anesthesia may improve survival in some patients.⁸ Anaesthetic death is one of the most stressful events as experienced by anaesthetists as well as surgeon which may vary from person to person or even from case to case. For someone it may be the emotional trauma and for others it may be the impact on their professional functioning.

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CAUSES OF ANAESTHETIC DEATHS:\textsuperscript{7,9,10}

1. Death due to Anaesthetic Agent: Hypersensitivity or adverse effects of anaesthetic agents causing cardiac arrhythmia/arrest or respiratory failure due to mayoneuronal blockage and rarely by liver necrosis and malignant hyperthermia as in cases of halothane administration.

2. Death due to Anaesthetists (Human Error): Improper techniques & equipments, lack of experience, gross negligence in precautions, careless in method, accidents during intubation/bronchoscopy, over dose of drugs and improper pre-anaesthetic medication.

3. Deaths due to Equipment Failure: Malfunction of apparatus, kinked pipes, cross tubes, explosion etc.

4. Deaths due to Functional Problems: Vagal inhibition, obstruction to glottis, cardiac arrhythmia, hypotension, sluggish reflex action as in unconscious patients.

5. Death due to factors other than Anaesthesia: Disease/injury for which anaesthesia and operation is being done, surgical mishappen (unintentional cutting/tearing of large blood vessels), postoperative events (phelebothrombosis, pulmonary embolism, aspiration), physical condition of patient (old age/diabetes/hypertension), inadequate communication between staff and unforeseeable conditions e.g. haemoglobinopathies (sickle cell anemia), occult coronary artery disease, transfusion hepatitis, and AIDS.

Gordon and Shapiro classify the causes of anaesthetic deaths into two groups:\textsuperscript{11}

1. Deaths which occur during the administration of anaesthesia, but which are not due to the anaesthesia; and

2. Deaths which are the direct result of the administration of an anaesthetic drug.

Deaths which Occur during the administration of Anaesthesia, but which are not due to Anaesthesia – There are various sub-categories under this group:

1. Deaths due to Injury or Disease which necessitated the Operation and Administration of Anaesthesia.

2. Deaths due to disease other than that for which the Operation was Undertaken, but which was Diagnosed before the Operation was Commenced

3. Deaths due to Disease other than that for which Operation was undertaken, but which was not Diagnosed before the Operation was Commenced

4. Surgical Deaths- A surgical mishap during the administration of anaesthesia may be responsible for the death of a patient.

Deaths which are the direct result of the Administration of Anaesthesia- The state of general anaesthesia of necessity deprive the patient of the majority of his protective reflexes. Consequently, homeostatic mechanisms are disturbed, particularly those pertaining to the respiratory and cardiovascular systems.

1. Death due to respiratory failure

2. Airway obstruction

3. Pneumothorax-

4. Aspiration of Gastric Contents

5. Respiratory depression

6. Equipment failure

7. Deaths due to Cardiovascular failure during anaesthesia

8. Hypovolaemia: Unrecognized or inadequately managed hypovolemia is the commonest cause of anesthesia related death attributable to the cardiovascular system.

9. Cardiac arrhythmia: Fatal cardiac arrhythmias may result from a variety of factors such as pre-existing disease, abnormal reactions to drugs, unskillful anesthesia, surgical stimulating, or a combination of these.

10. Diminished myocardial contractility: Myocardial performance may be impaired by metabolic disorder, electrolytic imbalances, hypoxia, hypothermia, drug and acute myocardial ischemia.

11. Complication of regional anesthesia:\textsuperscript{7,12}

• Pain - 25% of patients still experience pain despite spinal anesthesia.

• Postdural headache from cerebrospinal fluid (CSF) leak.

• Hypotension and bradycardia through blockade of the sympathetic nervous system.

• Limb damage from sensory and motor block.
• Epidural or intrathecal bleed.
• Respiratory failure if block is ‘too high’.
• Direct nerve damage.
• Hypothermia.
• Damage to the spinal cord - may be transient or permanent.
• Spinal infection.
• Aseptic meningitis.
• Haematoma of the spinal cord - enhanced by use of LMWH pre-operatively.
• Anaphylaxis.
• Anesthetic intoxication
• Urinary retention.
• Spinal cord infarction.

12. Adverse drug reaction: Hypersensitivity or adverse effects of anesthetic agents causing cardiac arrhythmia or cardiac arrest or respiratory failure due to mayoneuronal blockage and rarely by hepatic necrosis and malignant hyperthermia as in cases of halothane administration.

Medicolegal aspect of anaesthetic death and role of anaesthetist:

Whenever patient died during surgery done under anesthetic agent, the surgeon or anaesthetist should at once report the matter to the police for holding an inquest. In such situations, the purpose of the police inquest is to determine the existence of any prima facie evidence of criminal liability.

In a Case of Aruna ben, D Kothari and others vs Navdeep Clinic in which the patient died on table doctor didn’t send the police information regarding the death, and doctor was held responsible for this act of commission. The reason of doctor that the patient party didn’t want post mortem and even gave in writing, the court held that it is the doctor does not need any consent for sending the police information as the onus lies on doctor performing the surgery to establish beyond all doubts the cause of death as he cannot issue the death certificate without knowing the cause of death.13

Pre-Anaesthetic Check-up and Risk Assessment

The patient should be examined preoperatively for anaesthetic fitness. It is also necessary to prove that anaesthetist used reasonable care and skill in preparing the patient for anaesthesia before administrating it. The American society of anaesthesiologists has classified patients into number of grades according to their clinical conditions for assessing their physical fitness to undergo anaesthesia. The ASA classification is as follows:

ASA 1: Normally healthy individual
ASA 2: Patient with mild systemic disease.
ASA 3: Patient with severe systemic disease that is not incapacitating.
ASA 4: Patient with incapacitating systemic disease that is constant threat to life
ASA 5: Moribound patient who is not expected to survive 24 hours with or without operation.

<table>
<thead>
<tr>
<th>ASA rating</th>
<th>Mortality</th>
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<tr>
<td>1</td>
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<td>4</td>
<td>7.8</td>
</tr>
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<td>5</td>
<td>9.4</td>
</tr>
</tbody>
</table>

INFORMED CONSENT

Before giving anaesthesia, the anaesthetist should take a written consent from the patient. If the patient is minor than consent should be taken from the legal guardian. All the procedure should be explained to the patient. All possible side effects should also be explained. Nothing should be done against the will of the patient.

Reasonable degree of skill and care

When an anesthetist accepts the case, his duty is started. Now he has to examine the patient and decide whether the patient is fit for anesthesia or not and also what kind of anesthesia will be given, depending upon the clinical condition. Anaesthetist should have a reasonable degree of skill and care to perform all these acts. It is the duty of the hospital management to provide adequate and trained hands. They must provide all necessary latest functioning equipment. Trainee should be regularly supervised by the seniors. Anaesthetist must adhere to standard practice and follow the protocols of the institution.

Any act or omission by anaesthetist causing bodily injury, disease or death of the patient is negligence for which he/she can be sued in the civil court or in
consumer forum for compensation or can be punished under Sec. 304-A IPC in criminal court. Negligence against an anaesthetist can be proved when injury has occurred only from anaesthetic procedures due to deviation from the standard protocol.14

The burden of proving that the anaesthesiologist was negligent falls on the complainant. But when the negligence is gross and obvious to even a lay man, it comes under the doctrine of res ipsa loquitur, for example, when pre-anaesthetic evaluation is not done before giving anaesthesia, unexplained cardiac arrest during anaesthesia leading to death is negligence.13 Where an explosion occurred during the course of administering anaesthetic to the patient when the technique had been frequently been used without any mishap.15

Here the burden of proof does not lie on the plaintiff but defendant physician has to prove that the accident did not occur due to his negligence.16 In a case patient developed meningitis after spinal anaesthesia, court found that anaesthetic agent was not contaminated and the staff had taken the usual precautions to disinfect themselves before the operation, acquitted anaesthetist and passed sentence against hospital for some fault in sterilization procedure.17

PRECAUTION AND DEFENSE FOR ANAESTHETIST

Anesthetist should do pre-anaesthetic checkup. He should update his knowledge and apply reasonable degree of skill and care. Check all the machines and do sensitivity testing for those who cause allergic reaction. When an anesthetist is sued for negligence, he can defend himself by proving that he has applied reasonable degree of skill and care during anaesthetic procedures. A doctor is not negligent if he is acting in accordance with a practice accepted as proper by responsible body of medical men skilled in that art even though other doctors adapt a different practice. This is known as Bolam’s Law.18 The damage to the patient may also occur due to error in judgment, therapeutic misadventure, medical mal-occurrence, unforeseeable harm or when a new disease appears but doctor is not liable as long as he applied a reasonable standard of skill and care.

EXAMINATION OF ANESTHETIC DEATH19

The examination should be done into consideration by the pathologist when investigating an anesthetic death.

1) History: The necessary inquiries should cover the period prior to hospitalization.
2) Condition requiring surgery: some surgical conditions are on high risk e.g. resection of the aortic aneurysm and repair.
3) Preanaesthetic medications: error in relation to preoperative mechanism is giving wrong medication, over medication, or no medication, which may precipitate death.
4) Anaesthetic agents: inadvertent mixing of the anaesthetic gases may cause death.
5) Burn or explosion: death from anesthetic explosion occurs rarely.
6) Shock and hemorrhage: Shock and hemorrhage should be evaluated with other finding of the case.
7) Blood transfusion: Blood transfusion reactions and incompatibility should be investigated.
8) Resuscitative measure: the measures adopted should be noted.
9) Equipment: with appropriate qualified individuals, all the equipment including the valves and containers should be checked to assure the correct mixing of percentages.

AUTOPSY IN ANAESTHETIC DEATH20

Autopsy is performed without delay. Medical intervention should be left intact by medical & nursing staff. Relevant clinical case notes, x-rays, laboratory tests etc. should be studied prior to autopsy. Forensic experts should do professional first hand discussions with anaesthetist and surgeon involved. They should be invited to attend autopsy and to discuss the findings politely. For further investigations relative specimens e.g. toxicology, histology, biochemistry, and microbiology should be retained appropriately. It is essential to hold a discussion across the autopsy table involving Forensic expert/autopsy surgeon, anaesthetist and the surgeon concerned. It is often stated that deaths under anaesthesia were more often the fault of the anaesthetist than the anaesthesia alone.

While doing a post-mortem, it is difficult to evaluate the cause of death. Exterior of the body should be carefully examined looking for any wound,
surgical intervention or any other procedures. Occasionally, the odor of anesthetic agent may be smelt. The changes in the organs are of hypoxia. Alveolar air should be collected with a syringe by pulmonary puncture. Before chest is opened, blood should be collected under oil and both lung and brain saved and quick-frozen. In cases of spinal anesthesia, cerebrospinal fluid (CSF) should be collected for chemical analysis. The sample of gases used for anesthesia should also be sent for chemical analysis to know whether they were proportionately mixed before use. Gas chromatography study is done to evaluate the concentration of gases present in the viscera. When air embolism is suspected to be the cause of death, abdominal cavity should be opened first and inferior venacava should be inspected for air bubbles. Histopathological examination of tissue samples from heart, liver, kidney and brain should be done. Microbiological examination should be done for samples like blood and exudates. Serological examination to rule out the possibility of serologic reactions. The injection site, blood, and liver should be sent for toxicological identification of local anesthetic and its metabolic breakdown products.

**TOXICOLOGICAL EXAMINATION**

Collect sample and toxicological analysis should be done:

1) Alveolar air with a syringe by pulmonary puncture before opening the chest. One lung is removed and collected by clamping the main bronchus and retained in a nylon bag and sealed so that the headspace gas can be analyzed.

2) At autopsy some portion of fat from the mesentery, skeletal muscle tissue, brain, and liver, half of each kidney is retained.

3) Urine should be collected in containers, sealed and immediately refrigerated or frozen.

4) Blood should be collected under liquid paraffin. Blood, urine and other body fluids should also be collected for bacteriological examination.

5) Residual solutions, medication containers, samples of gases used for the anesthesia and samples of the operating room air may have to be collected in occasional cases.

**CONCLUSION**

- An anaesthetist should have better knowledge of his subject along with human anatomy, physiological functions and pathology. So that he could take proper decision and reduce mortality and morbidity.

- A good anaesthetist should do pre-operative check-up, develop good doctor patient relationship, make the patient comfortable for anaesthesia and surgery, take informed consent and explain about the procedure. Check all equipment and monitors along with necessary medicines. Supervise juniors and maintain up-to-date records.

- By the knowledge of the ASA “Standards for Basic Intra-Operative Monitoring” a decrease in the number of anesthesia-related liability claims.

- For the investigation of cause of death discussion between forensic pathologist, surgeon and anesthetist may arrive that will be the best consensus of opinion to offer the investigating authority and courts of law.

- Once this is done the courts will decide the issues of medical negligence by the fact whether the protocol was followed or not. This will also improve the patient care and the outcome.

- Use modern equipment’s and machines along with recent advancement in techniques, so that it can minimize the mortality and morbidity.

**Acknowledgement:** Nil

**Ethical Clearance:** Not needed

**Source of Funding:** Nil

**Conflict of Interest:** Nil

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Histopathological Changes in Adrenal Glands in a Case of Severe Burn Injury

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ABSTRACT

Adrenal glands are two small glands sitting over the two kidneys like a cap but taking a lot of burden, that tantamount to the major organs of our body; be it supporting and controlling our fright, flight, and fear of keeping our blood electrolytes normal. It is a very basic organ supporting human life in every aspect. So when this very human life brinks at the teetering edge, for example as in a case of a severe burn, this gland will undergo certain documentable changes to influence inevitable cascades boosting up the vital physiological processes of life. According to the National crime Research Bureau (NCRB) report of 2002 over 30,000 people died in India due to burn injuries, thereby contributing 9% of the total deaths. In various literatures, the glands and its immense endocrinally mediated effects on the body following a severe burn has been mentioned before. But here we are going to present the conspicuous histopathological changes in the Adrenal glands, following severe burn injury of a deceased female upon whom the autopsy was performed, to throw light over the pathophysiological aspects of severe burn injury from a different perspective.

Keywords: Adrenal glands, histopathological changes, severe burn, autopsy.

INTRODUCTION

Burns are among the most devastating injuries encountered in forensic medicine and are a leading cause of life-threatening trauma worldwide. According to the Centers for Disease Control and Prevention, someone in the United States dies in a fire every 175 minutes and is injured every 31 minutes. In Wallace Rule of Nine, for adults, 50% of body surface area if gets burnt can be fatal for a person. However the relationship between the extent of surface area burnt and the degree of morbidity and also mortality is very complex, both from clinical and pathological points of view.

Thermal injuries elevate corticosteroid secretion for weeks after injury, as a reaction to severe stress. Overload of the hypothalamic-pituitary-adrenal axis in this situation is thought to make this system unusually vulnerable to acute infarction and haemorrhage. Although the actual mechanism of adrenal hemorrhage is not clear, the combination of excessive stimulation by adrenocorticotropic hormone and hemodynamic instability have been implicated in its evolution. In case of burn injury the most common cause of death within 48 hrs. is hypovolemic shock. In most of the cases of burn injury, there is an evidence of violent struggle of the victim to get rid of the pain and agony resulting in a sudden surge in catecholamines i.e. Epinephrine and Norepinephrine. Also there is sudden spurt of K+ followed by massive fall.

Thus, the pathogenesis of adrenal changes, either biochemical or structural, as seen in burn cases are typically multifactorial. Necrosis and haemorrhage may occur during burns as a result of ischemia or during adrenal stimulation from vascular engorgement and stasis.

CASE HISTORY

In one February evening, a middle aged lady whose 90% body surface got burnt from an accident was rushed to Calcutta Medical College and Hospital and after receiving two days of treatment, she succumbed to the burn injury. The body subsequently
was taken to Kolkata Police Mortuary and the post mortem examination was performed by the autopsy experts from the Calcutta Medical College.

**AUTOPSY FINDINGS**

**a) External:** On meticulous external examination, dermo-epidermal burn injuries were detected over a wide area comprising of both sides of the chest wall, whole of the abdominal walls all around, whole of the back including the buttocks, anterior and posterior surfaces of both the upper limbs and right thigh and leg and only the anterior surface of the left thigh and leg and whole of the face.

**b) Internal:** a) Other than intense visceral congestion and edema of the lungs the internal findings were unremarkable. Both the kidneys were taken out en masse with their perinephric fat and adrenals were dissected out carefully maintaining its normal anatomical structures. The weight of the right and the left adrenal glands were 8 grams and 9 grams respectively. Both the glands were preserved in 10% formal saline solution. The standard protocols for histopathology were followed and tissue sections were stained with Haematoxylin and Eosin.

The specific findings on microscopy were as follows:

I. Haemorrhage and Inflammatory cellular infiltration(Fig:1)
II. Congestion(Fig:2)
III. Hyperplasia of Zona Glomerulosa with Oedema(Fig:3)
IV. Destruction of normal architecture of the gland with Necrosis(Fig:4)

**Histopathological examination of Adrenals**

**DISCUSSION**

The adrenal or suprarenal glands are a pair of endocrine glands situated in the posterior abdominal wall over upper pole of both the kidneys behind the peritoneum. Right suprarenal gland is triangular or pyramidal in shape and the left one is semilunar in shape, weighing 10-12 grams together. The glands are encased within the perinephric fat but the renal fascia is immediately continuous with the adrenal fascia; separated only by a thin septum, rendering them difficult to be dissected out during autopsy. They are
made up of two parts—the outer cortex and the inner medulla.[1,2]

The outer cortex is of mesodermal in origin, secreting a number of steroid hormones, primarily controlled by ACTH from the anterior pituitary. The adrenal cortex has three distinct zones. Beneath the capsule is the narrow layer of Zona Glomerulosa. An equally narrow Zona Reticularis abuts the medulla. Intervening is the broad Zona Fasciculata, which makes up about 75% of the total cortex.[1, 3]

Fig.5: Adrenal gland normal histology

Cells in the zona glomerulosa layer are separated by trabeculae of connective tissue that are continuous with the fibrous capsule of the gland and carry wide capillaries. Whereas the cells, in the zona fasciculate are arranged in columns radially oriented towards the medulla, having numerous lipid droplets responsible for the pale staining nature of the cytoplasm. Abundant mitochondria and a complex smooth endoplasmic reticulum are also present in the cells of this layer. The cells in the zona reticularis are small cells which form irregular cords and clusters, separated by capillaries and connective tissue. The cells contain relatively small quantities of cytoplasm and lipid droplets, and sometimes display brown lipofuscin pigment. On the other side, the chromaffin cells of the medulla are named for their characteristic brown staining.[3]

The adrenal cortex synthesizes three different types of steroids: (1) glucocorticoids (principally cortisol), which are synthesized primarily in the zona fasciculata and to a lesser degree in the zona reticularis; (2) mineralocorticoids, the most important being aldosterone, which is generated in the zona glomerulosa; and (3) sex steroids (estrogens and androgens), which are produced largely in the zona reticularis.[4]

The adrenal medulla is composed of chromaffin cells, which synthesize and secrete catecholamines, mainly epinephrine. Catecholamines have many effects that allow rapid adaptations to changes in the environment. Glucocorticoids have widespread effects on the metabolism of carbohydrate and proteins, mineralocorticoids are essential to the maintenance of a Na+ balance and ECF volume; and sex steroids exert its effects on the reproductive systems, particularly to the development of secondary sex characters.[3,4]

Burns, the commonest type of thermal injury, are among the most devastating injuries encountered in medicine and are a leading cause of life-threatening trauma worldwide. According to the Centers for Disease Control and Prevention, someone in the United States dies in a fire every 175 minutes and is injured every 31 minutes.[5] In acute burn injury within minutes to hours of injury, burned tissues release inflammatory and vasoactive mediators.[5-6]. The hyper metabolic response to burns is more severe and sustained than any other form of trauma. A massive surge in catecholamines and corticosteroids, 10 to 50 times greater than unburned plasma levels, drives the hyper metabolic response.[5]

The estimation of the surface area of the body involved is usually worked out by the Rule of Nine (Wallace); palmar surface of the patient’s hand being one percent of total body surface area (TBSA). According to American Burn association, Minor burn injury comprises of < 10% TBSA burn in adults, Moderate burn is 10 – 20% TBSA burn in adults whereas Major burn Criteria is> 20% TBSA burn in adults[7]. The prognosis is influenced by the age of the patient, his/her physical health at the time of the injury and also the treatment given. Under good treatment young children may recover from second degree burns involving 50-60 percent of their total body surface area[8]. In old age burns involving even 10 percent of the total body surface area are likely to prove fatal[9]. As mentioned above, surge of epinephrine and norepinephrine and also the sudden spurt of K+ followed by sudden fall may sensitize the body in the “Post Exercise Peril” Period.[10]

That is why; Burn is undoubtedly one of the major stresses that are encountered by the body. The term stress as used in biology has been defined as any
change in the environment that alters or threatens to alter an existing optimal steady state. Most if not all of these stresses activate counteractions at the molecular, cellular or systemic level that tend to restore the previous state i.e. they are homeostatic reactions\[4\]. Immune suppression and increased apoptotic loss of circulating lymphocytes have been reported after burn injury. Glucocorticoids are the predominant endocrine signaling system responsible for the increases in lymphoid cell apoptosis early after a burn injury in the thymus and spleen. Glucocorticoid-induced activation of caspase-3 appears to be a primary pathway for increased apoptosis. \[11\]. This hyperactive glucocorticoid, by its feedback mechanism, inhibits ACTH secretion to a dangerous level, resulting in Acute Adrenal Insufficiency also known as Secondary Hypoadrenalism\[4,11\].

Nevertheless, the basis for the adrenal hemorrhage is uncertain but could be due to seeding of small vessels in the adrenal, the development of disseminated intravascular coagulation, or endothelial dysfunction caused by microbial products and inflammatory mediators. Whatever the basis, the adrenals are converted to sacs of clotted blood, which obscures virtually all of the underlying detail. Histologic examination reveals that the hemorrhage starts within the medulla near thin-walled venous sinusoids, then suffuses peripherally into the cortex, often leaving islands of recognizable cortical cells\[12\].

According to another school of thought, increased functional activity is usually paralleled by an increase in size of the adrenal gland. Lipid depletion is commonly found, and cortical or medullary sinusoidal congestion is among the common pathologic findings. This in conjunction with autolysis may simulate hemorrhage. Hemorrhage, not infrequently massive and bilateral, may actually occur in fatal burn injury, consistent with the TBSA involved and extremities of age of affected individuals\[13\].

CONCLUSION

This autopsy based case study, emphasizing the correlation between the histopathological changes in Adrenal glands in a massive burn injury was performed mainly for academic interests. Besides the hemodynamic, biochemical, structural changes of the body, which are evident in any stress condition, we tried to reveal the histopathological changes of an organ responsible for the emergent actions under stress. Burn is considered to be one of the major stresses. The specific microscopical changes, which we have found in the adrenal glands, are similar to the changes when the body encounters other major stress situations. So, the basic common pathways by which human body encounters all the stresses are similar and thus, consequently the Adrenals end up having similar histopathological changes. In case of a severe burn injury, as we have found out, that there are certain specific histopathological changes in the adenal glands, changes which may infallibly result in the glucocorticoid mediated Secondary Hypoadrenalism But undaunted opinion regarding this, depending only one case study would be an overambitious work. That is why series of meticulous studies are required for this research.

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Tunneled Coronary Artery – A Case Series

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ABSTRACT

Isolated congenital coronary artery anomalies are rare, but well described cause of sudden death. Incidence of this condition is 1-1.5% of general population and only 50% of these cases are symptomatic. The medico legal significance is that it can be associated with exercise related sudden cardiac death in apparently healthy young adults. Tunneled coronary artery is an isolated congenital coronary artery disease in which a portion of a major coronary artery goes intramurally through the myocardium for a variable distance. The present descriptive prospective study was done at department of Forensic Medicine Government Medical College, Thiruvananthapuram. All cases brought for autopsy excluding the other causes of death were studied in detail during a period of one year from July 2009 to August 2010. Out of the 325 cases of sudden death, 120 were due to cardiac diseases and three cases showed features of tunneling of the coronary arteries. These cases were studied in detail and discussed in this case series.

Keywords: Tunneled Coronary Artery, Sudden Natural Death, Myocardial Ischaemia.

INTRODUCTION

Tunneled coronary artery is a congenital condition in which a portion of a major epicardial coronary artery goes intramurally through the myocardium for a variable distance1. It is usually considered as a benign condition and can be seen up to 80% of hearts at autopsy2. But a few cases have been reported regarding its association with sudden cardiac death.

The present descriptive prospective study was done at department of Forensic Medicine Government Medical College, Thiruvananthapuram. All cases brought for autopsy excluding the other causes of death were studied in detail during a period of one year from July 2009 to August 2010. Out of the 325 cases of sudden death, 120 were sudden cardiac death. Three cases showed features of tunneling of the coronary arteries.

CASE NO : I

A 40 year old male was found dead at his residence. At autopsy, there was no evidence of external or internal injuries. Heart weighed 250gm and was flabby. Lumen of right coronary artery was 1mm in diameter. Left anterior descending artery was seen dipping into the myocardium throughout its course and it was 5mm deep. On histopathology examination, coronary artery structure was normal. Myocardium showed inflammatory cell infiltration and necrosis of myocytes.

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Fig: 1 Heart showing Tunneling of Left Anterior Descending Artery
CASE NO: II

A 48 year old male was brought for autopsy with history of sudden death following chest pain while riding a bicycle. On examination, heart was flabby and weighed 225 gm. Left anterior descending artery was seen intramurally in the myocardium throughout its length and the depth from the epicardial surface was 6mm. Right coronary artery and left circumflex artery were normal. Microscopic structures of coronaries were normal. Myocardium showed congestion and inflammatory cell infiltration.

CASE NO III

A 43 year old loading and unloading worker was suddenly collapsed during his work. At autopsy, there was no evidence of external or internal injuries. Heart weighed 295 gm and was flabby. Left main coronary artery and its anterior descending branch were seen intramurally at a depth of 6 mm. On histopathology examination, coronary arteries and myocardium were normal.

In all cases, all other internal organs appeared normal and chemical analysis of viscera revealed no evidence of alcohol or poisons. So opinion as to the cause of death was given as postmortem findings are consistent with death due to coronary artery insufficiency.

DISCUSSION

The synonyms for tunneled coronary artery are intramural coronary artery and myocardial bridging. It was first mentioned by Reyman (1737) and the first in depth study of this condition was made by Geiringer in 1951. The length of the tunneling may be short, a few millimeters or long, a few centimeters. The most common site for the tunneling is middle 3rd of left anterior descending artery. Incidence of this condition varies from 1.5 to 16% by angiography to 80% in autopsy series. The low rate of detection of this condition during angiography is attributable to the thin bridges causing little compression. On an average, tunneling of the coronary arteries can be seen in about one third of adults. High prevalence has been reported in patients with hypertrophic obstructive cardiomyopathy.
Tunneled coronary arteries may be located at a depth of 1 to 10 mm with a typical length of about 10 to 30 mm. Two types of myocardial bridges have been identified: (1) superficial bridges in which the Left anterior descending artery is in the interventricular groove and the bridging myocardium crosses the artery perpendicularly or at an acute angle towards the apex and (2) deep in which muscle bundles arising from the right ventricular apical trabeculae, cross the Left anterior descending artery transversely, obliquely or helically before terminating in the interventricular septum.

Even though it is considered as a benign condition, patients can be rarely present with angina, myocardial ischemia and acute coronary syndromes, arrhythmias, ventricular dysfunction, exercise induced atrioventricular conduction block and sudden cardiac death. Autopsy studies have implicated tunneling of coronary artery in causing sudden cardiac death in individuals with otherwise normal heart and predominantly shown histological evidence of otherwise unexplained ischaemia. The physiologic effect caused by tunneling is systolic compression. But only 15% of the coronary blood flow occurs during systole and normally no ill effect can be produced. During exercise or stress, an increase in sympathetic drive will facilitate ischaemia because, tachycardia leads to an increase of the systolic-diastolic time ratio at the expense of diastolic flow. Increased contractility during stress further aggravates systolic compression. The factors related to the myocardial ischaemia and infarction are length of the tunneled segment, depth, degree of systolic compression and heart rate. Longer and deeper (>5mm depth) tunnelled coronary arteries, more than 75% of systolic occlusion of the vessel and tachycardia can contribute to myocardial ischaemia and infarction. Endothelial dysfunction and coronary artery spasm may also contribute to constriction of the tunneled segment.

In persons presenting with atypical chest pain, the tunneling of coronary artery can be established by coronary angiography, intra coronary Doppler ultrasound (ICD), Intravascular ultrasonography (IVUS) and intracoronary pressure devices. In coronary angiography, typical “milking effect” and a “step down – step up phenomenon induced by systolic compression of tunneled segment can be seen”. The characteristic IVUS observation for the existence of myocardial bridging is ‘half moon’ phenomenon. ICD shows “fingertip” phenomenon due to increased pressure gradient in early diastole as a result of reduced distal coronary resistance and delayed relaxation of myocardial fibres with continuing lumen compression.

Symptomatic patients may be treated with negative inotropic and/or negative chronotropic agents, surgical myotomy and/or CABG and stenting of tunneled segment. These can improve quality of life.

In the cases described above, all showed tunneling of one of the major coronary artery and in the two cases, there was ischaemic changes in the myocardium suggestive of coronary insufficiency. In the third case, 6mm deep tunneling of left anterior descending artery was seen and the myocardium appeared normal. Death occurred suddenly during severe exertion and there was no time for evolution of ischaemic changes in the myocardium.

CONCLUSION

Even though tunneled coronary artery is a common congenital benign condition, it can cause sudden cardiac death. It can be considered as cause of death if there is no evidence of injuries or poisoning and the only positive finding is tunneling of a major coronary artery with or without ischaemia.

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Custodial Death: A Two Years Prospective Study

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ABSTRACT

In any civilized nation, death in custody would pose several questions regarding safety of the person under confinement, and the functioning of law enforcement agencies comes under scanner. To analyze this situation from all aspects, present prospective study was conducted in the Department of Forensic Medicine and Toxicology, Govt. Medical College, Amritsar. A total of 70 (57 male and 13 female) cases of custodial deaths over a study period of 2 years were examined in detail. In 56 cases (80%), the cause of death was natural, while in 14 (20%) cases it was unnatural. In natural deaths, coronary artery disease (22.8%) and pulmonary tuberculosis (17.1%) were the two main causes of death. Of unnatural deaths, 10% were due to suicide, 4.3% were due to homicide and 5.8% were accidental in manner. This study emphasizes the role of doctor to evaluate cause of death and manner of death in custody and to suggest various means for the welfare of prisoners.

Keywords: custodial deaths, cause of death, manner of death, role of doctor.

INTRODUCTION

As per Oxford dictionary, custody means ‘protective care or guardianship of someone or something’. In the legal parlance, custody is defined as any point in time when a person’s freedom of movement has been denied by law enforcement agencies, such as during transport prior to booking, or during arrest, prosecution, sentencing and correctional confinement1.

Custodial death invites public wrath, concern and mass resentment in any civilized society because such an event indicates the lack of careful handling on the part of the authorities’ concerned2. Custodial violence leading to death in lock-ups strike a blow at the rule of law. Not that at each time, the death is due to violent causes but at times it may be due to natural causes or due to inadequate medical facilities or medical attention and diagnosis, or negligent behavior of authorities3. The person who is held in custody is totally dependent on his or her custodian for proper care and enough medical attention. Therefore, in all cases of custodial deaths, a thorough investigation is always needed. A doctor has a unique role in documenting medical evidence in cases of custodial deaths; doctor can greatly improve communication between health professionals and the regulatory authorities as well as facilitate the proper evaluation of information on this subject4,5.

MATERIAL & METHOD

The present prospective study of two years duration from 1.5.2008 to 30.4.2010 was carried out in the Department of Forensic Medicine and Toxicology, Govt. Medical College, Amritsar, on cases of custodial deaths brought for postmortem examination. During the period of the study, out of a total of 2387 autopsies conducted by the department, the total no. of custodial death cases was 70 (2.93%). All cases of custodial deaths were categorized, according to their place of confinement, in to three groups viz. jail custody, police custody and mental hospital custody (the persons lodged in the custody of Government mental hospital, Amritsar).

All the cases were studied in detail. Autopsy in each case was performed as per the standard protocol. The inquest papers, hospital record of the deceased, autopsy findings and the reports of the laboratory...
investigations including chemical examination were also gone through. Causes of death were categorized as natural or unnatural. All the observations were tabulated, analyzed and the results were compared with the previous studies.

**OBSERVATIONS**

In the present study, out of total 70 cases of custodial deaths, 42 (60%) died in jail custody, 27 (38.5%) died in mental hospital custody and in one (1.43%) case, the death occurred in the custody of the police.

**Table I: Age wise distribution of custodial death cases**

<table>
<thead>
<tr>
<th>Age group</th>
<th>Jail custody (n=42)</th>
<th>Mental Hospital Custody (n=27)</th>
<th>Police custody (n=01)</th>
<th>Total (n=70)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;10 years</td>
<td>1 (1.4%)</td>
<td>Nil</td>
<td>Nil</td>
<td>1 (1.4%)</td>
</tr>
<tr>
<td>11-20 years</td>
<td>3 (4.3%)</td>
<td>3 (4.3%)</td>
<td>Nil</td>
<td>3 (4.3%)</td>
</tr>
<tr>
<td>21-30 years</td>
<td>11 (15.7%)</td>
<td>3 (4.3%)</td>
<td>1 (1.4%)</td>
<td>15 (21.4%)</td>
</tr>
<tr>
<td>31-40 years</td>
<td>12 (17.1%)</td>
<td>5 (7.1%)</td>
<td>Nil</td>
<td>17 (24.3%)</td>
</tr>
<tr>
<td>41-50 years</td>
<td>4 (5.7%)</td>
<td>5 (7.1%)</td>
<td>Nil</td>
<td>9 (12.9%)</td>
</tr>
<tr>
<td>51-60 years</td>
<td>9 (12.9%)</td>
<td>5 (7.1%)</td>
<td>Nil</td>
<td>14 (20%)</td>
</tr>
<tr>
<td>&gt;60 years</td>
<td>2 (2.9%)</td>
<td>9 (12.9%)</td>
<td>Nil</td>
<td>11 (15.7%)</td>
</tr>
<tr>
<td>Total</td>
<td>42 (60%)</td>
<td>27 (38.6%)</td>
<td>1 (1.4%)</td>
<td>70 (100%)</td>
</tr>
</tbody>
</table>

Maximum no. of custodial deaths i.e. 17 (24.3%), occurred in the age group of 31-40 years. In jail custody deaths, maximum deaths i.e. 12 (17.1%) occurred in the age group of 31-40 years. While in mental hospital custody maximum deaths i.e. 9 (12.9%) occurred in the age group of above 60 years. The solitary case of death (1.4%) in police custody was of a 30 years old male. (Table I)

Of all Jail custody deaths, 30 (71.4%) were of under trial prisoners, while 12 (28.6%) were of convicted prisoners. (Fig.2)

**Fig.1 Gender wise distribution of custodial deaths**

Out of total 70 cases, 57 (81.4%) were male and 13 (18.6%) were female. Deaths in jail custody comprised of 40 (57.1%) males, in mental hospital custody comprised of 16 (22.9%) males and one (1.4%) death in police custody comprised of male; and rest of the cases were females.

**Fig.3 Incidence of hospital care before death**

As shown in Fig. 3, a total of 39 (55.71%) persons received medical care before their death, while 31 (44.3%) died at their place of confinement and did not receive medical care before their death. The cases that were brought dead to the hospital were considered not to have received medical care before their death.
TYPES OF CUSTODIES

Of all the custodial deaths, 56 (80%) died due to natural causes, while 14 (20%) died due to unnatural causes. 32 cases (45.1%) of jail custody deaths, 23 cases (32.85%) of mental hospital custody deaths and 1 case (1.4%) of police custody deaths were due to the natural causes. The remaining 10 cases (14.2%) of jail custody deaths and 4 cases (5.71%) of mental hospital custody deaths were due to unnatural causes. No case of unnatural death was reported from the police custody (Fig.4)

Table II: Distribution of natural causes of death

<table>
<thead>
<tr>
<th>Cause of death</th>
<th>Type of custody</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Jail custody (n=32) (%)</td>
<td>Mental hospital custody (n=23) (%)</td>
<td>Police custody (n=1) (%)</td>
<td>Total (n=56) (%)</td>
<td></td>
</tr>
<tr>
<td>Pulmonary Tuberculosis</td>
<td>11 (15.7%)</td>
<td>1 (1.4%)</td>
<td>Nil</td>
<td>12 (17.1%)</td>
<td></td>
</tr>
<tr>
<td>Coronary artery disease</td>
<td>7 (10%)</td>
<td>9 (12.8%)</td>
<td>Nil</td>
<td>16 (22.8%)</td>
<td></td>
</tr>
<tr>
<td>Septicemia</td>
<td>6 (8.8%)</td>
<td>3 (4.3%)</td>
<td>Nil</td>
<td>9 (12.8%)</td>
<td></td>
</tr>
<tr>
<td>Pneumonitis</td>
<td>3 (4.3%)</td>
<td>3 (4.3%)</td>
<td>Nil</td>
<td>6 (8.8%)</td>
<td></td>
</tr>
<tr>
<td>Chronic obstructive pulmonary disease</td>
<td>2 (2.9%)</td>
<td>5 (7.1%)</td>
<td>Nil</td>
<td>7 (10%)</td>
<td></td>
</tr>
<tr>
<td>Seizural disorder</td>
<td>1 (1.4%)</td>
<td>Nil</td>
<td>Nil</td>
<td>1 (1.4%)</td>
<td></td>
</tr>
<tr>
<td>Hepatic failure</td>
<td>1 (1.4%)</td>
<td>1 (1.4%)</td>
<td>Nil</td>
<td>2 (2.9%)</td>
<td></td>
</tr>
<tr>
<td>Acute tubular necrosis</td>
<td>Nil</td>
<td>Nil</td>
<td>1 (1.4%)</td>
<td>1 (1.4%)</td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>1 (1.4%)</td>
<td>1 (1.4%)</td>
<td>Nil</td>
<td>2 (2.9%)</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>32 (45.7%)</td>
<td>23 (32.8%)</td>
<td>1 (1.4%)</td>
<td>56 (80%)</td>
<td></td>
</tr>
</tbody>
</table>

Coronary artery disease was the most common overall natural cause of death in custody (16, 22.8%). In jail custody, however pulmonary tuberculosis accounted for most no. (11, 15.7%) of natural deaths. In mental hospital custody, coronary artery disease (9, 12.8%) was the main cause of natural death. The only person who died in police custody, the cause of death in his case was natural i.e. shock leading to acute tubular necrosis. (Table II)

Table III: Distribution of manner of unnatural deaths in custody

<table>
<thead>
<tr>
<th>Manner of death (Unnatural)</th>
<th>Type of custody</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Jail custody</td>
<td>Mental hospital custody</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Suicide</td>
<td>5 (7.1%)</td>
<td>2 (2.9%)</td>
<td></td>
<td>7 (10%)</td>
</tr>
<tr>
<td>Homicide</td>
<td>3 (4.3%)</td>
<td>0</td>
<td></td>
<td>3 (4.3%)</td>
</tr>
<tr>
<td>Accidental</td>
<td>2 (2.9%)</td>
<td>2 (2.9%)</td>
<td></td>
<td>4 (5.8%)</td>
</tr>
<tr>
<td>Total</td>
<td>10 (14.3%)</td>
<td>4 (5.8%)</td>
<td></td>
<td>14 (20%)</td>
</tr>
</tbody>
</table>
Out of 14 (20%) cases of unnatural custodial deaths, 7 (10%) were suicidal, 3 (4.3%) were homicidal and 4 (5.8%) were accidental in manner. Maximum no. of suicide cases, 5 (7.1%) occurred in jail custody, followed by mental hospital custody (2, 2.9%). All 3 (4.3%) cases of homicide occurred in jail custody. Accidental manner accounted for 2 (2.9%) cases each in jail and mental hospital custody. (Table III)

### Table IV: Methods of unnatural deaths and their distribution in different types of custody

<table>
<thead>
<tr>
<th>Type of custody</th>
<th>Suicide</th>
<th>Homicide</th>
<th>Accidental</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hanging</td>
<td>Poisoning</td>
<td>Injury</td>
</tr>
<tr>
<td>Jail custody</td>
<td>3 (4.3%)</td>
<td>2 (2.9%)</td>
<td>2 (2.9%)</td>
</tr>
<tr>
<td>Mental Hospital custody</td>
<td>1 (1.4%)</td>
<td>1 (1.4%)</td>
<td>-</td>
</tr>
<tr>
<td>Police custody</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td>4 (5.8%)</td>
<td>3 (4.3%)</td>
<td>2 (2.9%)</td>
</tr>
</tbody>
</table>

Hanging occurred as a method of suicide in 3 (4.3%) cases of jail custody, and in 1 (1.4%) case of mental hospital custody, while poisoning accounted for 2 (2.9%) cases of suicide in jail custody and 1 (1.4%) case of mental hospital custody. In jail custody, homicidal injuries accounted for 2 (2.9%) deaths. 2 (2.9%) deaths also occurred due to accidental manner in jail custody, 1 (1.4%) was due to cervical spine injury sustained after falling from roof and 1 (1.4%) occurred due to exposure to cold. The 2 (2.9%) deaths occurring due to accidental manner in mental hospital custody were due to falling down. (Table IV).

### DISCUSSION

The incidence of custodial deaths is steadily rising in India. According to the National Human Rights Commission, the no. of custodial deaths in 2000-2001 was 1,037, while in the year 2007-2008, they increased to 1,977. The increasing incidence of deaths in custody is affecting the credibility of the rule of law and the administration of criminal justice system.

In the present study, the incidence of custodial deaths was 2.93% of the total autopsies done. Out of 70 cases of custodial deaths studied, 57 (81.4%) were male and 13 (18.6%) were female. Maximum no. of custodial deaths were seen in the age group of 31-40 years (24.3%) followed by the age group of 21-30 years (21.4%).

In the study of Gargi and Chananan’ conducted over a period of 2 years, the incidence of custodial deaths was 0.77%. Bardale et al studied 70 custodial deaths over a period of 5 years out of unspecified no. of total autopsies. In both the above studies, all the cases were male and maximum age incidence was same as in the present study i.e.31-40 years.

It concludes that the incidence of custodial deaths has significantly increased in recent years. The crime rate among females has also increased, as shown by the increased no. of female prisoners dying in custody in present study. The age group of 21-30 years being the second most common age group of custodial deaths in present study concludes that crime rate is enhancing amongst the younger age group. The increasing incidence of custodial deaths coupled with increasing crime rates among the females and the younger generation is an alarming trend which should be the cause of concern for everyone.

Most of the deaths in jail (71.4%) involved under trial prisoners. The reason being that the under trials are uncertain about the outcome of their trial and thus cannot come to terms with the prison conditions. Due to this they become more aggressive and hence more prone to homicide, suicide, psychological diseases. The sluggish pace of trials is also responsible for their frustration and aggressive behaviour.

In the present study, 55.71% of the inmates had received medical attention before their death as compared to 64.28% in the study of Bardale et al. It concludes that of late, the timely referral of sick custodial patients to the hospital has decreased which is a negative trend and needs to be looked after by the authorities.
Table V: Comparison of cause of death with the previous studies

<table>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural death</td>
<td>80%</td>
<td>82.85</td>
<td>41%</td>
<td>61.5%</td>
<td>39%</td>
<td>45.1%</td>
<td>36.2%</td>
</tr>
<tr>
<td>Unnatural death</td>
<td>20%</td>
<td>17.15</td>
<td>59%</td>
<td>38.5%</td>
<td>61%</td>
<td>54.9%</td>
<td>61.2%</td>
</tr>
</tbody>
</table>

Except the study of Bardale et al, the incidence of unnatural custodial deaths is less in the present study as compared to the previous studies. The reason for this can be attributed to the activism of National Human Rights Commission, media awareness regarding custodial deaths, general public awareness and the constant fights of various NGO’s against the custodial torture. (Table V)

**NATURAL DEATHS**

In the present study, coronary artery disease was the overall major natural cause of death followed by pulmonary tuberculosis. However, in jail custody pulmonary tuberculosis was the main cause of natural death followed by coronary artery disease. In mental hospital custody, coronary artery disease was the major cause of natural death, followed by chronic obstructive pulmonary disease. It was also observed that the maximum no. of natural deaths in jail custody were in the age group of 21 to 40 years, while in mental hospital custody, were in the age group of 60 years and above. In police custody the only case of death was due to natural cause. The present study is in resemblance with previous studies conducted by Bardale et al\(^3\) and Gargi and Chanana\(^7\) in relation to the natural causes of death.

However, Wobeser et al\(^8\) reported that after coronary artery disease, cancer was the second most common cause of natural deaths in their study as compared to pulmonary tuberculosis in the present study. This probably is due to less congestion and neat and clean atmosphere in the prisons of the west.

**UNNATURAL DEATHS**

Among the 14 unnatural deaths, half (7) were due to suicide in the present study. This is similar to the findings of previous studies by Sattar et al, Wobeser et al, Okoye, Gargi and Channa and Karve Institute of social work, Pune, where suicide came out to be the cardinal manner of unnatural deaths. Hanging and poisoning were the two methods of committing suicide in this study. Therefore authorities should be careful that the inmates are not in the possession of poisons or other such things which may help them in taking the extreme step of ending their lives.

As far as homicide is concerned, 3 cases were reported from jail custody. In two cases, the death was due to injuries, which were either sustained during scuffle between the prisoners or allegedly inflicted by the prison guard. Administration of poison, allegedly by the jail authorities, was also seen in 1 case of death by homicide. These incidents show the inhuman and barbaric attitude of the jail authorities towards the inmates as well as lack of effective control over them and should be curbed at the earliest.

Accidental injuries were also reported in 3 cases. These were sustained due to accidental fall on the ground leading to death of the inmates. One person in jail custody was also reported to have died due to exposure to severe cold. The custodians should exercise due care and caution to minimize the risk of such deaths.

**CONCLUSION**

The custodians are bound by law to provide adequate necessary amenities to ensure the health and safety of the persons in custody, including timely medical assistance and treating the inmates in a humane manner. They are also bound to respect their right to life as enshrined in Article 21 of the constitution. However, the incidence of custodial deaths has shown an increasing trend in recent years. The authorities should take various steps to mitigate this trend. A doctor can also play a pivotal role in suggesting various means for the welfare of prisoners. He is responsible for proper and regular health checkups of the inmates which helps in early detection and treatment of natural and communicable
diseases. The inmates are also prone to various non-communicable diseases mainly due to physical inactivity, unhealthy and stressful environment and unhygienic food. They are also prone to various mental health problems like depression, anxiety and behavioral problems leading to physical and sexual violence, deliberate self-harm and violent behavior. The role of doctor in alleviation of these conditions can not be overemphasized. However it needs a holistic approach which includes vocational training, meditation and periodic psychological counseling of the inmates. The doctor also has the liability to properly document the various custodial deaths and disseminate the information to the authorities concerned.

Acknowledgement- Nil

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REFERENCES


Fetal Autopsy: A Review

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ABSTRACT

Fetal autopsy helps to arrive at an accurate diagnosis in case of fetal demise. It also enables the clinician to assess the recurrence risk of an adverse maternal outcome and thereby, provide proper genetic counselling to the affected parents. Despite the emergence of many advanced imaging techniques, many studies suggest that fetal autopsy holds its ground as the standard way to interpret the cause of fetal death. The procedure and guidelines followed for fetal autopsy play a great role in influencing the outcome. Hence, the protocol for a fetal autopsy is being described in this article. This article highlights the types of fetal perinatal autopsy; the legal prerequisites for a medicolegal and academic autopsy; the standard procedure of a fetal autopsy; and the comparison of efficacy of imaging techniques and autopsy to make a diagnosis of the cause of fetal loss, still birth and neonatal death.

Keywords: Fetal autopsy, medicolegal autopsy, academic autopsy, congenital anomalies, external examination.

INTRODUCTION

Fetal autopsy

Foetal autopsy helps to understand the cause of death and acts as a confirmation to the clinician regarding the cause of death.¹ Foetal autopsy can be of two types academic and medicolegal. The current article briefly describes the objectives and procedure to conduct a foetal autopsy of both the academic cases and medicolegal cases.

The major objectives of foetal or perinatal autopsy in an academic autopsy are to determine the gestational age, document rate of growth, detect any congenital anomalies, analyse the clinical diagnosis and treatment and ascertain the cause of death. These findings help the clinician to determine the possible recurrence rate in subsequent pregnancies and counsel accordingly.² In order to have a meaningful assessment, the family and personal history of parents, obstetric history, teratogenic exposure if any are taken into account.³,⁴,⁵

The trend of foetal autopsy has declined over the past few years. Noninvasive diagnostics like CT scan, MRI and prenatal ultrasound have been the latest mode of evaluating any anomaly associated with the foetus. Surprisingly, it has been observed that a number of anomalies are missed out in the prenatal scans and a number of studies have documented that autopsy is an important procedure to substantiate and add to the clinical information.⁶ There is sufficient evidence to prove none of the currently available imaging techniques can substitute an autopsy.

For academic and research purposes, fetuses can be obtained through elective abortions conducted as per the MTP act Govt of India (1971)⁷ and also through still births. A requisition form from a gynaecologist or a neonatologist is a prerequisite in case of an academic postmortem. An academic foetal autopsy can decipher the cause of death and aids in counseling the parents for future pregnancies. Among these, the fetuses with congenital anomalies can be preserved and displayed in the anatomy or pathology museum as teaching aids for medical students. The normal fetuses can be utilized to perform developmental studies. Foetal autopsy also has a major role in helping to understand and unfold the mystery of developmental anatomy. One can study the histogenesis of various organs and observe the expression of various molecular markers.
and decipher their role in development. Prior to conducting such a study, ethical clearance should be obtained from the institutional ethical committee.

On the other hand the medicolegal autopsies are carried out by requisition from a police officer of the rank of subinspector, incharge of a police station, under s 174 of Criminal Procedure Code (CrPC). It tries to determine the time of abortion/death in case of full term, viable or nonviable and the sex of the foetus. The officer has to inform the magistrate upon receiving information of an unnatural or accidental death. He has to perform an investigation and make a report which is known as Panchnama. signed by the police officer and few respectable members of the neighbourhood, known as Panchas, who witnessed the investigation. If the cause of death cannot be ascertained, or, foul play is suspected, the foetus is sent to the authorized medical person for an autopsy.

In accordance with s 162 of CrPC, it is imperative that the medical officer give a statement if the police officer asks for it, unless, otherwise directed by some state government regulations. The autopsy report shall prevail over the inquest report in case of any discrepancies between the two.

Guidelines to be followed prior to conduction of an autopsy:

All foetal autopsy cases are sent to the department of Anatomy or Pathology from the obstetrician or neonatologist. A competent foetal anatomist or pathologist should ideally carry out a foetal autopsy. Prior to conducting an autopsy, the requisition form of the treating doctor should be checked. All autopsies should follow the stringent rules of ICMR which are based on the Helsinki declaration. The parent or legal guardian of the deceased fetus should consent in written for the procedure in the presence of a witness.

The identity of the fetus must be confirmed. A detailed maternal history and medical history of any siblings (if present) must be taken. Once the consent form and the maternal status form is duly filled, the procedure can start.

Foetuses are preserved in 10% formalin to prevent postmortem autolysis and then transported to the lab.

On receiving the foetus a morphometric evaluation is conducted.

EXTERNAL EXAMINATION

1. Weighing

2. Measurements:

Measurement is done using pliable tape measure. String or thread can also be used and placed on a flat ruler to record length. Important parameters like the crown rump length (CRL), crown heel length (CHL), head circumference (HC), bi-parietal diameter, chest circumference (CC): at level of nipples, abdominal circumference (AC): at the level of umbilicus, foot length (FL). Foot length is useful in small gestational fetuses (severely macerated fetuses, major abnormalities like anencephaly and dilatation and evacuation procedure where only the foot may be intact). Inner and outer canthal distances and the inter-pupillary distance should be measured.

GENERAL EXAMINATION

A systematic external examination must be performed with a cephalic to caudal approach.

The appearance of normal healthy skin and its turgor marks it should be observed carefully (important for medicolegal cases). Hair and abnormal hair patterns should be observed. The skull should be palpated for any masses along with measurements and palpation of fontanelles. Ear, eyes and nose should be examined. Any signs of cleft lip or palate should be noted. Contour of the neck and back should be seen for any deformity. Chest and abdomen are to be assessed for symmetry. Upper and lower extremity are assessed for any deformity.

Remains of umbilical cord if attached to abdomen are usually measured and site of its insertion is noted. External genitalia: assessment of male and female phenotype and development are noted. In male fetus scrotal sac is palpated for testis and in female fetus the vaginal and urethral openings are identified. Anal atresia is also checked with a probe.

AUTOPSY PROCEDURE

To proceed with the autopsy clean instruments, sample bottles with fixative and properly labeled should be arranged. Following external examination a
complete dissection of the foetus is conducted. A good light source and a dissecting operative microscope (magnascope) to magnify structures is required.

**INITIAL INCISION**

The foetus is placed on a tray and the shoulders and chest are raised above the dissecting surface. Neck is hyper extended for allowing optimal exposure. A "Y" shaped incision is made extending the arms of "Y" to top of shoulders to free up the skin over anterior aspect of neck. Arms of "Y" converge inferiorly to lateral aspect and inferior aspect of nipple and meet midline at xiphoid process. The vertical limb of "Y" incision is made in midline from xiphoid process, extending around left side of umbilicus to pubic symphysis. A nick is made in this midline incision near the umbilical veins. Scissors with rounded tips are placed into the nick in abdominal wall. The abdominal wall is then opened up by lifting up on it slightly to avoid cutting abdominal organs. One finger is inserted inferior to umbilicus along inner abdominal wall to palpate umbilical arteries which extend on either side of urinary bladder. An elliptical incision is made along right side of umbilicus preserving urachus and umbilical vessels. Skin flap over chest is pulled upwards, retracting its attachment from chest. Skin, subcutaneous tissue and muscles are reflected out from lower ribs to expose abdominal contents.

**THORAX EXAMINATION**

Ribs are lifted and cut off for exposing thoracic organ by holding xiphoid process by toothed forceps. Lungs are inspected for normal lobation and patency of trachea is observed. The heart is exposed by removing thymus and position of the heart is noted. Each chamber with valves are examined and the aorta is cannulated to see for any developmental defect in the heart. Dissect the esophagus from behind so as not to miss any tracheoesophageal fistulas.

**ABDOMEN EXAMINATION**

After dissecting the thoracic region the abdominal cavity is dissected, the liver, occupies most of the abdominal cavity. The domes of the diaphragm are examined and its position is noted. Abdominal organs are inspected for situs, color, measurement and in situ relations. In foetus abdominal cavity to liver ratio is larger as compared to the adult anatomy. The liver is removed to see the stomach and follow the coils of intestine. They are uncoiled and the length is measured. Following this the pancreas is seen in the posterior abdominal wall. The kidney of the right and left side are observed along with the ureter and urinary bladder. The gonads are dissected out. In a female foetus, the uterus and uterine tubes with ovaries are identified. In males the testes is seen.

**CENTRAL NERVOUS SYSTEM EXAMINATION**

A craniotomy is done to remove the brain and brainstem to observe its development. Spinal cord is also examined by doing a laminectomy.

**Organ retrieval and histopathology:** Brain, lungs, liver, kidney, cardiac muscle and any other viscera to be studied are dissected and processed for histopathology. If a metabolic disorder or poisoning is suspected, the tissues must be taken within 4-6 hrs of death.

**Special investigations:** Karyotyping and whole body radiography is carried out wherever necessary.

After the dissection, all organs must be returned to the body cavities, and, the incisions must be sutured. The body is either handed over to the parents or disposed. If histopathological report is awaited, Provisional Report must be given to the clinician within 24-48 hrs.

**CONCLUSION**

For academic purposes, fetuses can be obtained through elective abortions conducted as per the MTP act, and also through still births. Among these, the fetuses with congenital anomalies can be preserved and displayed in the anatomy or pathology museum as teaching aids for medical students. The normal fetuses can be utilized to perform developmental studies.

Nowadays, fetal autopsies are being replaced with many contemporary techniques such as prenatal ultrasonography, x ray and karyotyping. Although these have revolutionized the process of establishing the cause of fetal death, fetal autopsy still is of vital importance because many associated malformations are missed during these investigations. Many other studies have similar findings and stress upon conducting an autopsy to obtain a meaningful diagnosis.

It is of paramount importance for the grieving
family that has had the misfortune of a fetal death. In case a family does not consent for an autopsy, they can be encouraged to agree for a limited autopsy, wherein, the only vital organs suspected to be affected, are autopsied. For example, if a cranial malformation is suspected, only the brain can be autopsied. It has to be kept in mind that such limited autopsies may not provide the complete picture.  

There are several factors that determine the effectiveness of a fetal autopsy, such as expertise of the embryologist/ anatomist/ pathologist; protocol used; antenatal diagnosis and the level of hospital care.

Literature reveals that the relevance of fetal autopsy cannot be negated. Autopsy still remains the gold standard to detect congenital anomalies and give a correct diagnosis to the parents. Thus, the clinicians must be sensitised to the necessity of a fetal autopsy. An increase in the number of venues offering the facilities of fetal autopsy is the need of the hour, so as to enable the clinician to arrive at the accurate diagnosis. This will undoubtedly help in genetic counselling of the families which have suffered from loss of pregnancy, thereby, attenuating the anxiety of such families as regards future risk of recurrence of the unfortunate event.

Conflict of Interest: None

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Funding: MAMC Research Scheme

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Suspected Virginity which Proved Fatal: A Case Report

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ABSTRACT

Deflowering is once in a lifetime event that cannot be repeated. Virginity is thus considered a gift, award, barrier or taboo. But it only has meaning amongst humans and off course the word “hymen”. The word Hymen is derived from Greek meaning – “membrane” and it also signifies “the Greek god of marriage”. These two facts summarize the conventional wisdom about this widely misunderstood tissue, that this fabled membrane if pierced, broken or torn asunder tend to bleed when women have intercourse, presumably for the first time. This concept has been seriously scrutinized in some of the smaller cities, conservative families and many cultures.

Here is a case report of a newlywed couple whose beautiful atmosphere of first wedding night turned out to be the worst nightmare over an issue of the small tissue “the hymen”, when the cynical attitude of the bridegroom couldn’t be tolerated by the bride and their family members, matters got out of control and lead to an unfortunate demise of the bridegroom.

Keywords: Virginity, hymen, culture.

INTRODUCTION

Virginity is a state of a person who has never engaged in sexual intercourse.1 There are cultural and religious traditions which place special value and significance on this state, especially in case of unmarried females, associated with notions of personal purity, honor and worth. The first act of sexual intercourse by a female is commonly considered within many cultures to be an important personal milestone. Its significance is reflected in expressions such as “saving oneself” and the occasion is at times seen as the end of innocence, integrity, or purity, and the sexualization of an individual.2 Brides who fail to bleed after sexual intercourse on the wedding night may face cruel consequences such as rejection, humiliation, ostracism, divorce and even violence. This is a type of incidences are still prevalent in countries like turkey, mid eastern Asia, Bangladesh, Brazil, the Ecuador, Egypt, India, Israel, Italy, Jordan, Pakistan, Morocco and Sweden.3

The attitudes of people towards sexuality on virginity differ according to their country of residence, socioeconomic status, family type, gender, knowledge on sexual education and perception of sexual topics.4 Here is a case of a man who erroneously understood the concept of virginity that turned out to be fatal.

CASE REPORT

The case report as narrated and documented by the investigating officer of Kolar police station and the accused, their identity has not been revealed. The ethical clearance from the relevant authorities has been obtained for publishing this paper.

A clerk who got recently married had learnt from his colleagues that a girl should bleed during first sexual intercourse and he was under the same impression. During his very first wedding night experience he found that his wife did not bleed and he started to doubt his wife’s virginity. Then he repeatedly inquired his wife whether it was her first experience or not, with repeated questioning by her husband she tried to prove her innocence stating she never had any sexual intercourse earlier. In spite of all this, the husband started torturing his wife. The beautiful atmosphere of the first night turned in to a
shocking one. The bride started crying and went off the room and narrated the whole story to her parents. The family members got horrified by the inhumane behavior of the bridegroom lost their temper and beat the bridegroom black and blue. Unfortunately, the bridegroom sustained multiple injuries and died of head injury.

**DISCUSSION**

The concept of virginity has significance only in a particular social, cultural and moral context. In the studies conducted, the researchers state the presence or absence of a hymen is not a reliable indicator of whether or not a female has been vaginally penetrated. Hymen as defined by a philosopher Hanne Blank as a “door frame mounted in a doorway that stands on the spot where ‘external stops’ and ‘internal’ starts”

Where the notion revolves around the word “Hymen” which is derived from the Greek meaning – “membrane” and also it signifies the “Greek god of marriage”. These two meanings summarize the conventional wisdom about this widely misunderstood tissue that this thin membrane filled with blood vessels situated just inside the vulva and partially occludes the vaginal wall, and when “pierced” or “torn asunder” tends to bleed when women have intercourse, presumably for the first time. The hymen is flexible and can be stretched or torn during first engagement in vaginal intercourse and may also be broken at birth, during childhood as a result of washing, walking, self-exploration, masturbation, physical activities or athletic activities.

There are varying understandings as to which types of sexual activities result in loss of virginity. The traditional view is that virginity is lost through vaginal penetration by the penis, consensual or non-consensual. Some cultures require proof of bride’s virginity before her marriage. This has traditionally been tested by the presence of an intact hymen, which was verified by either a physical examination or by a “proof of blood,” which refers to vaginal bleeding that result from the tearing of hymen after the first sanctioned sexual contact. In some cultures, the wedding blood-spotted bed sheet would be displayed as proof of both consummation of marriage and that the bride was a virgin. There is tremendous pressure on girls from smaller cities and more conservative families and virginity does still play a major factor when it comes to their marriage.

However many brides under such extreme pressure have gone to the extent of cutting their thighs with their sharpened finger nails producing enough blood to stain the sheets and satisfy tradition and the myth surrounding the hymen.

In another study, the statistics show that 0.1% females are born without hymen membranes and only 43% of women have bleeding during the first intercourse, the remaining 57% of women’s hymen is elastic enough to stretch or ruptured earlier without any bleeding.

According to the Gynecologist and sex counselors, this kind of mentality are largely because of our traditional values are still strongly embedded in us.

**CONCLUSION**

People of all ages have questions about sex and sexuality which is quite natural and is always a good thing to obtain accurate information. Some children are shy with their parents and teachers, they ask their friends to get answers or get information through internet. Unfortunately, this information is often unreliable, wrong or misleading. They often end up having misconceptions which are never cleared.

If one have questions about their partner’s previous sexual experiences, it is better to ask her in ways that are respectful, gentle and thoughtful manner rather than to make assumptions based on the bedroom sheets. It is also worth considering to what extent her sexual history matters to you in your current relationship, as well as to what extent your own history may matter to her.

In addition, the governmental institutions should fully live up to their obligations to enforce the laws that protect women’s rights, particularly with regards to laws concerning traditional practices such as honour crimes, and the testing of virginity. Role of parents, teachers, Governmental Organizations, Non-Governmental Organizations plays an important role in educating the children, families and general public.

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**Source of Funding:** Nil

**Ethical Clearance:** Institutional ethical clearance has been obtained.

**REFERENCES**

Study of Fatal Poisoning Cases in Tumkur Region

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ABSTRACT

Poisoning remains as one of the commonest cause of unnatural death. In this retrospective study, a total of 189 cases died due to poisoning and autopsied at District hospital, Tumkur, Karnataka were analyzed during the period January 2013 to December 2014. In the present study, males (71.42%) outnumbered females (28.58%) with majority belonging to 21-30 years age group (71 cases) followed by 31-40 years (41 cases). Organophosphorus poisoning accounted in 124 cases, followed by aluminum phosphide in 18 cases. Suicide was the commonest manner of death accounting for 173 cases. Poisoning acts as a medico-legal, social as well as epidemiological issue. Strict legal enforcement in selling and use of agrochemicals is needed.

Keywords: Poison; Death; Organophosphorus; Phosphide;

INTRODUCTION

Poisoning is one of the leading cause for unnatural premature death of lot of precious human lives and thereby hampering human resource development in India. According to World Health Organization, 3 million pesticide poisoning cases with 220,000 deaths occur yearly.¹,² Poisoning is the commonest mode adopted in India to commit suicide.³ In India, as agriculture is the main occupation, insecticides are used to a greater extent. There is variation in pattern of poisoning from region to region as it depends on the knowledge of people regarding the poison, accessibility, socioeconomic factors etc. Agriculture based occupations, low cost, easy accessibility without any strict rules on the sale of poison have caused an increase in incidence of poisoning cases.

MATERIAL & METHOD

Study material comprised of fatal poisoning cases autopsied during the two year period [January 2013- December 2014] at the district hospital, Tumkur, Karnataka. A total of 189 cases of poisoning were retrospectively analyzed based on the autopsy report, hospital case records and chemical analysis report. Poisoning due to animal bites were excluded from this study.

RESULTS & DISCUSSION

In this present study a total of 189 autopsied cases due to poisoning were analyzed, of which 135 cases (71.42%) were male and 54 cases (28.58%) were female. Male to female ratio was 2.5:1. In the study done by Gargi J et al ⁴ out of 340 cases of poisoning, 248 were male (72.94%) and 92 cases were female (27.06%) with the ratio 3:1 respectively. Similar results with male preponderance was found in the studies done by Shivaramu et al ⁵, Dash SK et al ⁶ and Chakrabarty P et al ⁷.

Most commonly involved age group in our study was 21-30 years, wherein 52 cases (38.51%) were male and 19 cases (35.18%) were female. This is followed by the age group of 31-40 years, of which 27 cases (20%) were male and 14 cases (25.9%) were female. [Table – 1] In Gargi J et al ⁴ study the majority of the victims were of the age group of 21-30 years (45.59%). Similar results were found in studies done by Shivaramu et al ⁵ and Gannur et al ⁸.

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The commonest manner of death due to poisoning was suicidal-173 cases (91.53%), followed by accidental variety-11 cases (5.82%), and alleged homicide 5 cases (2.6%). In Gargi J et al. study, manner of death being suicidal was highest (260 cases – 76.46%) as compared to accidental (71 cases – 20.91%) and six homicidal cases (1.78%). Similar results were noted in studies of Dash SK et al. and Sharma BK et al. 9

Among poisons detected, organophosphorus compound was found in 124 cases (65.60%), followed by 18 cases (9.52%) of aluminum phosphide, 15 cases (7.93%) were due to alcohol with organophosphorus compound. [Table – 2]. In study done by Shivaramu et al organophosphorus compound was found in majority of cases followed by aluminum phosphide. Similar results were found in studies of Gupta BD et al. and Rahul J et al. 11

In the present study health related issues were the most common motive for poisoning (60 cases - 31.74%), followed by family issues (46 cases – 24.33%), financial reasons (19 cases – 10.05%), educational (17 cases), etc. [Table – 3]. In study done by Chakrabarty P et al. more than one third (36.69%) of deaths were due to domestic conflict/violence/marital disharmony/ quarrel etc.

Table 1: Age wise distribution of poisoning cases.

<table>
<thead>
<tr>
<th>Age group (Years)</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 10</td>
<td>01</td>
<td>00</td>
</tr>
<tr>
<td>11-20</td>
<td>05</td>
<td>06</td>
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<td>21-30</td>
<td>52</td>
<td>19</td>
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<td>41-50</td>
<td>23</td>
<td>11</td>
</tr>
<tr>
<td>51-60</td>
<td>14</td>
<td>03</td>
</tr>
<tr>
<td>61-70</td>
<td>11</td>
<td>01</td>
</tr>
<tr>
<td>71-80</td>
<td>02</td>
<td>00</td>
</tr>
<tr>
<td>Total</td>
<td>135 cases</td>
<td>54 cases</td>
</tr>
</tbody>
</table>

Table 2: Distribution of cases according to the poison detected in chemical analysis.

<table>
<thead>
<tr>
<th>Type of poison</th>
<th>Number</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organophosphorus</td>
<td>124</td>
<td>65.60</td>
</tr>
<tr>
<td>Phosphide</td>
<td>18</td>
<td>09.52</td>
</tr>
<tr>
<td>Organophosphorus + Alcohol</td>
<td>15</td>
<td>07.93</td>
</tr>
<tr>
<td>Alcohol</td>
<td>07</td>
<td>03.70</td>
</tr>
<tr>
<td>Pyrethroid</td>
<td>05</td>
<td>02.64</td>
</tr>
<tr>
<td>Nitrobenzene</td>
<td>02</td>
<td>01.05</td>
</tr>
<tr>
<td>Carbamate</td>
<td>02</td>
<td>01.05</td>
</tr>
<tr>
<td>Formaldehyde</td>
<td>02</td>
<td>01.05</td>
</tr>
<tr>
<td>Pyrethroid + Alcohol</td>
<td>01</td>
<td>0.52</td>
</tr>
<tr>
<td>Pyrethroid + Nitrobenzene</td>
<td>01</td>
<td>0.52</td>
</tr>
<tr>
<td>Oleander</td>
<td>01</td>
<td>0.52</td>
</tr>
<tr>
<td>Paracetamol</td>
<td>01</td>
<td>0.52</td>
</tr>
<tr>
<td>Phenytoin</td>
<td>01</td>
<td>0.52</td>
</tr>
<tr>
<td>Alcohol + Phosphide</td>
<td>01</td>
<td>0.52</td>
</tr>
<tr>
<td>Negative FSL result</td>
<td>08</td>
<td>04.23</td>
</tr>
<tr>
<td>Total</td>
<td>189</td>
<td></td>
</tr>
</tbody>
</table>

Table 3: Distribution of cases according to motive.

<table>
<thead>
<tr>
<th>Motive</th>
<th>Number</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health issues</td>
<td>60</td>
<td>31.74</td>
</tr>
<tr>
<td>Family</td>
<td>46</td>
<td>24.33</td>
</tr>
<tr>
<td>Financial</td>
<td>19</td>
<td>10.05</td>
</tr>
<tr>
<td>Educational</td>
<td>17</td>
<td>8.99</td>
</tr>
<tr>
<td>Dowry</td>
<td>10</td>
<td>5.29</td>
</tr>
<tr>
<td>Unascertained</td>
<td>37</td>
<td>19.57</td>
</tr>
<tr>
<td>Total</td>
<td>189</td>
<td></td>
</tr>
</tbody>
</table>

CONCLUSION

Rapid industrialization and massive use of pesticides in agriculture has increased the incidence of poisoning. Epidemiological study of poisoning can help in taking measures for prevention of it. In the present study, males (71.42%) outnumbered females (28.58%) with majority belonging to 21-30 year age
group (71 cases), followed by 31-40 years (41 cases). Organophosphorus poisoning accounted in 124 cases, followed by aluminum phosphide in 18 cases. Suicide was the most common manner of death in this study. Strict legal enforcement in selling of agrochemicals is needed. Agriculturists must be educated regarding the usage of insecticides in order to avoid accidental exposure.

Acknowledgement: District Surgeon and RMO of District Hospital, Tumkur, for their kind support to carry out this research work.

Conflict of Interest: None

Source of Funding: None

Ethical Clearance: Not applicable, as this is a retrospective study based on autopsy reports.

REFERENCES


Sex Determination by Computerized Tomographic Study of Foramen Magnum in Adults

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ABSTRACT
Skeletal remains in the identification of sex have been used for long period. Skull is considered second best, after pelvis in determination of sex. Methods based on morphological characteristics and morphometry have been in use with good accuracy. The standardized radiographic techniques have advantage over morphological methods being calculable and reproducible. The objective of the study was to obtain the reliability of foramen magnum parameters in sex estimation and to test the accuracy of the radiological method adopted. A total of 105 (55 male & 50 female) Three dimensional axial skull base images from the North Karnataka population were selected. Using Fisher’s linear discriminant functions test, three parameters namely, the length of left condyle (LLC), width of foramen magnum (WFM) and maximum bicondylar diameter (MBD) emerged to be statistically significant in each sex (p< 0.05) with an overall accuracy of 70.48%, in sex prediction.

Keywords: Foramen magnum (FM); Forensic Anthropology; Computerized tomography; Sex determination; Three dimensional reconstruction; Discriminant function analysis.

INTRODUCTION
Accurate identification of skeletal and decomposing human remains is the utmost challenging task in forensic practice, all over the globe and in India as well. Sex determination is one of it. Sex can be established by gross examination of skeleton using metric and morphological techniques.¹-³ Sexing the skeleton which is intact and entire is certainly easier and reliable with high accuracy as against done with only a part of the skeleton or fragmented skeletal remains.² The recovered fragmented bones pose the extreme difficulties in the identity.⁴-⁵ However, incomplete skull bones irrespective of being in good state, need subsequent osteological studies dealing with sexual dimorphism especially those parts which usually withstand bad conditions of burial, natural calamities, mass disasters, terroristic activities, conflagration etc. Considering these facts, foramen magnum always attracts attention of most of the researchers, though its importance is controversial.⁸

The occipital bone remains well protected and well preserved structure by huge volume of soft tissues. This makes occipital bone useful in the sex determination studies compared to other parts of the skull.⁸ Literature review revealed only few studies on sex determination by Three Dimensional Computerized Tomography (3D CT) study of foramen magnum.¹-⁸,¹⁰,¹¹,¹³

MATERIAL & METHOD
The present prospective study was conducted in the Department of Forensic Medicine, SDM College of Medical Sciences & Hospital, Dharwad, over a period of 18 months during January 2011 to June 2012. Material for the present study comprised of a total of one hundred five (105) Three Dimensional Tomographic (3D CT) scanned axial images of the skull base of 55 male and 50 female randomly chosen adult subjects from a North Karnataka population.

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of age group 25-60 years, referred to the Radiodiagnosis department, SDM College of Medical Sciences and Hospital, Dharwad. The case files were studied in accordance with that of inclusion and exclusion criteria. Written consent was obtained from each of the patient or relatives prior to the CT exposure. The consecutive cranial CT slices were then obtained parallel to orbito-meatal line at 3 mm slice thickness in axial mode by caudo-cranial movement of the platform for cranial CT images routinely. The probable errors due to asymmetry/obliquity by the faulty positioning of the patient for collimated images were minimized by 3D volume rendered images technique (VRT). The axial images gained by the scanning were transferred to the reconstruction application using 3D medical application software. Two co-ordinate points (horizontal and vertical) were used to reconstruct the single image. The first step was to define cranial landmarks. The most prominent anatomy in 3D view was selected to get proper image with the modification into 3D model. Second step was to measure foramen magnum and related structure parameters in millimeters using digital calipers graduated to 0.1 mm. Landmarks for taking these measurements are illustrated in the Figure 1 and 2 as 3D CT images. Total nine parameters measured by two separate observers in each case were as follows.

1. Length of foramen magnum (LFM): The maximum internal length of the foramen magnum along the mid-sagittal plane

2. Width of foramen magnum (WFM): The maximum internal width of the foramen magnum perpendicular to mid-sagittal plane

3. Length of right occipital condyle (LRC): The maximum length of right condyle along the long axis

4. Width of right occipital condyle (WRC): The width of right condyle

5. Length of left occipital condyle (LLC): The maximum length of left condyle along long axis

6. Width of left occipital condyle (WLC): The width of left condyle

7. Minimum intercondylar distance (MnID): The minimum distance between medial edges of the articular surfaces of both condyles

8. Maximum bicondylar distance (MBD): The bicondylar breadth, the maximum distance between lateral edges of the articular surfaces of the condyles

9. Maximum medial intercondylar distance (MID): The intercondylar breadth, the maximum distance between the medial articular margins of both condyles

There were no significant Inter or Intra observer’s errors observed for 10 cases prior to taking the study. The data was subjected to the different statistical procedures like descriptive statistics, unpaired t test, discriminant function analysis and Fisher’s linear discriminant function analysis.

Figure 1: 3D CT scan image illustrating parameters of the foramen magnum (LFM-3D1 and WFM-3D2) and occipital condyles (LRC-3D3, WRC-3D4, LLC-3D5, WLC-3D6)

Figure 2: 3D CT scan image illustrating other related parameters of foramen magnum and occipital condyles (MnID-3D1, MBD-3D2, MID-3D3)

RESULTS

The sample of 105 3D CT images was selected among the 2412 cases subjected to CT head scan in the department of Radio-diagnosis during the study
period. By unpaired t test, the parameters LRC and LLC and MBD, reported higher sex differentials with a higher significance at \( p < 0.01 \) statistically.

By applying direct discriminant function analysis to all the measured variables taken together to evaluate their predictor power for sex determination. It was observed that none of the parameter showed statistically significant discrimination at \( p < 0.05 \). The stepwise discriminant function analysis involves evaluation of the best combination of variables that can predict the sex correctly. It was observed that LLC, with \( p \) value = 0.005 disclosed the most differential variable for sex determination. It was followed by WFM with \( p \) value = 0.0151) and MBD, with \( p \) value = 0.05). Thus, by utilizing these three significant parameters, the Canonical discriminant coefficients were calculated and depicted in table 2. The unstandardized discriminant coefficients were used for building the formula among the statistically significant variables. Thus, by installing these coefficients in the formula, one can determine the sex of a given bone with certain accuracy.

The standardized discriminant coefficients were used to compare the relative importance of the independent variables. In the present study, the sectioning point obtained was 0.0627, with male centroid as -0.06265 and female centroid as 0.6891. The values greater than -0.6265 were considered as male and values lesser than 0.6891 were considered as female in the studied population. The next step was to calculate the constant values between both sexes utilizing the statistically significant variables such as LLC, WFM and MBD. Hence, the Fisher’s linear discriminant function analysis was performed as in Table...The resultant formula derived by Stepwise discriminant function analysis was as follows.

\[
D_{\text{male}} = 2.9628 \times \text{LLC} + 4.7580 \times \text{WFM} + 5.3746 \times \text{MBD} - 236.4015
\]

\[
D_{\text{female}} = 2.5771 \times \text{LLC} + 4.4925 \times \text{WFM} + 5.1769 \times \text{MBD} - 210.7264
\]

Where, \( D \) signified, the discriminant score of the sex for the total sample measured, LLC= length of left condyle, WFM= width of foramen magnum and MBD= maximum bicondylar distance. The accuracy of the stepwise function analysis was then tested for classifying the sex correctly. The results observed were 72.73% with male sample, 68.00% with female sample and 70.48% for both sexes taken together. Thus, in an unidentified fragmented skull with these three values installed in the formula, the resultant larger numerical value among the two (\( D_{\text{male}} \) and \( D_{\text{female}} \)) scores implies that sex, with an accuracy of 70.48%.

### Table 1: Comparison of mean values of the parameters among both sexes by unpaired \( t \) test

<table>
<thead>
<tr>
<th>Variables **</th>
<th>Male</th>
<th>Female</th>
<th>( t )-value</th>
<th>( p )-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>LFM</td>
<td>35.31</td>
<td>33.75</td>
<td>3.2774</td>
<td>0.0014*</td>
</tr>
<tr>
<td>WFM</td>
<td>29.31</td>
<td>27.93</td>
<td>3.1376</td>
<td>0.0022*</td>
</tr>
<tr>
<td>LRC</td>
<td>23.72</td>
<td>21.83</td>
<td>4.2363</td>
<td>0.0000*</td>
</tr>
<tr>
<td>WRC</td>
<td>11.88</td>
<td>11.31</td>
<td>1.9755</td>
<td>0.0500*</td>
</tr>
<tr>
<td>LLC</td>
<td>24.00</td>
<td>21.73</td>
<td>5.0915</td>
<td>0.0000*</td>
</tr>
<tr>
<td>WLC</td>
<td>12.66</td>
<td>11.78</td>
<td>3.1415</td>
<td>0.0022*</td>
</tr>
<tr>
<td>MnID</td>
<td>15.23</td>
<td>14.92</td>
<td>0.7140</td>
<td>0.4768</td>
</tr>
<tr>
<td>MBD</td>
<td>48.55</td>
<td>46.07</td>
<td>4.9137</td>
<td>0.0000*</td>
</tr>
<tr>
<td>MID</td>
<td>24.06</td>
<td>24.04</td>
<td>0.0176</td>
<td>0.9860</td>
</tr>
</tbody>
</table>

\( p < 0.05 \)

* \( p \) Values that are highly significant
DISCUSSION

Present study depicted the statistically significant difference between the mean male and mean female values (p < 0.05) by applying an unpaired t test. This was similar to the results presented in similar morphometric studies for diverse global populations of Nigerian, Historic British, Turkish, Brazilian and Indian origin. The forward stepwise discriminant function analysis revealed the parameters such as LLC as best discriminator, followed by WFM and MBD as the next statistically significant parameters in sex determination with p< 0.05. However, using sectioning point (0.0627) derived (Table 2) by stepwise discriminant function analysis, a value higher than sectioning point was considered to be female (0.6891) and value below it is considered to be male (-0.6265) (Table 2). By utilizing these three parameters LLC, WFM, MBD and using Fisher’s linear discriminant function analysis, in the present study 72.73% of the males and 68.00% of the females predicted the sex identity correctly, with an overall accuracy of 70.48% in sex determination (Table 3).

In a similar 3D CT study reported by Uysal S et al involving one hundred living subjects from Turkey, 79.20% of the males and 82.7% of the females predicted sex identity correctly with an overall accuracy of 81% for both sexes. This higher percentage of accuracy here as compared to our study could be due to the difference in the source population involved. In our study, the statistical significance of the MBD was an additional finding, which was not reported by Uysal S et al’s study. This necessitates further studies in future to provide better results.

Uthman AT et al in their study reported a higher rate of accuracy of 90.7% in male and 73.3% in female, with an overall accuracy of 81.8% than the present study. Their study included sagittal (LFM) and transverse (WFM) diameter, along with the circumference (FMC) and the area (FMA) of the foramen magnum. 3D CT measurements were utilized for FMC and FMA only, while the other parameters were measured on 2D CT images. The higher rate of percentage reported in their study may be attributed to the use of 3D CT images of the above mentioned parameters. Utilizing LFM and WFM, they reported only 69.3% of the overall accuracy in classifying the sex. The other tomographic studies by, Erdil FH et al and Penenkova et al did not performed discriminant function analysis.

In a morphometric study Macaluso PJ, reported 67.7% accuracy by stepwise function analysis utilizing LLC, MLC and MnD confirming significant sexual dimorphic traits. On applying direct function analysis, he also reported that the percentage...
accuracy got reduced to 66.6% with lengths (LRC and LLC) and breadths (WRC and WLC) of both condyles. However, our study differed with these results, reporting a higher percentage of accuracy of 70.48% by LLC, WFM and MBD as the significant sexual dimorphic traits (Table 3), perhaps due to difference in the methodology opted. Both sexes are thus predicted almost equally by stepwise function analysis in the present and Macaluso PJ’s study. Gapert et al in their study, also expressed limited sexual dimorphism in the occipital condyles reporting 69.2% to 76.2% accuracy after performing discriminant function analysis in their study sample of British skulls.

Babu YPR et al observed a higher percentage accuracy of 81% in prediction of the sex among the total of ninety (90) adult dry skull samples of Indian origin studied by them, by performing BLR (Binary Logistic Regression) analysis with the anteroposterior (APD) and transverse (TD) diameters of the foramen magnum. The differences in statistical methods applied by Babu YPR et al in their study may attribute to the higher percentage of accuracy reported by them than by us in the our study.

The population, genetic factors, environmental changes and geographical distribution will always have an impact in development of an individual. The difference in accuracy can be attributed to differences in the population studied. The methodological difference can also play an important role in achieving various grades of success in determining the sex.

The major advantage of taking digital measurements is that it can be employed with great speed and accuracy, on the CT scan images. It can be obtained without much difficulty and destruction of the specimen. The 3D CT makes it more accurate in identifying the osteological landmarks as compared to routine two dimensional CT images. It provides all the necessary information in a single radiologic study, as against two or more studies that would have been essential in the past. Yet, the researcher must comprehend to categorize the parameters selected on the image for getting accurate results. However, the disadvantages for 3D CT studies are that, it is an expensive method and that it cannot be practiced without the help of radiologist and the technical equipment required, which is available only in a Radio-diagnosis department of a tertiary care hospital.

**CONCLUSION**

A total of 9 parameters of foramen magnum LFM and WFM and its related parameters LRC, WRC, LLC, WLC, MnID, MBD and MID were measured on the three dimensional computerised tomography images in a total of 105 (males 55 and females 50) South Indian study subjects of North Karnataka origin.

Mean of values of all parameters were higher in male (n=55) as compared to female (n=50) sample.

Significant sexual dimorphism was observed using stepwise discriminant function analysis. The percentage accuracy for sex determination in males was 72.73%, and in females it was 68.00%, with an overall accuracy of 70.48% for total sample studied.

The three dimensional Computed Tomographic (3D CT) method utilized in the present study can be useful when the fragmented cranial bases referred for examination in routine forensic practice. However, it may not be recommended when an intact and complete cranium is being referred for examination.

**Acknowledgement:** Authors would like to acknowledge Mr. Jawali statistician, SDM College of Dental sciences and hospital, Sattur, Dharwad.

**Ethical Clearance**- Obtained from Institutional ethical committee

**Source of Funding**- Nil

**Conflict of Interest**- Nil

**REFERENCES**


Estimation of Stature by Measurement of Foot Length

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ABSTRACT

Stature is one of the important criteria for identification of an individual. Estimation of stature is especially important when the dead body is found in the form of skeleton or only part of a dead body is found. In present study attempts are made to find out the correlation between the stature and foot length of an individual. Total 160 students (80 male & 80 female) of medical college, Jhalawar are included in study. All these students were measured for stature and foot length. The data obtained were analyzed statistically. Regression equations were derived for right and left foot separately and by these regression equations formulae derived. In present study, stature of a person can be estimated within the error of 3.86 to 4.17 cm from the foot length.

Keywords: Stature, foot length, Regression Equations

INTRODUCTION

A medico-legal expert is often required to establish the identity of an unknown dead body, found in skeletonised or mutilated state. In such cases stature of the person is estimated to establish the identity. It is based on the fact that there is a relationship exist between the measurements of stature and different body parts and long bones of an individual.

A number of studies by different researchers such as Trotter M. & Glesser G. C.¹, Albrook D.² and Athwale N. C.³ etc. has been conducted throughout the world to develop formulas to reconstruct the stature using long bones

Later on studies has been conducted by percutaneous measurements of different body parts to find out the correlation between different body parts & stature. Such studies has been conducted by different researchers like Krishan K & Sharma A⁴, Agnihotri A K & Purvar B et al.⁵, Patel S M et al.⁶, Kanchan T et al.⁷, Chavan K D & Datir S B et al.⁸ and Chikhalkar B G et al.⁹ etc.

The present study is conducted to find out correlation between the foot length and stature of an individual and to derive the regression formulae to estimate the stature from the foot length of an individual. This study will help to estimate the stature of an unknown dead body when it is found in mutilated or dismembered state but foot is intact.

MATERIAL & METHOD

The present study has been conducted on 160 (80 male and 80 female) students of medical college, Jhalawar. All students belongs to age group 18-25 years. Their informed consent were taken and then their measurements were taken. Stature was measured in standing position on stadiometer without shoes with head oriented in eye to eye (Frankfort) plane. The foot length was measured as a distance from the most prominent point of the back of the heel to the tip of hallux or tip of the second toe when the second toe was longer than hallux using the sliding caliper.

All these measurements were taken by author no 1 on the same time on each day. After that these data were analyzed statistically and regression equations were derived for right and left foot length to estimate the stature of an individual.

OBSERVATION & DISCUSSION

The stature of the male varies from 158 cm to 185 cm with mean stature is of 172.1 cm and standard
deviation is 5.791cm. The length of right foot of the males varies from 24.2cm to 29.5cm with mean foot length is 26.241cm and standard deviation is 1.039cm and correlation coefficient with stature is 0.729. The length of left foot of the males varies from 24.4cm to 29.4cm with mean foot length is 26.237cm and standard deviation is 1.098cm and correlation coefficient with stature is 0.724 (see Table-1)

Table-1 Measurement of stature and foot length in males (in Cm)

<table>
<thead>
<tr>
<th>Measurements</th>
<th>Stature</th>
<th>Right foot length</th>
<th>Left foot length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum</td>
<td>185</td>
<td>29.5</td>
<td>29.4</td>
</tr>
<tr>
<td>Minimum</td>
<td>158</td>
<td>24.2</td>
<td>24.4</td>
</tr>
<tr>
<td>Mean</td>
<td>172.1</td>
<td>26.241</td>
<td>26.237</td>
</tr>
<tr>
<td>Standard deviation (S D)</td>
<td>5.791</td>
<td>1.039</td>
<td>1.098</td>
</tr>
<tr>
<td>Correlation coefficient (r)</td>
<td>0.729</td>
<td>0.724</td>
<td></td>
</tr>
<tr>
<td>Standard error</td>
<td>3.96</td>
<td>4.02</td>
<td></td>
</tr>
</tbody>
</table>

The stature of the female varies from 149cm to 173cm with mean stature is of 158.831cm and standard deviation is 5.395cm. The length of right foot of the females varies from 21.8cm to 27cm with mean foot length is 23.906cm and standard deviation is 1.161cm and correlation coefficient with stature is 0.698. The length of left foot of the females varies from 21.9cm to 27cm with mean foot length is 23.901cm and standard deviation is 1.103cm and correlation coefficient with stature is 0.693 (see Table-2)

Table-2 Measurement of stature and foot length in females (in Cm)

<table>
<thead>
<tr>
<th>Measurements</th>
<th>Stature</th>
<th>Right foot length</th>
<th>Left foot length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum</td>
<td>173</td>
<td>27</td>
<td>27</td>
</tr>
<tr>
<td>Minimum</td>
<td>149</td>
<td>21.8</td>
<td>21.9</td>
</tr>
<tr>
<td>Mean</td>
<td>158.831</td>
<td>23.906</td>
<td>23.901</td>
</tr>
<tr>
<td>Standard deviation (S D)</td>
<td>5.395</td>
<td>1.161</td>
<td>1.103</td>
</tr>
<tr>
<td>Correlation coefficient (r)</td>
<td>0.698</td>
<td>0.693</td>
<td></td>
</tr>
<tr>
<td>Standard error</td>
<td>3.86</td>
<td>4.17</td>
<td></td>
</tr>
</tbody>
</table>

For estimation of stature from hand length regression equations is derived using the formulae

\[ y-y' = r \frac{SDy}{SDx} (x-x') \]

here \( y = \text{Stature} \), \( y' = \text{mean stature} \),
\( r = \text{Correlation coefficient} \),
\( SDy = \text{Standard deviation of stature} \),
\( SDx = \text{Standard deviation of foot length} \),
\( x = \text{foot length} \), \( x' = \text{mean foot length} \)

Using this formulae stature is calculated in males as-

\[ \text{Stature} = 4.06x \text{ Right foot length } + 65.458 \]
\[ \text{Stature} = 3.82x \text{ left foot length } + 71.845 \]

Using this formulae stature is calculated in females as-

\[ \text{Stature} = 3.25x \text{ Right foot length } + 81.212 \]
\[ \text{Stature} = 3.39x \text{ left foot length } + 77.793 \]

**CONCLUSION**

In the present study, a significant correlation between stature and foot length has been observed in both males and females.

Measurements of right foot length were greater than the left foot but the difference is marginal and statistically insignificant.

By using the regression equations in present study the stature can be estimated within the error of 3.96cm and 4.02cm for right & left foot respectively in males. (Table-1)

In females the stature can be estimated within the error of 3.86cm and 4.17cm for right & left foot respectively by using the regression equations in present study. (Table-2)

The present study will be helpful in medico-legal cases in establishing identity, by estimating the stature of an individual, if only body parts with intact foot is found like in cases of bomb blast, mass disaster, train accidents etc.

**Acknowledgement:** We are thankful to Mrs. Anju Jain for helping us to derive statistical data.

**Conflict of Interest:** Nil

**Ethical Clearance:** Taken
Source of Funding:- Self funding

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Profile of Unnatural Deaths in Paediatric Age Group at SMS Medical College and Associated Hospitals Jaipur – an Autopsy Based Study

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ABSTRACT

Unnatural childhood deaths are associated with intense trauma and separation distress for the parents and near relatives. Traumatic injuries can be brought about by many ways like road traffic accident, burns, fall from a height, drowning, hanging, poisoning etc. This study was conducted at the Department of Forensic Medicine, SMS Hospital, Jaipur over a period of one year from November, 2013 to October, 2014. A total of 3306 medico-legal autopsies were conducted during the study period, out of them 221 cases were pediatric fatalities due to unnatural causes were included in the study. About two thirds of all the cases were males compared to females which contributed about 33.93 %. Majority of the fatalities were attributed to Road traffic accidents (51.61%). In our study shock and coma were found to be nearly at par with each other as mode of death.

Keywords: Pediatrics age group, child, adolescent, forensic autopsy, medico legal case, unnatural death.

INTRODUCTION

Many times an autopsy surgeon is confronted with death of a child. Traumatic injuries can be one of the leading etiological factors responsible for deaths in children. Unnatural childhood deaths are associated with intense trauma and separation distress for the parents and near relatives. Traumatic injuries can be brought about by many ways like road traffic accident, burns, fall from a height, drowning, hanging, poisoning etc. The traditional view of injuries as “accidents”, or random events, has resulted in the historical neglect of this area of public health. There are very few studies from developing countries discussing the profile of pediatric trauma. In order to suggest means of preventing this unnecessary loss of precious lives of children, it is quite vital to understand the specific mechanisms involved in their causation.

MATERIAL & METHOD

This study was conducted at the Department of Forensic Medicine, SMS Hospital, Jaipur over a period of one year from November, 2013 to October, 2014. A total of 3306 medico-legal autopsies were conducted during the study period. Out of these total of 221 autopsies were of the age group from 0 to 18 age group and satisfying inclusion criteria. This study was conducted to determine and evaluate the socio-demographic profile of different types of cases and to assess the manner, mode and cause of their death in pediatric age group.

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death as per record or found to be natural deaths on post-mortem examination. The information regarding age, sex, and the circumstances leading to such deaths was obtained from the parents or close relatives, hospital records and the concerned investigating agencies. The manner of death, whether homicidal, accidental or suicidal, was determined with the help of accompanying police documents.

**OBSERVATIONS AND RESULTS**

**Table 1: Sex and Age wise distribution of Subjects**

<table>
<thead>
<tr>
<th>Age (In Years)</th>
<th>Sex</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Female</td>
<td>Male</td>
</tr>
<tr>
<td>&lt; 1 Year</td>
<td>1 (0.44%)</td>
<td>3 (1.35%)</td>
</tr>
<tr>
<td>1 To 5 Years</td>
<td>11 (4.98%)</td>
<td>14 (6.33%)</td>
</tr>
<tr>
<td>5 To 10</td>
<td>8 (3.62%)</td>
<td>22 (9.96%)</td>
</tr>
<tr>
<td>10 To 15</td>
<td>27 (12.22%)</td>
<td>64 (28.96%)</td>
</tr>
<tr>
<td>15 To 18</td>
<td>28 (12.67%)</td>
<td>43 (19.47%)</td>
</tr>
<tr>
<td>Total</td>
<td>77 (33.93%)</td>
<td>144 (66.07%)</td>
</tr>
</tbody>
</table>

About two thirds of all the cases were males compared to females which contributed about 33.93%. Majority of the cases were found in age group 10 to 15 (41.18%) followed by 15 to 18 age group (32.14%). Least affected age group was less than 1 year where only 4 cases were found (1.79%).

**Table 2: Classification according to incidence leading to fatality**

<table>
<thead>
<tr>
<th>Incidence</th>
<th>Total Number of Subjects</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rta</td>
<td>114</td>
<td>51.61%</td>
</tr>
<tr>
<td>Burns</td>
<td>42</td>
<td>19.01%</td>
</tr>
<tr>
<td>Poisoning</td>
<td>15</td>
<td>6.78%</td>
</tr>
<tr>
<td>Electrocution</td>
<td>21</td>
<td>9.50%</td>
</tr>
<tr>
<td>Fall From Height</td>
<td>13</td>
<td>5.88%</td>
</tr>
<tr>
<td>Hanging</td>
<td>14</td>
<td>6.32%</td>
</tr>
<tr>
<td>Fall of Heavy Object</td>
<td>1</td>
<td>0.45%</td>
</tr>
<tr>
<td>Hit By Ball</td>
<td>1</td>
<td>0.45%</td>
</tr>
<tr>
<td>Total</td>
<td>221</td>
<td>100%</td>
</tr>
</tbody>
</table>

Majority of the fatalities were attributed to Road traffic accidents (51.61%) followed by burns (19.01%). Other important causes were found out to be electrocution (9.5%) and poisoning (6.78%).

**Table 3: Distribution of cases according to Manner of Death**

<table>
<thead>
<tr>
<th>Manner</th>
<th>Total Number of Subjects</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accidental</td>
<td>195</td>
<td>88.24%</td>
</tr>
<tr>
<td>Suicide (Poisoning + Hanging)</td>
<td>20</td>
<td>9.05%</td>
</tr>
<tr>
<td>Homicide</td>
<td>6</td>
<td>2.71%</td>
</tr>
<tr>
<td>Total</td>
<td>221</td>
<td>100%</td>
</tr>
</tbody>
</table>

Majority of the fatalities were accidental (88.24%) followed by suicidal (which included poisoning and hanging) and accounted for 9.05% of all the fatalities. Homicidal were about 2.71%.

**Table 4: Distribution according to mode of death**

<table>
<thead>
<tr>
<th>Mode</th>
<th>Total Number of Subject</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shock</td>
<td>70</td>
<td>31.68%</td>
</tr>
<tr>
<td>Coma</td>
<td>69</td>
<td>31.22%</td>
</tr>
<tr>
<td>Asphyxia</td>
<td>12</td>
<td>5.44%</td>
</tr>
<tr>
<td>Septacemic Shock</td>
<td>50</td>
<td>22.62%</td>
</tr>
<tr>
<td>Reserved</td>
<td>20</td>
<td>9.04%</td>
</tr>
<tr>
<td>Total</td>
<td>221</td>
<td>100%</td>
</tr>
</tbody>
</table>

In our study shock and coma were found to be nearly at par with each other as mode of death accounting for 31.68% and 31.22% of all the cases respectively. They were followed by septicaemic shock causing 22.62% of fatalities.

**DISCUSSION AND CONCLUSION**

This study was carried out over one year period from November 2013 to October 2014, at a tertiary care centre to analyze the pattern of unnatural deaths in the region. A total of 3306 medico-legal autopsies were conducted at the mortuary during the study period out of which 221 autopsies (8.19%) were concluded to be unnatural deaths satisfying the inclusion and exclusion criteria and thus, included in the study.

In our study the age group 10 to 15 years (41.18...
%) was the most affected followed by 15 to 18 years (32.14%). It can be attributed because the child is growing at a hasty rate because of beginning of the puberty. The teenage years bring many changes, not only physically, but also mentally and socially. During these years, children increase their ability to think abstractly and eventually make plans and set long-term goals. As children begin to struggle for independence and control, many changes may occur like they want independence from parents, peer influence and acceptance becomes very important. All these factors explains the high rate of mortality as these are the active years for the children life and they are engage themselves in all types of physical activities and thus, more prone to risks.

About two thirds of all the cases were males compared to females. A teenage male tend to be more aggressive and ask for more independence leading. Thus teenagers are likely to seek out new experiences and engage in more risk-taking behavior which explains the higher mortality rates in males than females.

About 51.61% of all the fatalities the incidence leading to death was human created fiend road traffic accident. Recent increase in number of fast vehicles sprawling the roads has led to massive increase in road traffic accidents leading untimely fatalities. This is particularly true of our country where traffic rules and traffic sense are not very stringently practiced. In our study after road traffic accident the other menace to our society was found to be thermal deaths. Children are usually involved as a passenger in incidence like road traffic accident. But recently teenage driving has been on increase. The combination of youth and inexperience puts younger drivers at high risk. Their inexperience means they have less ability to spot hazards, and their youth means they are particularly likely to take risk thus leading to ill-timed fatalities.

The major cause of death was attributed to shock (31.68%) and coma (31.22%). It is self explanatory because these both cause of death are usually associated with accidents.

To bring the mortality rate down, children should be made aware about the importance of strict compliance to traffic rules and regulations. One of the best ways to do it is to include road safety issues in school syllabus. Those children who ride bicycles should be made to wear helmets as it is expected to reduce the severity of injury to the head. Proper implication of rules for issue of driving licenses should be practiced as the teenage drivers are havoc for self and society. Separate lanes should be made for different types of vehicles as traffic is on the increase day by day.

The study clearly shows that teenage group is the most common age group to be involved in the fatalities. So this indicates that is utmost responsibility of the parents and care givers so that a teenager and child gets a healthy and safe environment for his or her growth.

Studies like this should be conducted more as the can give accurate information on causes and circumstances of such deaths through a process of medico-legal investigations is essential in creating an awareness among the general public and the government so that policies for better environment for the children can be provided.

**Acknowledgement:** The authors are thankful to Dr. Subhash Nepalia, Ex-Principal,& Dr. U. S. Aggarwal, Principal, SMS Medical college, Jaipur along with the faculty & Residents of Department of Forensic Medicne, SMS Medical College, Jaipur.

**Conflicts of Interest:** Recently there has been massive increase of children unnatural mortality. Therefore this study draws attention to this relatively untouched study of children unnatural mortalities

**Ethical Clearance:** Not required.

**Source of Funding:** Self.

**REFERENCES**


Epidemiological Study of Fatal Snake Bite Cases in Rural Pondicherry

Arun KS Prakash, Ananda Reddy, Balaraman R

ABSTRACT

Background: India is significantly contributing for the global magnitude of snakebites envenoming owing to its climate, thick population and outdoor occupational activities. Snakebite deaths are occupational hazards among poor rural agricultural communities. Aims: This study aimed to assess epidemiological elements and autopsy findings constrained in fatal snakebites in this locality. Materials & Method: It’s a cross sectional study of fatal snakebite cases autopsied at the Puducherry Government hospital mortuary from 2012 to 2014. Socio-demographic data were gathered from interviews, body findings were observed at autopsy and finally analysed the data. Results: Total 46 snakebite related autopsied cases were studied in the study centre. Highest incidence of snakebites were noticed in rural population, males in their third decades, Hindus, and poor. Most vulnerable were farming and gardening workers, many victims not received anti-snake venom and were died within 24 hours. At autopsy, local findings like fang marks, redness and cellulitis were more significant than systemic findings. Conclusions: Importing awareness & education among vulnerable on prevention, first aid, do’s, don’ts and appropriate management of snakebite. Keywords: Snake bites, Fatalities, Envenomation, Fang marks.

INTRODUCTION

Envenomation and fatalities related to snakebites are highest in tropical and subtropical countries of Southeast Asia and Africa, and they are an important public health problem in the poorer rural farming population. Each year snakebites causing 94,000 fatalities worldwide, but the actual onus is difficult to estimate because many cases are underreported to hospital. The high incidence of snake bite mortalities in India is related to thick density of human population, distribution of poisonous snakes, ecology, hot climate and biodiversity. There is a strong association between snakebite-induced mortality with poverty, mistaken identity, mismanagement by untrained rural traditional therapists, poor transportation facilities, delay at arrival to health services, non-availability and improper dosing of antisnake venom. Snake bite is an important occupational hazard in outdoor workers including agricultural workers, farmers, gardeners and fishermen. Even though fatalities related to snakebite are very familiar in this locality and seemed to have been neglected. Hence this study is helpful in interpreting epidemiological factors, pattern of injuries and cause of death in fatal snake bites.

MATERIALS & METHOD

This cross sectional, descriptive study was conducted at the Indira Gandhi Government General Hospital and Postgraduate Institute, Puducherry (Union territory in South India) from January 2012 to November 2014. All snakebite related deaths autopsied were included in this study, but many such fatalities were not subjected to autopsy. Data
related to demographic and epidemiological factors behind every victim in snakebites such as gender, age, nativity, occupation, season, time and place of bite were collected by personal interview with the concerned police authorities, relatives of the deceased, eye witnesses. All body findings like injuries (site of the bite, fang marks, local and systemic findings of envenomation, and management) were gathered from case sheets and autopsy. The collected data were statically analyzed using the Microsoft excel package (2010) for frequencies, percentages, proportions & ratios and results were interpreted.

**OBSERVATIONS & RESULTS**

Forty six fatal snake bite cases were autopsies in the study center over the three year study period, which accounts for 1.14% of total medico-legal autopsies performed (n=4014) in this coastal area. Maximum victims were males in their third and fourth decades of life (Table-1). Incidences were highest among rural, Hindus and poor communities. The majority of the snakebite events were happened during rainy season, daytime, at agricultural fields and over half of victims were not reported to hospital within one hour. Many victims were not considered medical treatment as their first option and not taken anti-snake venom. Demographic elements of victims are depicted in Table-2.

Bite marks were located predominantly over the lower limbs (67.4%), especially over foot and ankles. External autopsy findings include fang marks alone or fang marks associated with bleeding, swelling, blister and cellulites were seen over ¾ of the cases. Internal changes like hemorrhage, sepsis and acute renal failure were seen in 1/3 of fatal cases. The bitten snake was positively identified only in 37% cases and the rest were unidentified. Cause of death was either due to neurological (32.6%) or haemorrhagic (23.9%) complications in the majority of cases. (Table-3).

**DISCUSSIONS**

Snakebite is an accidental event requires emergency medical intervention to reduce morbidity and mortality in the rural Indian population. Snake bites are neglected occupational problem, but still they are estimated for 50,000 deaths per year in India. Over 75% of snakebite victims have a strong belief on traditional folk healers (mantriks) than treatment given by health facilities, hence they report to hospitals only at the later stages. In developing countries most of snakebites occur as an occupational hazard, whereas in developed countries it is more of a recreational activities.

Males in their third and fourth decade of life are predominantly and regularly tangled in fatal snake bites, as they are more ambulant and spend lots of time in outdoor farming and related activities. Rural agricultural and farming people are at higher incidence of poisonous snakebites, as they engaged in outdoor, live in mud houses / huts, sleep on a floor, barefoot walk, work in dark and untidy conditions. Similar to earlier studies, the most victims are rural and agricultural inhabitants in the present study.

The highest incidence was noticed in daytime, rainy and summer seasons, due to flooding of holes, harvesting and prays eating stored grains leads to encroach of snakes into houses and habitat in surrounding human dwelling places. It is noteworthy that the majority of victims were lived with poverty. Timely availability of quality emergency medical services to the snake bitten victim will play a crucial role in preventing mortalities and disabilities. In many cases medical treatment was not sought immediately or within crucial first hour, and tried traditional and folk medicine before coming to hospital services at later stage, the reasons were multifactorial; lot of belief in folk medicine, lack of awareness, ignorance, poverty, transportation problems, lack of nearby emergency health facilities and lack of antisnake venom in the hospitals.

The frequent location of snakebites were foot and ankles of lower limbs, and hands of upper limbs. The identification of the bitten species is vital for specific management, but unfortunately not be possible in most cases due to the fact that victims were frightened, anxious, ignorant, and inability to spot the snake in dark / crops. Polyvalent anti-snake venom against four poisonous snakes remains the treatment of choice for snake bite in India, owing to its feasibility, long term storage, and difficulty in identification of snake. Bite marks and Local complications were observed over 75% cases and almost half of the cases respectively. These findings highlights the importance of keeping the alleged snake bite cases under observation. Bleeding from the bite site, ecchymosis and cellulitis were the common manifestation of local envenomation as observed in many studies.
Table 1: Age & gender-wise distribution of fatalities due to snake bites.

<table>
<thead>
<tr>
<th>Age in years</th>
<th>Males</th>
<th>Female</th>
<th>Total (Number &amp; Percentage)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 10</td>
<td>01 (2.2%)</td>
<td>01 (2.2%)</td>
<td>02 (4.3%)</td>
</tr>
<tr>
<td>11 - 20</td>
<td>04 (8.7%)</td>
<td>02 (4.3%)</td>
<td>06 (13.0%)</td>
</tr>
<tr>
<td>21 - 30</td>
<td>08 (17.4%)</td>
<td>05 (10.9%)</td>
<td>13 (28.3%)</td>
</tr>
<tr>
<td>31 - 40</td>
<td>06 (13.0%)</td>
<td>04 (8.7%)</td>
<td>10 (21.8%)</td>
</tr>
<tr>
<td>41 - 50</td>
<td>05 (10.9%)</td>
<td>03 (6.5%)</td>
<td>08 (17.4%)</td>
</tr>
<tr>
<td>51 – 60</td>
<td>03 (6.5%)</td>
<td>02 (4.3%)</td>
<td>05 (10.9%)</td>
</tr>
<tr>
<td>61 &amp; above</td>
<td>02 (4.3%)</td>
<td>00 (0.0%)</td>
<td>02 (4.3%)</td>
</tr>
<tr>
<td>Total</td>
<td>29 (63%)</td>
<td>17 (37%)</td>
<td>46 (100%)</td>
</tr>
</tbody>
</table>

Table 2: Socio-demographic profile of fatalities related to snake bites.

<table>
<thead>
<tr>
<th>Native area</th>
<th>Rural</th>
<th>Semi-urban</th>
<th>Urban</th>
<th>Unknown</th>
<th>Total (100%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Religious status</td>
<td>Hindu 43 (93.4%)</td>
<td>Muslim 01 (2.2%)</td>
<td>Christian 01 (2.2%)</td>
<td>Unknown 01 (2.2%)</td>
<td>46 (100%)</td>
</tr>
<tr>
<td>Occupational status</td>
<td>Agriculturist, Laborer, Gardner 27 (58.7%)</td>
<td>Fisherman &amp; Unemployed 10 (21.7%)</td>
<td>Student, Employed 03 (6.5%)</td>
<td>Housewife 06 (13.0%)</td>
<td>46 (100%)</td>
</tr>
<tr>
<td>Socioeconomic status</td>
<td>Lower 33 (71.7%)</td>
<td>Middle 09 (19.6%)</td>
<td>Upper 03 (6.5%)</td>
<td>Unknown 01 (2.2%)</td>
<td>46 (100%)</td>
</tr>
<tr>
<td>Marital status</td>
<td>Single 26 (56.5%)</td>
<td>Married 18 (39.1%)</td>
<td>Divorced 01 (2.2%)</td>
<td>Unknown 01 (2.2%)</td>
<td>46 (100%)</td>
</tr>
<tr>
<td>Time of the bite</td>
<td>12AM-6AM 05 13 (28.2%)</td>
<td>6AM-12PM 19 (41.3%)</td>
<td>6PM-12AM 09 (19.6%)</td>
<td>46 (100%)</td>
<td></td>
</tr>
<tr>
<td>Place of incident</td>
<td>House, Farm house 08 (17.4%)</td>
<td>Agricultural field, Garden 29 (63.0%)</td>
<td>Sea, Beach 06 (13.0%)</td>
<td>Workplace, Factory 03 (6.5%)</td>
<td>46 (100%)</td>
</tr>
<tr>
<td>Time lapse in admission to hospital</td>
<td>Within hour 32 (69.5%)</td>
<td>2hr-12hrs 11 (23.9%)</td>
<td>12-24hrs 02 (4.3%)</td>
<td>After 1 day 01 (2.2%)</td>
<td>46 (100%)</td>
</tr>
<tr>
<td>Seasonal variations</td>
<td>Rainy season 22 (47.8%)</td>
<td>Winter 07 (15.2%)</td>
<td>Summer 07 (15.2%)</td>
<td>Unknown 00 (0.0%)</td>
<td>46 (100%)</td>
</tr>
<tr>
<td>Survival Period</td>
<td>Within 1 hour 09 (19.6%)</td>
<td>2-6 hours 10 (21.7%)</td>
<td>6-24 hours 02 (4.3%)</td>
<td>Over24Hours 16 (34.7%)</td>
<td>46 (100%)</td>
</tr>
</tbody>
</table>

Table 3: Injury pattern and cause of death in fatal snake bites

<table>
<thead>
<tr>
<th>Site of bite</th>
<th>Upper limbs 12 (26.1%)</th>
<th>Lower limbs 31 (67.4%)</th>
<th>Trunk 02 (4.3%)</th>
<th>Head &amp; Neck 01 (2.2%)</th>
<th>Total (100%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM findings</td>
<td>Bite marks 35 (76.1%)</td>
<td>Bleeding, Redness Edema, Blisters 21 (45.6%)</td>
<td>Cellulitis/Gangrene 07 (15.2%)</td>
<td>Internal changes 18 (39.1%)</td>
<td>46 (100%)</td>
</tr>
<tr>
<td>Cause of death</td>
<td>Neurogenic shock, Respiratory paralysis 15 (32.6%)</td>
<td>Hemorrhagic shock, Acute renal failure 11 (23.9%)</td>
<td>Sepsis 06 (13.0%)</td>
<td>Others 14 (30.4%)</td>
<td>46 (100%)</td>
</tr>
<tr>
<td>Bitten snake identified</td>
<td>Cobra 06 (13.0%)</td>
<td>Viper 09 (19.6%)</td>
<td>Sea snake 02 (4.3%)</td>
<td>Unidentified 29 (63.0%)</td>
<td>46 (100%)</td>
</tr>
</tbody>
</table>
CONCLUSIONS AND SUGGESTIONS

Snakebite related fatalities are remarkably high in rural habitant middle aged males, and agriculture related workers. Enhanced awareness and community education to the general public and vulnerable on preventive programs, do’s & don’ts, first aid and misbelief related to snake bite will mitigate adverse events. Availability of prompt transportation facilities, nearby health care services & anti-snake venom during the early crucial hours in rural India will dramatically reduce mortalities and disabilities. Training of medical officers and update of protocols to deal with emergencies like snake bite should be made mandatory. This a hospital based study and hence statistics depicted are underreported, so it reflects poorly on the burden of fatal snakebites in this region.

Acknowledgement: I express my wishes and deep sense of gratitude to all the faculty members of Departments of Forensic Medicine, Indira Gandhi Government General Hospital and Post-Graduate Institute (IGGGH &PGI) & SMVMCH, Puducherry for their support and help.

Conflicts of Interest: The Authors declare that there is no conflict of interest

Financial Support: We declare that we have no source of support in the form of grants.

Ethical Clearance: Taken from Institutional research and ethics committee for this study.

REFERENCES


A Five Year Retrospective Study on Autopsied Cases of Crime against Women {U/S 304[B], 498[A] & 306 IPC} at BIMS, Belagavi

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ABSTRACT

Centuries have come and centuries have gone, but the plight of women is not likely to change. Cruelty against women has been age-old phenomenon, where women have been subjected to brutality and inexplicable exploitation for one reason or the other. Under this cruelty against women, one of the most heinous and burning issue is the Dowry Death. By virtue of this pathetic plight, she has been enduring cruelty meted out to her at the hands of her husband and his relatives. Present study provides the statistical analysis of deaths relating to cruelty against women in autopsied cases booked under Sec. 498(A), 304(B), 302 & 306 of IPC during 2010-2014 at Belgaum Institute of Medical Sciences (BIMS), Belagavi. During five year retrospective study, total number of 3878 cases was autopsied at BIMS out of which 80 cases (10.3%) were booked under above mentioned sections of IPC. Out of 80 cases 39 deaths (48%) were due to burns, 22 (27.5%) due to hanging, 15 (18%) due to poison and 4 deaths belong to other category (1 each due to fall from height & drowning and 2 cases are of advanced decomposition).

Keywords: Sec 498(A) IPC, Dowry deaths, Cruelty against women, NCRB, Burns.

INTRODUCTION

If all the violence that have been done on women, if put in a bundle and rolled into one, then... Earth would not hold it, Sky could not enfold it, It could not be lighted and warmed by the sun

According to National Crime Records Bureau (NCRB) statistics there were 309,546 crimes against women reported to the police in the year 2013 against 244,270 in 2012, with the highest number recorded in Andhra Pradesh. Every 9 minutes, in India a case of cruelty is committed by either husband or a relative of the husband. The overall conviction rate for crime against women is 32 per cent recorded in the latest data for 2012. One woman dies every hour due to dowry related reasons on an average in the country.
**Table A: Crime against women during 2008-2012 and Percentage variation in 2012 over 2011**

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Rape (Sec. 376 IPC)</td>
<td>21,467</td>
<td>21,397</td>
<td>22,172</td>
<td>24,206</td>
<td>24,923</td>
<td>3.0</td>
</tr>
<tr>
<td>2</td>
<td>Kidnapping &amp; Abduction (Sec.363 to 373 IPC)</td>
<td>22,939</td>
<td>25,741</td>
<td>29,795</td>
<td>35,565</td>
<td>38,262</td>
<td>7.6</td>
</tr>
<tr>
<td>3</td>
<td>Dowry death (Sec. 302, 304 IPC)</td>
<td>8,172</td>
<td>8,383</td>
<td>8,391</td>
<td>8,618</td>
<td>8,233</td>
<td>-4.5</td>
</tr>
<tr>
<td>4</td>
<td>Cruelty by husband and Relatives (Sec. 498-A IPC)</td>
<td>81,344</td>
<td>89,546</td>
<td>94,041</td>
<td>99,135</td>
<td>106,527</td>
<td>7.5</td>
</tr>
<tr>
<td>5</td>
<td>Assault on women with intent to outrage her modesty (Sec. 354 IPC)</td>
<td>40,413</td>
<td>38,711</td>
<td>40,613</td>
<td>42,968</td>
<td>45,351</td>
<td>5.5</td>
</tr>
<tr>
<td>6</td>
<td>Insult to the modesty of women (Sec. 509 IPC)</td>
<td>12,214</td>
<td>11,009</td>
<td>9,961</td>
<td>8,570</td>
<td>9,173</td>
<td>7.0</td>
</tr>
<tr>
<td>7</td>
<td>Importation of girl from Foreign country (Sec. 366-B IPC)</td>
<td>67</td>
<td>48</td>
<td>36</td>
<td>80</td>
<td>59</td>
<td>-26.3</td>
</tr>
<tr>
<td>A</td>
<td>Total IPC Crime against women</td>
<td>1,86,616</td>
<td>1,94,835</td>
<td>2,05,009</td>
<td>2,19,142</td>
<td>2,32,528</td>
<td>6.1</td>
</tr>
<tr>
<td>8</td>
<td>Commission of Sati Prevention</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>-</td>
<td>-100.0</td>
</tr>
<tr>
<td>9</td>
<td>Immoral Traffic (Prevention Act 1956)</td>
<td>2,659</td>
<td>2,474</td>
<td>2,499</td>
<td>2,435</td>
<td>2,563</td>
<td>5.3</td>
</tr>
<tr>
<td>10</td>
<td>Indecent representation of women</td>
<td>1,025</td>
<td>845</td>
<td>895</td>
<td>453</td>
<td>141</td>
<td>-68.9</td>
</tr>
<tr>
<td>11</td>
<td>Dowry Prohibition Act 1961</td>
<td>5,555</td>
<td>5,650</td>
<td>5,182</td>
<td>6,619</td>
<td>9,038</td>
<td>36.5</td>
</tr>
<tr>
<td>B</td>
<td>Total SLL Crime against women</td>
<td>9,240</td>
<td>8,969</td>
<td>8,576</td>
<td>9,508</td>
<td>11,742</td>
<td>23.5</td>
</tr>
<tr>
<td><strong>Total (A + B)</strong></td>
<td><strong>1,95,856</strong></td>
<td><strong>2,03,804</strong></td>
<td><strong>2,13,585</strong></td>
<td><strong>2,28,650</strong></td>
<td><strong>2,44,270</strong></td>
<td><strong>6.8</strong></td>
<td></td>
</tr>
</tbody>
</table>

According to NCRB, West Bengal tops the list in the country with 15.24% cases booked under 498(A) Karnataka 2.7% and 0% in Sikkim, Nagaland and Mizoram during 2013. Highest dowry death reported in Uttar Pradesh 28.89%, Karnataka 3.43% and nil in Arunachal Pradesh, Manipur, Himachal Pradesh, Mizoram, Sikkim and Goa during 2013.

**OBJECTIVES OF THE STUDY**

Belagavi is the largest district of Karnataka and BIMS being the only government medical college in the district. Present study provides the statistical analysis of deaths relating to cruelty against women in autopsied cases booked under Sec. 498(A), 304(B), 302 & 306 of IPC during 2010-2014 at Belgaum Institute of Medical Sciences (BIMS), Belagavi.

Such a detailed study of statistical analysis was never done in and around Belagavi before which could give a perspective of magnitude of problem at hand.

**METHODOLOGY**

**Source of Data:** Five year retrospective analysis of the autopsied cases of Cruelty against women booked under combination of Sec. 498 (A), 304(B), 302, 306 IPC was done from Jan 1st 2010 to Dec 31st 2014 at Belgaum Institute of Medical Sciences (BIMS) Belagavi.

**INCLUSION CRITERIA:** All autopsied cases of Cruelty against women booked under combined sections of Sec. 498 (A), 304(B), 302, 306 IPC are considered.

**EXCLUSION CRITERIA:** All other autopsied cases other than those mentioned in inclusion criteria.
**OBSERVATION AND RESULTS**

Table No. 1: Autopsied cases of Cruelty against women

During the study period of 5yrs (2010-2014) total no. of 3,878 cases were autopsied at Belgaum Institute of Medical Sciences (BIMS) mortuary. Out of which 80 cases were deaths due to Cruelty against women booked under combination of Sec. 498(A), 302, 306, 304(B) constituting 10.3% of the total cases.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total no. of Autopsied cases</th>
<th>Death due to Cruelty against women</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>759</td>
<td>14</td>
<td>1.8%</td>
</tr>
<tr>
<td>2011</td>
<td>751</td>
<td>25</td>
<td>3.32%</td>
</tr>
<tr>
<td>2012</td>
<td>790</td>
<td>16</td>
<td>2.02%</td>
</tr>
<tr>
<td>2013</td>
<td>813</td>
<td>12</td>
<td>1.47%</td>
</tr>
<tr>
<td>2014</td>
<td>766</td>
<td>13</td>
<td>1.69%</td>
</tr>
<tr>
<td>Total</td>
<td>3,878</td>
<td>80</td>
<td>10.3%</td>
</tr>
</tbody>
</table>

Table No. 2 Cause of death: Out of 80 cases of deaths due to cruelty against women 39 (48%) deaths were due to burns, 22 (27.5%) due to hanging, 15 (18%) due to poison and 4 cases belong to other category (1 each case due to fall from height, drowning and 2 cases are of advanced decomposition).

<table>
<thead>
<tr>
<th>YEAR</th>
<th>Burns</th>
<th>Hanging</th>
<th>Poison</th>
<th>Others **</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>6</td>
<td>4</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>2011</td>
<td>11</td>
<td>9</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>2012</td>
<td>8</td>
<td>2</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>2013</td>
<td>7</td>
<td>3</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>2014</td>
<td>7</td>
<td>4</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>39</td>
<td>22</td>
<td>15</td>
<td>4</td>
</tr>
<tr>
<td>%</td>
<td>48%</td>
<td>27.5%</td>
<td>18%</td>
<td>5%</td>
</tr>
</tbody>
</table>

** Others – Fall from height, drowning, 2 cases of advanced stage of decomposition.

Table No. 3 Age wise distribution: Age wise distribution of cases shows majority of victims, 51 cases (63%) belong to age group of 20 – 30 yrs and 24 cases (30%) in the age group of 30-40yrs. This shows that almost all the cases (75) belong to the reproductive age group of 20-40yrs.

<table>
<thead>
<tr>
<th>Age in years</th>
<th>No. of Cases booked under 498(A)IPC</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;20</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>20 - 30</td>
<td>51</td>
<td>63</td>
</tr>
<tr>
<td>30 - 40</td>
<td>24</td>
<td>30</td>
</tr>
<tr>
<td>40 - 50</td>
<td>01</td>
<td>1.25</td>
</tr>
<tr>
<td>Total</td>
<td>80</td>
<td>100</td>
</tr>
</tbody>
</table>

Table No. 4 Area wise distribution: The cases from rural 60 (75%) area far exceed the urban area 20 (25%)

<table>
<thead>
<tr>
<th>Year</th>
<th>Rural</th>
<th>Urban</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>11</td>
<td>3</td>
</tr>
<tr>
<td>2011</td>
<td>18</td>
<td>7</td>
</tr>
<tr>
<td>2012</td>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td>2013</td>
<td>10</td>
<td>2</td>
</tr>
<tr>
<td>2014</td>
<td>11</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>60</td>
<td>20</td>
</tr>
</tbody>
</table>

Table No. 5: Religion distribution: Most of the victims were hindus 69 cases (86%) and rest of them were Muslim 11 cases (14%).

<table>
<thead>
<tr>
<th>Religion</th>
<th>Cases</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hindu</td>
<td>69</td>
<td>86%</td>
</tr>
<tr>
<td>Muslim</td>
<td>11</td>
<td>14%</td>
</tr>
<tr>
<td>Total</td>
<td>80</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table No. 6 - Year wise distribution of cases booked under combination sections of 498(A), 304(B), 306 & 302 IPC: Majority of cases 48(60%) are booked under combination of 498 (A) + 306 IPC, 17 cases (21.25%) are booked under combination of 498 (A) + 302 IPC and 15 cases are booked under combination of 498 (A) + 304(B) IPC.

<table>
<thead>
<tr>
<th>Section of IPC</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>Total</th>
<th>%</th>
</tr>
</thead>
</table>
| 498 (A) + 302  | 3    | 8    | 2    | 4    | 17   | 17    | 21.25%
| 498 (A) + 306  | 7    | 11   | 12   | 6    | 48   | 60.0  |
| 498 (A) + 304 (B) | 4   | 6    | 02   | -    | 3    | 15    | 18.5 |
| Total          | 14   | 25   | 16   | 13   | 80   | 100   |

DISCUSSION

In the present study of 5yrs (2010-2014) total no. of 3,878 cases were autopsied at Belgaum Institute of Medical Sciences (BIMS) mortuary. Out of which 80 cases were deaths due to Cruelty against women booked under combination of Sec. 498(A), 302, 306, 304(B) constituting 10.3% of the total cases. Out of 80 cases of deaths due to cruelty against women are 39 cases (48%) deaths were due to burns, 22 cases (27.5%) due to hanging, 15 cases (18%) due to poison and 4 cases belong to other. The mortality of crime against women is consistent with the NCRB data.
Table B: Proportion of Crime against women Vs Total IPC Crimes

<table>
<thead>
<tr>
<th>SL. No.</th>
<th>Year</th>
<th>Total IPC Crimes</th>
<th>Crime against women</th>
<th>Percentage to total IPC crimes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2008</td>
<td>20,93,379</td>
<td>1,86,612</td>
<td>8.9</td>
</tr>
<tr>
<td>2</td>
<td>2009</td>
<td>21,21,345</td>
<td>2,03,804</td>
<td>9.9</td>
</tr>
<tr>
<td>3</td>
<td>2010</td>
<td>22,24,831</td>
<td>2,13,585</td>
<td>9.6</td>
</tr>
<tr>
<td>4</td>
<td>2011</td>
<td>23,25,575</td>
<td>2,19,142</td>
<td>9.4</td>
</tr>
<tr>
<td>5</td>
<td>2012</td>
<td>23,87,188</td>
<td>2,44,270</td>
<td>10.2</td>
</tr>
</tbody>
</table>

In a study conducted by Radhika RH and Anand K, at KIMS, Bangalore, maximum number of victims of dowry death belong to the age group of 18-25 years (60%), which goes consistent with the present study and hanging is the most common chosen method of suicide (78.33%) which is in contrast to the present study wherein deaths due to burns is maximum.

Retrospective study conducted at Mangalore by Ritesh G. Menezes et al. shows maximum victims of dowry death belong to age group of 20-25yrs, 70.6% victims were from rural background, 70.6% were suicidal in nature, most victims (70.6%) were hindus and most frequent method used was burns. All these findings are consistent with present study.

Two years prospective study was carried out by Sachidananda Mohanty, Mousami, Geethasahu in the Department of Forensic Medicine and Toxicology, MKCG Medical College, Berhampur, India shows majority of the victims of dowry death (83%) were young aged between 18 to 26 years. All the victims were Hindu by religion with a predominant 63% from rural background and 57% of suicidal deaths were accounted. All these findings go in consistent with present study whereas hanging was most chosen method which is contrast to our study.

In studies conducted by Srivastava and Arora, Nayak A, Dasgupta SM and Tripathi CB majority of victims fall in age group of 18-30 years and belong to rural area and same was observed in our study.

Maximum cases falling in the age group of 20-30yrs, could be due to multiple factors like- immature unstable mind in the early twenties, inability to adjust to the new environment during early years of marriage at in-laws house which always is felt as hostile by the new bride, impulsive decisions due to lack of patience in that age group and summarising the above, its lack of any knowledge about institution of marriage.

Cases from rural areas (60) by far outnumber the cases from urban areas (20). The reasons behind it are again multifactor- female illiteracy in rural areas, lack of self-confidence among rural females may be due to illiteracy, traditional mindset of parents in rural areas that once their daughter is married she in any condition should abide by rules & regulations at in-laws place and never complain, similar mindset at in-laws place that their daughter in-law has just got to obey every word and cannot have any say of her own, lack of awareness of laws relating to protection of women both by the new bride & her in-laws, the list is endless.

Out of 80 cases 69 victims (86%) belong to hindus and rest of them 11 cases (14%) to muslim. This is because in our region maximum population belong to hindu religion.

Majority of cases 48(60%) are booked under combination of 498 (A) + 306 IPC, 17 cases (21.25%) are booked under combination of 498 (A) + 302 IPC and 15 cases (18.5%) are booked under combination of 498 (A) + 304(B) IPC. To summarise 60% are suicidal, 21.5% are homicidal and 18.5% of cases may be suicidal or homicidal in nature.

In the present study, deaths due to burns are in majority (48%), followed by hanging (27%) and poison (18%). Deaths due to hanging and poison, in the context of above mentioned sections, are almost always suicidal in nature, whereas that due to burns may be suicidal or homicidal or accidental. Even the dying declarations do not provide accurate reason for burns, as the victim many times is under immense pressure due to many reasons. Its much easier to prove homicidal burns as suicidal or accidental, more so in the absence of any witnesses and also easy availability of inflammable agents like kerosene in rural areas, is probably the reason behind maximum deaths being due to burns.

CONCLUSION

Dowry death is a shameful menace which our country is staring at even in this century. It’s the very basic mindset among the people of our country that dowry is a part of marriage, should change first. Older generation, who are now the parents or in-laws should be made aware that, no dowry is not a normal ritual of marriage but a big offence. The
younger generation, the bride & bride-groom, should feel ashamed of this dowry system, rather than boast about the magnitude of dowry they received or gave away. Law, either police or judiciary, will play its role only after the offence is committed, but eradication of offence itself is possible only by the change of mindset of people.

Having said the above particularly about dowry death, which the present study provides detailed statistics about, crime against women in general is a bigger problem which every country is facing, more so with developing countries like ours.

**Suggestions to reduce crime against Women**

1. Strict implementation of the existing laws to reach logical conclusion is the key.

2. Need of fast track courts particularly to deal with such cases is the need of the hour. As the trial period increases, the chances of witnesses turning hostile due to various pressures upon them, is more.

3. A time frame should be fixed for completion of trial in each crime, like rape or dowry deaths.

4. Introduction of new school curriculum highlighting crimes against women and laws related to them should be taught from high school level itself. The young generation must be basically taught to respect women before their minds become corrupt.

6. In this era of internet, the effective use of the technology is important to tackle the menace of increasing crimes against women like dowry death. Thus Police departments of various states and women organizations have made the complaint registration process easier and now the complaints can even be registered through e-mail, post or on the websites of the concerned department.

7. NGO’s like women organizations which work in partnership with government must be promoted because they provide education and awareness programs. The range of their services must be strengthened.

Acknowledgement: Nil

Conflict of Interest: Nil

Ethical Clearance: Not applicable as it is only statistical analysis

Funding: Self

**REFERENCE**

1. in.reuters.com/article/.../india-rape-crime-stats-idINKBN0FD0DF201407...accessed on 2/6/2015.
Trend of Unnatural Deaths in Male Population in Varanasi Region- A Retrospective Study

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ABSTRACT

Death may be natural (resulting from disease) or unnatural deliberate action of other (homicide), intentionally self inflicted (suicide), result of an environmental influence (accident). Deaths in males due to unnatural causes, especially in the 2nd and 3rd decades of their life, have been observed in Indian society for the last few decades. Present study is carried out at forensic medicine department, Institute of Medical Sciences, Banaras Hindu University, Varanasi. Relevant information and subjective data like age, habitat, and manner of death of various causes of death victims have been collected from medico legal autopsy register. Data of 3711 autopsied males are analyzed retrospective for periods of two and half years from January 2012 to July 2014. The aim of this study is to find out the pattern of unnatural deaths in male and the various factors associated with such deaths in Varanasi region and to out find remedial measures to bring down the incidence. Road traffic accidents 1504(40.53%) contribute most common cause and 21 to 40 year found to be the most common age group affected 1709(46.05%). Male residing in rural area 2911(78.44%) and religion Hindu 3008(81.06%) were way more affected. Such unnatural death can be prevented by education, awareness, change in attitude and mindset of society etc. but the law enforcement agencies must also take strict measures to curb it down.

Keywords: Unnatural death, autopsy, road traffic accident, poisoning

INTRODUCTION

Thanatology deals with death in all aspects. Section 46 IPC death denotes death of a human being unless the contrary appears from the context. Registration of birth and deaths act section 2(b) defines death as permanent disappearance of all evidence of life at any time after live birth has taken place. Death may be natural (resulting from disease) or unnatural deliberate action of other (homicide), intentionally self inflicted (suicide), result of an environmental influence (accident). There are several causes of unnatural deaths, and these deaths may be the result of unintentional or intentional injuries. According to the National Crime Reports Bureau (NCRB) 2013 report, 5.7 lakh people died of unnatural reasons such as murder, natural disaster, accident, and suicide in India. There has been a steady increase in the number of road traffic accidents, while accidental burns, poisoning, drowning, electrocution, and fall from heights are also on the rise. In the studies conducted in India and also in other countries, it is observed that of all deaths due to unnatural causes, it is the male population who is gets affected the most, especially in the 2nd and 3rd decade of their life. The magnitude of deaths due to burns is so large as India is the only country in the world where fire is classified among the fifteen leading causes of death in 1998 standing fourteenth in the list.
AIM OF THE STUDY

Aims of present study are to find out:

A) the pattern of unnatural deaths in male and
B) the various factors associated with such deaths in Varanasi region.

MATERIAL & METHOD

Present study is carried out at forensic medicine department, Institute of Medical Sciences, Banaras Hindu University, Varanasi. Relevant information and subjective data like age, habitat, religion and manner of death of various causes of death victims have been collected from medico legal autopsy register. Total 3711 cases of autopsied male are analyzed retrospective for periods of two and half years from January 2012 to July 2014. Cases were included in group of various cause of death on the basis of confirmation by investigating officer and corroborative finding at medico legal examination.

RESULTS AND OBSERVATIONS

Table 1: Shows distribution of manner of unnatural death pattern in males. Road traffic injury 1504(40.53%), contribute most common cause followed by Poisoning 304(8.19%), Railway track accidents 302(8.14%) etc. Table 2: Shows age wise distribution of unnatural death. 21 to 40 year found to be the most common age group affected 1709(46.05%) followed by 41 to 60 year 1153(31.07%) and males of age more than 80 year were least affected. Table 3: Habitat wise distribution of unnatural death shows that the death amongst the male residing in rural area 2911(78.44%) outnumbered the urban 224(6.04%). Address of 576(15.52%) males were not known. Table 4: According to religion, Hindu 3008(90.07%) were way more affected than Muslim 131(3.53%) and Christian 6(0.16%). Religion of 566 (15.25%) persons were not known. Table 5: For the better analysis of the manners of unnatural deaths in younger age groups, we have further subdivided the age group 0-20 years in three sub groups viz. Infant, 1-12 years and 13-20 years (i.e. Teenagers). Death of males in 13-20 Year of age 333(72.70%) constitute the largest chunk in the age group 0-20 years and 8.97% of the total autopsied male cases.

<table>
<thead>
<tr>
<th>Manner of Death</th>
<th>No. of Cases</th>
<th>Percentage of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blunt Weapon</td>
<td>255</td>
<td>6.87</td>
</tr>
<tr>
<td>Burn</td>
<td>222</td>
<td>5.98</td>
</tr>
<tr>
<td>Disease</td>
<td>583</td>
<td>15.71</td>
</tr>
<tr>
<td>Drowning</td>
<td>176</td>
<td>4.74</td>
</tr>
<tr>
<td>Heat Stroke</td>
<td>1</td>
<td>0.03</td>
</tr>
<tr>
<td>Electrocution</td>
<td>64</td>
<td>1.72</td>
</tr>
<tr>
<td>Firearm</td>
<td>73</td>
<td>1.97</td>
</tr>
<tr>
<td>Hanging</td>
<td>171</td>
<td>4.60</td>
</tr>
<tr>
<td>Laryngospasm</td>
<td>1</td>
<td>0.03</td>
</tr>
<tr>
<td>Lightening</td>
<td>2</td>
<td>0.05</td>
</tr>
<tr>
<td>Poisoning</td>
<td>304</td>
<td>8.19</td>
</tr>
<tr>
<td>RDS</td>
<td>1</td>
<td>0.03</td>
</tr>
<tr>
<td>Railway Track Accident</td>
<td>302</td>
<td>8.14</td>
</tr>
<tr>
<td>Road Traffic Accident</td>
<td>1504</td>
<td>40.53</td>
</tr>
<tr>
<td>Snake + Scorpion Bite</td>
<td>3</td>
<td>0.08</td>
</tr>
<tr>
<td>Still birth</td>
<td>3</td>
<td>0.08</td>
</tr>
<tr>
<td>Strangulation</td>
<td>3</td>
<td>0.08</td>
</tr>
<tr>
<td>Unknown</td>
<td>43</td>
<td>1.16</td>
</tr>
<tr>
<td>Total</td>
<td>3711</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 2: Distribution of unnatural death in male in different age groups

<table>
<thead>
<tr>
<th>Age Group (in years)</th>
<th>No. of Cases</th>
<th>Percentage of total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foetus</td>
<td>4</td>
<td>0.11</td>
</tr>
<tr>
<td>0-20</td>
<td>458</td>
<td>12.34</td>
</tr>
<tr>
<td>21-40</td>
<td>1709</td>
<td>46.05</td>
</tr>
<tr>
<td>41-60</td>
<td>1153</td>
<td>31.07</td>
</tr>
<tr>
<td>61-80</td>
<td>362</td>
<td>9.75</td>
</tr>
<tr>
<td>&gt;80</td>
<td>25</td>
<td>0.67</td>
</tr>
<tr>
<td>Total</td>
<td>3711</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 3: Distribution of unnatural death in male habitat wise

<table>
<thead>
<tr>
<th>Habitat</th>
<th>No. of Cases</th>
<th>Percentage of total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rural</td>
<td>2911</td>
<td>78.44</td>
</tr>
<tr>
<td>Urban</td>
<td>224</td>
<td>6.04</td>
</tr>
<tr>
<td>Unknown</td>
<td>576</td>
<td>15.52</td>
</tr>
<tr>
<td>Total</td>
<td>3711</td>
<td>100</td>
</tr>
</tbody>
</table>
Table 4: Distribution of unnatural death in male in different religions

<table>
<thead>
<tr>
<th>Religion</th>
<th>No. of Cases</th>
<th>Percentage of total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hindu</td>
<td>3008</td>
<td>81.06</td>
</tr>
<tr>
<td>Muslim</td>
<td>131</td>
<td>3.53</td>
</tr>
<tr>
<td>Christian</td>
<td>6</td>
<td>0.16</td>
</tr>
<tr>
<td>Unknown</td>
<td>566</td>
<td>15.25</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>3711</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Table 5: Distribution of unnatural death in male in different age subgroups (of age group 0-20 years)

<table>
<thead>
<tr>
<th>Sub Group (in years)</th>
<th>No. of Cases</th>
<th>Percentage of total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infant</td>
<td>9</td>
<td>1.96</td>
</tr>
<tr>
<td>1-12</td>
<td>116</td>
<td>25.32</td>
</tr>
<tr>
<td>13-20</td>
<td>333</td>
<td>72.70</td>
</tr>
<tr>
<td><strong>Total (0-20 years)</strong></td>
<td><strong>458</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

DISCUSSION

Unnatural death is one of the major indicators of the level of social and mental well being. Responsibility for prevention of unnatural deaths in our society does not rest only on the law enforcement. Public health and other human service agencies must assist in preventing unnatural deaths as they have done to prevent other major causes of morbidity and mortality.

Our study shows that the most common cause of unnatural death in male is road traffic accident 40.53% followed by Poisoning 8.19%, Railway track accidents 8.14% etc. Death by injury due to blunt weapon(6.87%), burn(5.98%), drowning(4.74%), hanging(4.60%) and death due to firearm injury(1.97%) are the other important contributors for the male fatality in males. In the study by Awdhesh Kumar et al, it was observed that vehicular accidents were the most common cause of fatality in the Varanasi population between 2009 to 2013. This result is consistent with some other studies as well. However, in other study, burn victims constituted 25.38% of the cases and this is followed by the victims of road traffic accidents 22.24%. Meera T et al found out that road traffic accidents 68.4 % was the leading cause of death in the females of the Manipur.

According to age wise distribution of unnatural death that most dynamic age group 21 to 40 year were most common age group affected 46.05% followed by 41-60 age group (31.07%). Public health departments, public authorities and other human service agencies also must assist with honest effort in searching the primary cause of unnatural deaths and their prevention. In other studies as well, most of the cases were between 21-40 years. Interestingly, these unnatural deaths among younger victims in their studies were attributed to road traffic accidents.

Another important we did in our study is that for the better analysis of the manners of unnatural deaths in younger age groups, we further subdivided the age group 0-20 years in three sub groups viz. Infant, 1-12 years and 13-20 years (i.e. Teenagers). Out of the total cases of the age group 0-20 years, it is the teenager section (13-20 years of age) which is affected the most i.e. 72.70%. This teenager subgroup (13-20 years of age) also constitute 8.97% of the total male cases. Together, these two group i.e. 13-20 years & 21-40 years, constitutes more than half (55%) of the total male cases.

In our study habitat wise distribution of unnatural death shows that rural habitat 78.44% outnumber urban habitat 6.04%. This difference is due to more rural population in Varanasi area. Our result is consistent with the findings of the other studies as well. However, in other study, 63.14% of the victims were urban in comparison to the rural population 36.86%.

In our study Hindu were major contribution 81.06% followed by Muslim 3.53% and Christian 0.16%. In two other studies, Hindus were more than Muslims respectively.

CONCLUSION

The development of any state or society is judged by condition of health and education of the population of that region, it is also important in health information system which is needed for health planning and intervention strategies. Our study highlighted incidence of unnatural deaths among males of the Varanasi region most of whom are Hindus and belongs to age group of 21 -40 years. Road traffic accident is an important reason of unnatural deaths among the males residing in rural area and not using the helmets while driving. Drunk driving in this region is another factor contributing into the
high incidence of RTA. Such unnatural death can be prevented by education, awareness, change in attitude and mindset of society, also by legislation and most importantly men themselves can lower or prevent such incidences. Also, we found out an alarming high incidence of unnatural deaths in Teenage group males who are in the need of more social and legal support. The N.G.Os and Social Organizations can contribute their bit by building a satisfactory interpersonal relationship between the young and the elders in the society. Strict implementation of traffic rules regulation, with special attention to be paid to: Drunken drivers, Unskilled or semiskilled drivers, is also recommended to curb down the incidences of road traffic accidents.

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Conflict of Interest: Nil

Source of Funding: This research was not financially supported by any funding agencies.

Ethical Clearance: The present study was approved by “Institutional Ethical Committee” of Institute of Medical Sciences, Banaras Hindu University, Varanasi. All the information has been taken under consideration of medical ethical committee.

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2. Gautam Biswas; thanatology; review of forensic medicine and toxicology; 2nd edition; 2013; Jaypee brothers medical publishers(p) LTD; PP: 110.


ABSTRACT

Hip bone, also known as pelvic bone, is an innominate bone with no specific nomenclature for it. Hip bone is undoubtedly the most important evidence for sex determination of an unidentified individual from skeletal remains, followed by skull, sacrum and femur. The present study involves assessment of three dimensional measurable parameters, width of hip bone ($W_{hb}$), vertical hip bone axis ($V_{hba}$), and horizontal hip bone axis ($H_{hba}$), in relation to gender identification of a dry human hip bone. Dry hip bones, preliminarily assessed for gender, and greater than 18 years of age, were included, and those exhibiting sexual dimorphism and/or of lesser age were excluded from the study. The observations were tabulated and statistically analyzed. Significance level was assessed with $p$ value < 0.05. Correlation study, linear regression type, was also done between $V_{hba}$ and $H_{hba}$ amongst the hip bones of the same sex. The present study reports significant and reliable findings in relation to $V_{hba}$ and $H_{hba}$. Findings in relation to $W_{hb}$ were however not significant.

Keywords – Legal, study, gender, identification, hip bone, vertical, horizontal, axis

INTRODUCTION

It’s an absolute delight to the forensic medicine professional when skeletal remains sent to him for opining on sex/ gender contains a hip bone, and that’s because, treasure of information regarding identification is associated with this piece of skeletal remain. Hip bone, also known as pelvic bone, is an innominate bone with no specific nomenclature for it. Such a useful bone in identification, but is unnamed. Shakespeare’s quote, “What’s there in the name” seems to go well with it. However, information derived from hip bone is near specific when it comes to sex differentiation of unidentified skeletal remains.

It’s formed by three parts, ilium, pubis and ischium, connected together by acetabulum. It has ilium directed upwards, pubis antero-medially and the ischium postero-laterally and directed downwards. As, the bone is directly involved with the process of childbirth, gross sexual variations between a male and a female hip bone can be deemed obvious, unlike the long bones, which have a weight bearing function, and therefore show minimal sex differences, especially tibia.

Hip bone is undoubtedly the most important evidence for sex determination of an unidentified individual from skeletal remains, followed by skull, sacrum and femur. Krogmann’s weightage for pelvic bone in relation to sex differentiation has been the highest (92%) amongst skeletal remains. Author of the present study claims to have put in sincere efforts to raise this value. The present study involves assessment of three dimensional measurable parameters, width of hip bone ($W_{hb}$), vertical hip bone axis ($V_{hba}$), and horizontal hip bone axis ($H_{hba}$), in relation to gender identification of a dry human
hip bone. Width of hip bone (W_{hb}) and vertical hip bone axis (V_{hba}) have been studied by various authors before, the later one; however, has gained importance in the present one. The observations were tabulated and statistically analyzed. The results were compared and discussed with various other studies like Gupta S and Arora K [3], Singh et al [4], Verneau [5], Garson JC [6], Lander [7], Maruyama et al [8], Segebarth and Orban [9], Davivongs et al [10], and Camacho et al [11].

**MATERIAL & METHOD**

Material for this cross-sectional study consisted of 32 unidentified dry human hip bones. Gender was preliminarily assessed by examining important parameters like greater sciatic notch (size & shape), presence/absence of pre-auricular sulcus, pubis shape & size, obturator foramen size & shape, acetabular maximum diameter, sacroiliac articulation surface, and orientation of ischiopubic rami and ischial tuberosity. The study was conducted on dry hip bones from teaching collection of the Anatomy department (after having taken consent from the head of that department) at Karpaga Vinayaga Institute of Medical Sciences and Research Centre, India. Dry hip bones, preliminarily assessed for gender, and greater than 18 years of age, were included. All the bones were assessed to be greater than 18 years based on iliac crest fusion with ileum. Dry hip bones exhibiting sexual dimorphism and/or of lesser age were excluded from the study. With 33 dry hip bones available, 1 was excluded by implementing exclusion criteria. With confidence level at 95% and confidence interval at 3, sample size was determined as '32' (Fig1). Hip bones with male features (m) were 17 (n), and those of females (f) were 15 (n).

![Fig 1 Sample size](image1)

**Measurements considered for the present study were** Width of hip bone (W_{hb}), Vertical hip bone axis (V_{hba}), and Horizontal hip bone axis (H_{hba}). Width of hip bone (W_{hb}) was measured using Hepburn’s osteometric board with the two wooden planks approximated at anterior and posterior superior iliac spines (Fig2). Vertical hip bone axis (V_{hba}) was also measured using Hepburn’s osteometric board with the two wooden planks approximated at superior most part of iliac crest at one end and inferior most part of ischial tuberosity on the other end (Fig2). Some authors, like Singh et al [4], called this parameter ‘length’, while some, Gupta S and Arora K [3], called it ‘height’. However, author of the present study preferred to call it ‘Vertical hip bone axis (V_{hba})’ considering its anatomical position, and to correlate it with Horizontal hip bone axis (H_{hba}). Whatever are the nomenclature, V_{hba} / length / height, the measuring criteria remains the same.

![Fig 2: Measuring method for W_{hb} and V_{hba}](image2)

The third parameter, Horizontal hip bone axis (H_{hba}), was measured using a measuring scale from point ‘a’ to ‘b’. Point ‘a’ denoted superior most point of pubic symphysis on its inner margin, and point ‘b’, posterior inferior iliac spine (Fig3).

![Fig 3: Line ‘ab’ as H_{hba}](image3)

The observations were tabulated and statistically analyzed with unpaired t test. Significance level was assessed with p value < 0.05. Correlation study, linear regression type, was also done between V_{hba} and H_{hba} amongst the hip bones of the same sex.

**FINDINGS**

Observations for all the hip bones [male hip bones (m) = 17 (n), female hip bones (f) = 15 (n)] were tabulated into a master-chart. Mean, standard deviation (SD) and standard error of mean (SEM) were calculated using the data obtained and statistical significance with p<0.05 was assessed using unpaired t-test. Table1
highlights on the unpaired t-test findings in male (m) and female (f) hip bones for the parameters $V_{hba}$, $W_{hb}$ and $H_{hba}$ respectively.

Table 1: Statistical analysis with unpaired t-test for $V_{hba}$, $W_{hb}$ and $H_{hba}$.

<table>
<thead>
<tr>
<th></th>
<th>Mean (cms)</th>
<th>SD (cms)</th>
<th>SEM (cms)</th>
<th>n</th>
<th>Findings</th>
<th>Statistical Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{hba}$</td>
<td>19.129</td>
<td>0.242</td>
<td>0.059</td>
<td>17</td>
<td>&gt;19.3cms=m, &lt;18.9cms=f</td>
<td>Significant</td>
</tr>
<tr>
<td></td>
<td>18.880</td>
<td>0.365</td>
<td>0.094</td>
<td>15</td>
<td>18.9-19.3cms=dimorphic</td>
<td></td>
</tr>
<tr>
<td>$W_{hb}$</td>
<td>13.135</td>
<td>0.127</td>
<td>0.031</td>
<td>17</td>
<td>Not Significant</td>
<td></td>
</tr>
<tr>
<td></td>
<td>13.080</td>
<td>0.332</td>
<td>0.086</td>
<td>15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$H_{hba}$</td>
<td>12.882</td>
<td>0.238</td>
<td>0.058</td>
<td>17</td>
<td>&gt;14cms=f, &lt;13.1cms=m</td>
<td>Extremely Significant</td>
</tr>
<tr>
<td></td>
<td>14.200</td>
<td>0.165</td>
<td>0.043</td>
<td>15</td>
<td>13.1-14cms=dimorphic</td>
<td></td>
</tr>
</tbody>
</table>

Fig 4 and 5 highlight on linear regression analysis between $V_{hba}$ and $H_{hba}$ of male (m) and female (f) hip bones respectively. The result was low positive correlation with male (m) hip bones, but high positive correlation with females (f).

Fig 4: Linear regression analysis between $V_{hba}$ (m) & $H_{hba}$ (m) demonstrating low positive correlation

Fig 5: Linear regression analysis between $V_{hba}$ (f) & $H_{hba}$ (f) demonstrating high positive correlation

DISCUSSION

For discussion purpose, as already mentioned, $V_{hba}$ (Vertical hip bone axis) of the present study is the same as length or height of hip bone quoted by various authors in the past, like Gupta et al [3] and Singh et al [4]. However, $W_{hb}$ (width of hip bone), is same for the present and the previous studies. The third parameter, $H_{hba}$ (Horizontal hip bone axis) is a newly introduced parameter. References weren’t found, even with best of efforts, by the author of the present study in relation to $H_{hba}$.

Statistical analysis for the parameters $V_{hba}$ and $H_{hba}$ was significant, in fact, extremely significant in the case of $H_{hba}$. In anatomical position, $H_{hba}$ actually represents the pelvic cavity diameter, sharing the same plane as the iliopectineal line. Female pelvic cavity shape and size has a direct relation with parturition process. Author of the present study exploited this fact while introducing this unique and useful parameter, which is $H_{hba}$. And of course, it did live up to the author’s expectations by significantly differing in male and female hip bones. Fig 6 demonstrates this difference.

In anatomical position, $H_{hba}$ of a female hip bone, which is obviously in the horizontal plane, has its point ‘a’ located further anterior, and point ‘b’, further
posterior to that of a male hip bone. In Fig6, we can clearly spot the difference in length of the lines ‘ab’ corresponding to \(H_{hba}\) between the male and female hip bone. Two factors significantly contributed to this difference. One, of course, is the wider pelvic cavity in females, and second, it’s the wider greater sciatic notch of females, which is responsible for a more posterior placement of the posterior inferior iliac spine (PIIS).

There was a significant difference in male and female \(V_{hba}\) however, not as significant as \(H_{hba}\). Mean \(V_{hba}\) in the present study was 19.13 cms in males and 18.88 cms in female hip bones. However, Verneau [5] reported 22 cms for male and 19.7 cms for female hip bones respectively. Garson JG [6] reported length \((V_{hba})\) of the hip bone in females of European population as 20.17cms, of Australian population as 18.44cms, and of Andamanese population as 16.7cms. Studies done by Verneau [5], Lander [7] and Maruyama et al [8] show a slightly higher mean length \((V_{hba})\) when compared to the present study. Maruyama et al [8] reported length \((V_{hba})\) of hip bone in males as 22cms, and that in females as 20cms. Author of the present study attributes these differences in mean \(V_{hba}\) (length) values amongst various studies to be due to racial variations.

Mean \(W_{hb}\) (width) values in the present study were 13.14 and 13.08cms in male and female hip bones respectively. Verneau [5] reported comparatively higher values of 16.4cms and 15.6cms for male and female hip bones. Maruyama et al [8] reported 13.6cms and 13.1cms for male and female hip bones, which are in line with the present study findings. Segebarth and Orban [9], reported height \((V_{hba})\) and iliac width \((W_{ha})\) as significantly higher in male hip bones. However, Davivongs et al [10], by his study in Australian Aborigine pelvis, reported significant sex differences with these parameters, but, the male and female ranges overlapped. Interestingly, Camacho et al [11] reported similar findings as the present study in relation to width \((W_{hb})\). However, \(W_{hb}\) was statistically analyzed as ‘not significant’ in the present study, and therefore, author of the present study reports \(W_{hb}\) as ‘less useful parameter’ in sex differentiaion of dry human hip bone.

**CONCLUSION**

The present study reports significant and reliable findings in relation to \(V_{hba}\) and \(H_{ab}\). Findings in relation to \(W_{hb}\) were however not significant. \(V_{hba}\) and \(W_{hb}\) were already studied in the past by various authors under the names; ‘length’ / ‘height’ and ‘width’ of hip bone respectively, and thus, remain as highly reliable parameters for gender identification of a dry human hip bone till date. However, author of the present study was very satisfied and convinced with the outcome of the third parameter, \(H_{hba}\), in gender identification of dry human hip bone, and therefore, recommends for more research to be done in relation to \(H_{hba}\).

The present study had an average sample size, which, the author of the present study believes is the only limitation of the study. However, author also believes to have given the best of efforts to overcome this limitation while recording observations to the best of accuracy during the study with the available material, and thus, results are equally reliable.

**Acknowledgement:** I thank Dr. T.L.Anbumani, Professor & head, department of Anatomy, Karpaga Vinayaga Institute of Medical Sciences & Research Centre, for having consented to the use of teaching collection of dry human hip bones of his department for the present study. Author also acknowledges the immense help received from the scholars whose articles are cited and included in references of this manuscript. The author is also grateful to authors / editors / publishers of all those articles, journals and books from where the literature for this article has been reviewed and discussed.

**Conflict of Interest** – None declared

**Source of Funding** – None

**Ethical Clearance** – Not required (This article does not contain any studies with human participants or animals).

**REFERENCES**


Strategic Analysis of Injuries and Causes of Death in Fatal Two Wheeled Vehicle Accidents–An Autopsy Oriented Study in Southern India

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The Oxford Medical College Hospital and Research Centre, Bangalore, ³Head of the Department, Department of Forensic Medicine, Indira Gandhi Government General Hospital and Postgraduate Institute, Puducherry

ABSTRACT

Two wheeled vehicular accidents are estimated for a substantial number of civilian’s deaths & disabilities world-wide and in different regions of India. This study draws attention to the profile, pattern of injuries & causes of death among the road users who died in two wheeler accidents. This autopsy oriented study was carried out during the calendar year 2013 at the union territory (Puducherry). Post-mortem data of all the two wheeler related fatalities were tabulated, critically analysed and arrived at conclusions.

Two wheeler Road Traffic Accident (RTA) deaths are recorded for 10.84% of all medico-legal autopsies. Males (male: female ratio of 4.3:1) and young adults in their second and third decade of life are killed often in RTAs. Two wheeler occupants and pedestrians are the most vulnerable road users. These road mishaps were occurred mostly in summer & rainy seasons, weekends and during peak hours of traffic between 3PM to 9PM. Deceased sustained multiple injuries over the head & limbs. Majority of the victims have fatal injuries were located on the head and limbs of vulnerable road users. Skull fractures & Intracranial haemorrhages are commonly associated with fatal cases. RTAs require a multitudinal approach at various levels like wearing protective devices and adherence to road safety rules by all the two wheeler users especially vulnerable road users will decrease the number of accidents, disabilities and in turn lethality.

Keywords: Two wheeled vehicles, Road traffic accidents, Fatal injuries, Vulnerable road users.

INTRODUCTION

The alarming increase in the number of people seriously injured and killed on the roads in road traffic accidents (RTA) has been a great concern globally. Nearly about 90% of the RTAs are occurring in low and middle-income countries though these countries have approximately half of the world’s vehicles.¹ Injuries resulting from RTAs are responsible for a huge share of disabled and death of young and middle aged populations, and also liable for enormous economic burden to the families.² RTA deaths are presently highest in India (1,30,000 deaths per year) and they are the sixth leading cause of death. However the trends of RTA deaths and road safety situation in different regions of India are widely variable and moreover under-reported.

The Puducherry (Union Territory in south India) and the adjacent districts of Tamil Nadu state (Villupuram, Cuddalore and Chennai) have reported the highest rate of RTAs in India.³ Nearly half of those dying on the Indian roads are two wheeler users like motorcyclists, pedestrians and pedal cyclists, hence they are considered as vulnerable
Therefore, this study was aimed at emphasizing on the pattern injuries and causes of death in two-wheeler accidents.

**MATERIALS & METHOD**

This study was carried out in Indira Gandhi Government General Hospital and Postgraduate Institute at Puducherry from 1st January to 31st December 2013. It is an autopsy oriented, descriptive cross sectional study of two wheeled vehicles related RTA deaths (motorized and non-motorized). We included all RTA deaths involving two wheeled vehicles, which occurred either due to collision between any 2 two wheeled vehicles /collision between a two wheeler & any other motor vehicle having more than 2 wheels / two wheeler hits a pedestrian or a static objects on or off the road. Death of individuals due to non-vehicular accidental injuries, RTAs involving other than two wheelers, decomposed bodies, no clear history and suspicious cases are excluded from this study group.

The details about the victim’s demographic profile, circumstances leading to the accident and thereafter were obtained by personal interview with the police, relatives, eye witnesses and survived persons of the accident before performing the autopsy procedure. While conducting medico-legal autopsy, all the injuries & body findings were meticulously examined and correlated with the history. Finally the data on profile, autopsy findings and additional data was analyzed statistically and the conclusions were drawn.

**OBSERVATIONS AND RESULTS**

Altogether, 1318 medico-legal autopsies were conducted at the study centre during the calendar year 2013. Among 312 cases of RTA deaths, two wheelers are exclusively involved in death of 143 cases. Accordingly two wheeler RTAs were responsible for the highest number (45.8%) of RTA deaths and shared for 10.84% of total autopsies. The fatalities were more among males (81%) with a gender ratio of 4.3:1. Majority of the victims were in the age group of 20-49 years (58%), among them young adults of 20-29 years (25%) are most affected (Table 1).

The highest two wheeler RTAs were reported in the summer (March, April & May) and rainy seasons (July, August & September) of the year (Figure-1). This study revealed that maximum accidents were happened at weekends 40% (Saturday & Sunday) and during daytimes (79%) with a peak at evening rush traffic hours 42% (15:00-21:00) (Table 2).

Among the road users the most vulnerable for fatalities are motorcycle riders (46%), pedestrians (24%), pillion riders (18%) and pedalcyclists (9%) in descending order. Fatal RTAs were occurred more so on highways (national & state). Geared motorcycles (78%) are the frequently crashed vehicles compared to non-geared vehicles (mopeds-13% and pedal cycles-06%). Remarkably 81% of victims lost their lives within first 24 hours of the accident (Table 3). It was observed that only 8% of the motorcycle riders were having a helmets worn on their head at the time of the accident, but none of the pillion rider was wearing a helmet.

Blunt mechanical injuries to the head & face, or to the limbs of the body are very evident. Abrasions, Contusions and Lacerations are the most common blunt mechanical injuries noticed in two wheeler RTAs. Lacerations and fractures are commonly associated with fatal two wheeler RTAs (Table 4). Skull Fractures were more often seen over the vertex of the skull and the common variety is fissured. Among the intracranial haemorrhages commingling of subdural and subarachnoid haemorrhages are the commonest (34%), and pontine haemorrhage was least type (04%) (Table 5).

Head injuries are the single most common cause of deaths (45%), polytrauma and hemorrhagic shock are the 2nd and 3rd major causes of death respectively in fatal two wheeler accidents (Table 6).

**DISCUSSIONS**

Worldwide, at least 1.2 million were killed and 50 million people were injured each year in RTA crashes. Annually over 1.2 million people are seriously injured, at least 3 lakh people were disabled permanently and over 80,000 people die in India due to RTAs. Motorized two wheeler users and pedestrians are having the highest rates of injuries among the RTA cases. In the present study two wheeler related RTA deaths are accounted for 45.8% of RTA deaths, and the value is close to Jaipur study (49%). The mortalities are significantly higher among two wheeler users than other vehicle occupants. Two wheelers are being used enormously by the Indian population due to its convenience and suitability. But these vehicles are highly vulnerable to accidents owing to their poor
stability, bad road conditions and rash driving.

The fatalities are more in males with a gender ratio of 4.3:1. The gender ratio is narrow in only few studies (1.7:1), but in most earlier studies, gender ratio is high up to 9.1. Many studies conducted on RTA in India and abroad also expressed that most victims are young and middle aged between 20-49 years and 18-37 years. Young and middle aged males are victims in most two wheeler accidents, because they lead a more active physical life and use these vehicles for employment, lifestyle and joy.

We observed two seasonal peaks for two wheeler RTAs and similar seasonal fluctuations were reported in earlier studies and they are due to environmental conditions and increased vehicle mobility. RTAs occur more in daytimes and particularly during evening peak traffic hours between 15:00 to 21:00 hours. These timing of accidents are closely coincide with other Indian studies and these timings are coherent with the high travel activity of people. Multiple factors are responsible for the bulk of accidents during these rush hours; high vehicle density on roads, unequal distribution of traffic, urgency to reach destination, stress, tiredness & less attention, absence of foot paths and failure to follow traffic rules.

In recent years two wheelers are the most commonly used vehicles on the road of Puducherry and its users are at great risk to accidents & fatalities. Pedestrians and cyclists are the common victims in fatal road accidents in the earlier Sri Lankan study (1988), and pedestrians and car occupants are frequent victims in an Iran study (2004). Pedestrians are the major road users in India and they die in RTA, the main reasons being narrow roads, lack of footpaths, and the low traffic sense among the public.

Beyond 50% of the victims in two wheeler RTAs are died either at the scene of accident / while transportation to hospital / within an hour of hospitalization. Various other researchers also concluded that plenty of victims lost their lives within first 24hours after the accident. It is noteworthy that the timely availability of emergency medical services to trauma cases will play a crucial role in the victim’s outcome, thus mobile emergency units, sophisticated trauma centres nearby are essential to prevent mortality rate. The helmet wearing by the rider, and the pillion rider is neither practiced effectively nor mandatory by law in certain states of India.

Head and limbs are the commonest anatomical parts injured in two wheeler accidents. The reason being head and limbs are least protected and receives the maximum force in two wheeler accidents, whereas spine is protected well. Head injuries are the single most common cause of death. The commonest type of skull fracture was fissure fractures and the commonest variety of intracranial haemorrhage was a combination of subdural and subarachnoid hemorrhages.

Table 1: Age and Gender-wise distribution of fatal two wheeler accidents

<table>
<thead>
<tr>
<th>Age group in years</th>
<th>Male gender (Number &amp; Percentage)</th>
<th>Female gender (Number &amp; Percentage)</th>
<th>Total (Number &amp; Percentage)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-9 years</td>
<td>03 (02%)</td>
<td>01 (01%)</td>
<td>04 (03%)</td>
</tr>
<tr>
<td>10-19 years</td>
<td>14 (10%)</td>
<td>03 (02%)</td>
<td>17 (12%)</td>
</tr>
<tr>
<td>20-29 years</td>
<td>30 (21%)</td>
<td>06 (04%)</td>
<td>36 (25%)</td>
</tr>
<tr>
<td>30-39 years</td>
<td>23 (16%)</td>
<td>05 (03%)</td>
<td>28 (20%)</td>
</tr>
<tr>
<td>40-49 years</td>
<td>13 (09%)</td>
<td>06 (04%)</td>
<td>19 (13%)</td>
</tr>
<tr>
<td>50-59 years</td>
<td>18 (13%)</td>
<td>02 (01%)</td>
<td>20 (14%)</td>
</tr>
<tr>
<td>60-69 years</td>
<td>09 (06%)</td>
<td>03 (02%)</td>
<td>12 (08%)</td>
</tr>
<tr>
<td>&gt;70 years</td>
<td>06 (04%)</td>
<td>01 (01%)</td>
<td>07 (05%)</td>
</tr>
<tr>
<td>Total</td>
<td>116 (81%)</td>
<td>27 (19%)</td>
<td>143 (100%)</td>
</tr>
</tbody>
</table>
Figure 1: Monthly distribution of two wheeler accidental deaths

Table 2: Distribution of fatal cases according to weekdays and time of accidents

<table>
<thead>
<tr>
<th>Days &amp; Tim (24hr)</th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
<th>Saturday</th>
<th>Sunday</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>06:01-09:00</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>19(13%)</td>
</tr>
<tr>
<td>09:01-12:00</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>4</td>
<td>6</td>
<td>5</td>
<td>25(17%)</td>
</tr>
<tr>
<td>12:01-15:00</td>
<td>2</td>
<td>1</td>
<td>4</td>
<td>0</td>
<td>1</td>
<td>4</td>
<td>2</td>
<td>14(10%)</td>
</tr>
<tr>
<td>15:01-18:00</td>
<td>5</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>9</td>
<td>6</td>
<td>32(22%)</td>
<td></td>
</tr>
<tr>
<td>18:01-21:00</td>
<td>3</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>29(20%)</td>
</tr>
<tr>
<td>21:01-24:00</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>14(10%)</td>
</tr>
<tr>
<td>00:01-06:00</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>10(07%)</td>
</tr>
<tr>
<td>Total</td>
<td>19(13%)</td>
<td>17(12%)</td>
<td>20(14%)</td>
<td>13(09%)</td>
<td>17(12%)</td>
<td>31(22%)</td>
<td>26(18%)</td>
<td>143(100%)</td>
</tr>
</tbody>
</table>

Table 3: Characteristic variable in fatal two wheeler accidents

<table>
<thead>
<tr>
<th>Analysis of variables (road network, vehicles and victims) in fatal two wheeler accidents</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type of road</strong></td>
<td>143(100%)</td>
</tr>
<tr>
<td>National Highway 52 (36%)</td>
<td></td>
</tr>
<tr>
<td>State Highway 25 (17%)</td>
<td></td>
</tr>
<tr>
<td>City Roads 33 (23%)</td>
<td></td>
</tr>
<tr>
<td>Village Roads 18 (13%)</td>
<td></td>
</tr>
<tr>
<td>Approach Road 12 (08%)</td>
<td></td>
</tr>
<tr>
<td>Unknown 03 (02%)</td>
<td>143(100%)</td>
</tr>
<tr>
<td><strong>Two wheeler involved</strong></td>
<td></td>
</tr>
<tr>
<td>Geared motorcycle 112 (78%)</td>
<td></td>
</tr>
<tr>
<td>Scooter 05 (03%)</td>
<td></td>
</tr>
<tr>
<td>Moped 18 (13%)</td>
<td></td>
</tr>
<tr>
<td>Pedal Cycle 08 (06%)</td>
<td></td>
</tr>
<tr>
<td>Unknown 02 (01%)</td>
<td></td>
</tr>
<tr>
<td><strong>Road user status</strong></td>
<td></td>
</tr>
<tr>
<td>Pedestrian 34 (24%)</td>
<td></td>
</tr>
<tr>
<td>Rider 66 (46%)</td>
<td></td>
</tr>
<tr>
<td>Pillion Rider 26 (18%)</td>
<td></td>
</tr>
<tr>
<td>Pedal cyclist 13 (09%)</td>
<td></td>
</tr>
<tr>
<td>Others 02 (01%)</td>
<td></td>
</tr>
<tr>
<td>Unknown 03 (02%)</td>
<td>143(100%)</td>
</tr>
<tr>
<td><strong>Time to hospitalization</strong></td>
<td></td>
</tr>
<tr>
<td>Non-hospitalized 37 (26%)</td>
<td></td>
</tr>
<tr>
<td>Within an hour 79 (55%)</td>
<td></td>
</tr>
<tr>
<td>2-4 hours 21 (15%)</td>
<td></td>
</tr>
<tr>
<td>5-12 hours 04 (03%)</td>
<td></td>
</tr>
<tr>
<td>12-24 hours 01 (01%)</td>
<td></td>
</tr>
<tr>
<td>2 days onwards 01 (01%)</td>
<td></td>
</tr>
<tr>
<td><strong>Survival period</strong></td>
<td></td>
</tr>
<tr>
<td>Spot death 41 (29%)</td>
<td></td>
</tr>
<tr>
<td>Transportation or &lt;1hr hospital 38 (27%)</td>
<td></td>
</tr>
<tr>
<td>2-6 hours 20 (14%)</td>
<td></td>
</tr>
<tr>
<td>7-24 hours 15 (11%)</td>
<td></td>
</tr>
<tr>
<td>2-6 days 17 (12%)</td>
<td></td>
</tr>
<tr>
<td>7 days or more 04 (02%)</td>
<td>143(100%)</td>
</tr>
</tbody>
</table>
Table 4: Distribution and type of injuries in fatal two wheeled accidents*

<table>
<thead>
<tr>
<th>Regional injuries</th>
<th>Abrasion</th>
<th>Bruises</th>
<th>Laceration</th>
<th>Fracture</th>
<th>Crush</th>
<th>Multiple injuries</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head &amp; face</td>
<td>44 (20%)</td>
<td>33 (29%)</td>
<td>57 (40%)</td>
<td>38 (25%)</td>
<td>05 (03%)</td>
<td>27 (19%)</td>
<td>204</td>
</tr>
<tr>
<td>Spine</td>
<td>03 (02%)</td>
<td>03 (03%)</td>
<td>01 (01%)</td>
<td>09 (06%)</td>
<td>01 (01%)</td>
<td>01 (01%)</td>
<td>17</td>
</tr>
<tr>
<td>Chest</td>
<td>11 (08%)</td>
<td>11 (10%)</td>
<td>06 (04%)</td>
<td>17 (12%)</td>
<td>02 (01%)</td>
<td>06 (04%)</td>
<td>53</td>
</tr>
<tr>
<td>Abdomen &amp; pelvis</td>
<td>13 (07%)</td>
<td>13 (13%)</td>
<td>09 (06%)</td>
<td>04 (03%)</td>
<td>01 (01%)</td>
<td>03 (02%)</td>
<td>43</td>
</tr>
<tr>
<td>Upper limbs</td>
<td>27 (09%)</td>
<td>31 (23%)</td>
<td>38 (27%)</td>
<td>24 (17%)</td>
<td>07 (05%)</td>
<td>19 (13%)</td>
<td>146</td>
</tr>
<tr>
<td>Lower limbs</td>
<td>39 (27%)</td>
<td>23 (16%)</td>
<td>26 (18%)</td>
<td>19 (13%)</td>
<td>03 (02%)</td>
<td>13 (07%)</td>
<td>124</td>
</tr>
<tr>
<td>Head &amp; Limbs</td>
<td>37 (19%)</td>
<td>22 (22%)</td>
<td>40 (28%)</td>
<td>22 (15%)</td>
<td>01 (01%)</td>
<td>25 (17%)</td>
<td>147</td>
</tr>
<tr>
<td>Multiple parts</td>
<td>11 (08%)</td>
<td>07 (07%)</td>
<td>17 (12%)</td>
<td>03 (02%)</td>
<td>04 (03%)</td>
<td>08 (06%)</td>
<td>50</td>
</tr>
<tr>
<td>Total</td>
<td>185 (22%)</td>
<td>143 (19%)</td>
<td>194 (25%)</td>
<td>136 (17%)</td>
<td>24 (03%)</td>
<td>102 (13%)</td>
<td>781 (100%)</td>
</tr>
</tbody>
</table>

* multiple responses

Table 5: Distribution of intracranial haemorrhages in fatal RTA cases

<table>
<thead>
<tr>
<th>Type</th>
<th>Number &amp; Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Epidural Haemorrhage (EDH)</td>
<td>10 (07%)</td>
</tr>
<tr>
<td>Subdural Haemorrhage (SDH)</td>
<td>32 (22%)</td>
</tr>
<tr>
<td>Subarachnoid Haemorrhage (SAH)</td>
<td>19 (13%)</td>
</tr>
<tr>
<td>Intracerebral Haemorrhage (ICH)</td>
<td>05 (03%)</td>
</tr>
<tr>
<td>Intraventricularhaemorrhage (IVH)</td>
<td>06 (04%)</td>
</tr>
<tr>
<td>Pontine haemorrhage (PH)</td>
<td>04 (03%)</td>
</tr>
<tr>
<td>SDH + SAH</td>
<td>49 (34%)</td>
</tr>
<tr>
<td>EDH + SDH + SAH</td>
<td>11 (08%)</td>
</tr>
<tr>
<td>Other combinations</td>
<td>08 (06%)</td>
</tr>
<tr>
<td>Total</td>
<td>143 (100%)</td>
</tr>
</tbody>
</table>

Table 6: Causes of death in fatal two wheeler RTA cases

<table>
<thead>
<tr>
<th>Causes of death</th>
<th>Number &amp; Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head injuries</td>
<td>64 (45%)</td>
</tr>
<tr>
<td>Spinal injuries</td>
<td>07 (05%)</td>
</tr>
<tr>
<td>Chest injuries</td>
<td>10 (07%)</td>
</tr>
<tr>
<td>Abdomino-pelvic injuries</td>
<td>06 (04%)</td>
</tr>
<tr>
<td>Haemorrhagic shock</td>
<td>16 (11%)</td>
</tr>
<tr>
<td>Polytrauma</td>
<td>21 (15%)</td>
</tr>
<tr>
<td>Injury to vital organs</td>
<td>10 (07%)</td>
</tr>
<tr>
<td>Sepsis</td>
<td>09 (06%)</td>
</tr>
<tr>
<td>Total</td>
<td>143 (100%)</td>
</tr>
</tbody>
</table>

CONCLUSIONS

- Young adult males between 20-29 years are killed frequently in two wheeler RTAs.
- Two wheeler occupants and pedestrians are at significant risk of lethality.
- Fatal RTAs occurs more during daytimes, peak traffic hours & more than 50% of them die during first 24 hours.
- Blunt mechanical injuries, lacerations & fractures are commonly associated with fatalities. Skull fractures & Intracranial hemorrhages are
common findings in fatal RTAs.

- Head injuries, Polytrauma and Hemorrhagic shock are ranked number 1, 2 & 3 causes of death in fatal two wheeler accidents.

**SUGGESTIONS**

- Enact and strongly enforce road safety laws & regulation to control speed, wearing safety devices, prohibition of drunken driving and mobile usage while driving.

- Road infrastructure should be designed, developed and modified to optimal safety standard.

- Strengthen standards of emergency trauma care and rehabilitation facilities in the rural & semi urban areas by promoting polices and emergency services to decrease mortalities and disabilities.

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**Conflicts of Interest:** We authors declare that there is no conflicts of interest.

**Source of Funding:** There is no source of funding for this research article.

**Ethical Clearance:** Institutional research & ethical committee approval were obtained to conduct this study

**REFERENCES**


17. Verma PK, Tewari KN. Epidemiology of road traffic injuries in Delhi; Result of survey.


A Cross Sectional Study of Age Related Pubic Symphyseal Changes in 3rd and 4th Decades of Life

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ABSTRACT

Background – Out of various indicators for estimating age above 25 years, age related changes in pubic symphyseal surface between 2nd – 5th decades of life have been found to be reliable during the said period; more during 3rd & 4th decades. Objectives - To estimate age, based on the morphological changes over pubic symphyseal surface, by applying the standard criteria devised by Mckern and Stewart and to find out its usefulness in application to the people of North Karnataka region.

Methods – Cross sectional study carried from 1st November 2007 to 31st October 2008 over 50 pubic bones (37 males and 13 females) from persons aged between 20-40 years collected at postmortem. The changes in the pubic symphyseal surface was observed and compared to the standard criteria devised by Mckern and Stewart. Results – For males, after adding +1 and +2 years for the total score 6-7 and 10 respectively, morphological changes in pubic symphyseal surface were found accurate for age estimation. For females, the age range was high in the total scores 6-7 (22-35 years) and total score 10 (30 years) compared to Mckern and Stewart’s total score 6-7 (20-24 years) and total score 10 (23-28 years). Conclusions and interpretation – Age estimation in males was fairly accurate as compared to females using Mckern and Stewart’s method.

Keywords - Mckern Stewart’s criteria, age estimation, pubic symphysis.

INTRODUCTION

Bones are the most durable and relatively indestructible structures of the body. They yield a lot of information and also resist putrefaction to a great extent. There are several methods that can help us in assessing age from bones. The result comes in ranges and these ranges are wide after 2nd decade of life1. The metamorphic changes in the pubic symphysis have been found to be one of the best means of age determination during this period. When the changes in the pubic symphysis are correlated with other skeletal criteria, Krogman ventures estimation of age with an accuracy of + 2 years2.

Each pubic symphysis possesses a more or less oval outline with nine descriptive morphological features3.

Research done in US by Mckern and Stewart made further very useful revisions as a remedial to the many problems faced by Todd4.
Todd had the impression that there is no sex difference in age changes of the pubic symphysis or in the rates of these changes. Hence, he concluded that “assessment of age of females by the pubic symphysis cannot be as accurate as in the case of males. So it was necessary to be more cautious in applying male pubic standards to female.”

Thus with the basic work of Todd and the refinements introduced by Brooks, McKern and Stewart, the pubic symphysis takes its place as the most reliable indicator of age in the human skeleton after 2nd decade of life. An important research was done by McKern and Gilbert on 103 of known parity and age and developed a new method for aging female pubic symphysis. They demonstrated that females are absolutely different from males in the rate and locality of age related metamorphic changes in the pubis. They also, like McKern and Stewart found it best to reduce the number of features considered by Todd to three basic components and follow these through a succession of metamorphic changes.

The study was conducted with an aim to correlate the age from symphysis pubis changes using McKern & Stewart. The objectives of the study were to observe the morphological changes those occur in the symphysis pubis of 20-40 years of age groups in males and females, to estimate age based on the morphological changes by applying the standard criteria devised by McKern & Stewart and study its usefulness of its application to the people of North Karnataka.

MATERIALS & METHOD

A total number of 50 human pubic bones were collected from dead bodies brought for medicolegal autopsies in the mortuary of Department of Forensic Medicine & Toxicology, Jawaharlal Nehru Medical College, Belgaum. Prior approval by the Institutional Ethics Committee for removal of bones was taken.

Sample of pubic bones without a history of any disease or deformity affecting the bones during their lifetime were collected from dead bodies of persons between age group 20-40 years in which 37 were males and 17 were females.

The bones, after removal from soil, were washed with mild soap water, air dried and studied by using McKern-Stewart criteria’s model casts.

OBSERVATION AND FINDINGS

Males

Component –I (dorsal demiface)

First site to show developmental morphological changes is the dorsal demiface. Stage 0 (ridges and grooves are very prominent) was not seen. Stage I (filling of grooves dorsally and formation of dorsal margin in middle one third) is not seen. Stage II (dorsal margin is complete) was not seen. Stage III (dorsal plateau is seen in middle third) was observed in 3 cases with an age range of 22-23 years (mean 22.33). Stage IV (the plateau still exhibiting vestiges of billowing extends over the dorsal demiface) was observed in 10 cases with an age range of 22-28 years (mean 24.80). Stage V (dorsal demiface is flat) was observed in 24 cases with an age range of 28-40 years (mean 33.75).

When compared each stages of component I age range in the present study with standard McKern and Stewart’s study (Table No V), it coincided within the age range of their study.

Component –II (Ventral Demiface)

It is next in development to show metamorphic changes. Stage I (ventral bevelling is present at superior extremity of ventral border) was observed in 6 cases with an age range of 22-25 years (mean 23). Stage II (ventral bevelling along the entire ventral border) was observed in 3 cases with an age range of 22-28 years (mean 25.33). Stage III (bony extensions from either or both extremities start to form ventral rampart) was observed in 7 cases with an age range of 23-30 years (mean 27.28). Stage IV (ventral rampart is extensive but gaps are still evident in upper two thirds along the ventral border) was observed in 5 cases with an age range of 28-35 years (mean 32.6). Stage V (ventral rampart is complete) was observed in 16 cases with an age range of 30-40 years (mean 33.12).

When compared each stages of component II age range in the present study with standard McKern and Stewart’s study (Table No V), it revealed 2 years delay for stage I, III and IV and 4 years delay in stage II. But stage V fell within age range of their study.
Component –III (Symphyseal Rim)

It is next in development to ventral demiface. Stage I (dorsal rim is partially formed) was observed in 6 cases with an age range of 22-23 years (mean 22.16). Stage II (dorsal rim is completely formed) was observed in 11 cases with an age range of 25-30 years (mean 27.72). Stage III (symphyseal rim is complete) was observed in 13 cases with an age range of 30-38 years (mean 34.69). Stage IV (symphyseal rim begins to thin out or breakdown) was observed in 4 cases with an age range of 27-32 years (mean 29.75). Stage V (rarefaction of symphyseal face and further breakdown of symphyseal rim) was observed in 3 cases with an age range of 38-40 years (mean 39).

When compared each stages age range in the present study with standard Mckern and Stewart’s study (Table No 1), it revealed within the age range of their study except in stage IV which has appeared 2 years earlier.

The total score was compared to standard Mckern and Stewart’s age range. For the total score 10 (30 years) was +2 years and for other total score it fell within the age range.

Females

Component –I (dorsal demiface)

There were no cases in Stage 0, I and II in our study. Stage III was observed in 2 cases with an age of 22 years (mean 22). Stage IV was observed in 3 cases with an age range of 26-35 years (mean 29.66). Stage V was observed in 8 cases with an age range of 26-33 years (mean 30.25).

Comparing our component age range (Mckern and Stewart’s method) study to that of Mckern and Gilbert’s (Table No.VI), the age range fell within except the stage I which is delayed for 8 years.

Component –III (Symphyseal Rim)

There were no cases in stage 0 in our study. Stage I was observed in 4 cases with an age range of 22-28 years (mean 25 years). Stage II was observed in 7 cases with an age range of 26-35 years (mean 30.25 years). In Stage III no case was seen. Stage IV was observed in 1 case with an age of 33 years. Stage V was observed in 1 case with an age of 30 years.

The total score was compared to standard Mckern and Stewart’s age range, for the total score 6-7 (22-35 years) was +11 years, for the total score 10 (32 years) was +4 years, for the total score 15 (32 years) was 6 years earlier. For other total scores it fell within the age range.

The total score was compared to standard Mckern and Gilbert’s age range, it falls within the age range.

DISCUSSION

Todd emphasized that “race has strikingly little influence upon pubic metamorphosis”. As per the study done in Japan the age changes in pubic bone of Japanese individuals were 2-3 years earlier which was same in our study too.

As per the study done in US, estimates in males had a high correlation with known age whereas females were a bit lower which was same in our study.

In another study, it was concluded that “assessment of age of females by the pubic symphysis cannot be as accurate as in the case of males. So it is necessary to be more cautious in applying male pubic standards to female”. In our study also it was more accurate in males than compared to females.

In the same study, male pubic standards of Mckern and Stewart was not applicable for female pubic symphysis as they found that there were significant differences in male and female patterns and developed a system to respond to them. In our study also we noted the similar difference between male and female symphyseal rim, but on careful
observation the age range in females were higher in younger age group.

Male age estimation by Mckern and Stewart method was more accurate in the younger age group (16-35 years) in a study done by by Harikrishna and Bhootra. It gave indication of age within the range of 5-6 years and after that the changes in pubic bone show a long variation in age estimation. In females age estimation was more accurate in higher age group (32-50 years) than younger age group. In our study it was accurate in the age group (20-40 years) in males, but in females less accurate.

Table 1 Comparison of age limits of component stages of males with Mckern and Stewart’s Method

<table>
<thead>
<tr>
<th>IN THE PRESENT STUDY</th>
<th>MCKERN AND STEWART’S METHOD ’57</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage</td>
<td>No of cases</td>
</tr>
<tr>
<td>COMPONENT I</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td>I</td>
<td>-</td>
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<tr>
<td>II</td>
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</tr>
<tr>
<td>III</td>
<td>3</td>
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<tr>
<td>IV</td>
<td>10</td>
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<tr>
<td>V</td>
<td>24</td>
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<tr>
<td>COMPONENT II</td>
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<td>3</td>
</tr>
<tr>
<td>III</td>
<td>7</td>
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<tr>
<td>IV</td>
<td>5</td>
</tr>
<tr>
<td>V</td>
<td>16</td>
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<td>COMPONENT III</td>
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<td>III</td>
<td>13</td>
</tr>
<tr>
<td>IV</td>
<td>4</td>
</tr>
<tr>
<td>V</td>
<td>3</td>
</tr>
</tbody>
</table>
Table 2 Comparison of age limits of component stages of females with Mckern and Gilbert’s Method

<table>
<thead>
<tr>
<th>IN THE PRESENT STUDY</th>
<th>MCKERN AND GILBERT’S METHOD ’73</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Stage</strong></td>
<td><strong>No of cases</strong></td>
</tr>
<tr>
<td>COMPONENT I</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td>I</td>
<td>-</td>
</tr>
<tr>
<td>II</td>
<td>-</td>
</tr>
<tr>
<td>III</td>
<td>2</td>
</tr>
<tr>
<td>IV</td>
<td>3</td>
</tr>
<tr>
<td>V</td>
<td>8</td>
</tr>
<tr>
<td>COMPONENT II</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>I</td>
<td>1</td>
</tr>
<tr>
<td>II</td>
<td>2</td>
</tr>
<tr>
<td>III</td>
<td>2</td>
</tr>
<tr>
<td>IV</td>
<td>3</td>
</tr>
<tr>
<td>V</td>
<td>4</td>
</tr>
<tr>
<td>COMPONENT III</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td>I</td>
<td>4</td>
</tr>
<tr>
<td>II</td>
<td>7</td>
</tr>
<tr>
<td>III</td>
<td>-</td>
</tr>
<tr>
<td>IV</td>
<td>1</td>
</tr>
<tr>
<td>V</td>
<td>1</td>
</tr>
</tbody>
</table>

**CONCLUSION**

1. Age can be estimated by the study of metamorphosis of os pubis based on the Mckern-Stewart’s criteria up to the accuracy of +2 year in the age group of 20-30 years, +3 years in the age group of 30-40 years in males and in females it’s not useful.

2. It can be useful by using Mckern and Stewart’s criteria and calculating the total scores for females as per the Mckern and Gilbert’s criteria.

3. Approximate age of individual can be assessed by just studying the morphological changes in any component of symphysis pubis defined by Mckern-Stewart’s criteria but for accurate assessment of ages, changes in all the three components need to be taken into consideration.

**Acknowledgement** - Nil

**Source of Funding** - Self

**Conflict of Interest** - Nil

**REFERENCES**


5. Todd TW. Age changes in the pubic bone. VIII. Roentgenographic differentiation. Am J Phys Anthrop 1930; 14 (2): 255-71


Hanging, Strangulation or Both? A Case Report

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ABSTRACT

Hanging may be suicidal, accidental or homicidal. However, accidental or homicidal hangings are rare. Presence of marks of struggle in alleged case of hanging, always create a doubt about strangulation. Sometimes history provided by the patient or his relative may complicate the issue. In the present case, the history given by patient and relatives and the clinical findings were totally inconsistent with each other and complicated the issue. However, repeated counseling and complete examination of the patient helped arrival at a conclusion as a case of “Post strangulation hanging”.

Keywords: Hanging, Strangulation.

INTRODUCTION

Hanging and Strangulation are usually differentiated with the help of ligature mark. However, no opinion should be drawn solely on the basis of ligature mark.\(^1\) The ligature mark may even be indistinct or absent. History given by relatives of the deceased, who usually try to save their near ones, are often unreliable and confusing and hence cannot be not considered as an important criterion to form an opinion. The external signs may provide some clue to differentiate between the two, but these signs may be absent when death is due to vasovagal and carotid sinus effect.\(^1\) So, it is important that the opinion should be based collectively on history, complete examination findings including ligature material, signs of asphyxia, external injuries and findings of crime scene investigation.

CASE REPORT

A young female was brought to the Emergency Department of Himalayan Institute Hospital, Dehradun. The sister in law of the victim informed that the victim hanged herself at home and she rescued the victim and brought her to the hospital. When the reason for hanging was asked, she replied that her husband is a auto rickshaw driver and not working since a month. The victim was earlier not providing any information. However, when the patient was examined, the findings, including examination of ligature mark and marked congestion of both the eyes, were creating a doubt about strangulation.

A day after the incidence, when the victim was questioned, she told that she strangled herself with her dupatta. But the victim did not give any statement regarding her husband. The authors were still not satisfied with the history. The matter was again discussed with the sister –in-law of the victim. Finally, she revealed that there was a quarrel between the couple and that her brother strangled her. Later, the victim hanged herself to end her life, but she was rescued.

The victim was restless, depressed and so proper informed consent was obtained from both the victim and her relatives for examination, photography and publication.

External examination:

External signs of asphyxia were well marked. Both eyes were markedly congested [Fig. 1]. Swelling
of the neck was present. In addition to asphyxial changes, hoarseness of voice, dyspnea and difficulty in swallowing were also observed.

In Hanging there is suspension of the body with ligature round the neck and the constricting force being the weight of the body. However, in strangulation there is constriction of neck by ligature or by any other means but without suspending the body.\(^1\)

Hanging is usually suicidal or accidental, apart from rare cases of lynching.\(^2\) It is a common method of committing suicide. In contrast, suicidal strangulation is the rarest phenomenon. Strangulation is usually considered to be homicidal. Accidental strangulation is rare, but it may occur when an article of clothing tightens round the neck with the help of a machine.\(^1\) Accidental strangulation is still rare among adults.\(^3\)

Circumstantial evidence also plays an important role in deciding the manner of asphyxial death.\(^4\)

The ligature mark may completely encircle or be present only on the anterior aspect of the neck, when the ligature is pulled upward from behind.\(^3\)

Sometimes, a ligature mark may be the only evidence available in asphyxial deaths due either to hanging or strangulation. A detailed examination of the ligature mark is mandatory to differentiate between hanging and strangulation.\(^5\)

Signs of asphyxia are usually not well marked in cases of hanging. But, in cases of strangulation the signs are well marked, except when the death is due to vasovagal and carotid sinus effect. In asphyxial syndromes, sometimes all the findings are negative in a particular case, when the death is due to direct neurogenic action at the cardiac level and the time is too short for petechiae and other signs to form.\(^6\) But, in the present case the signs of asphyxia were well marked and point towards strangulation.

11 pounds of pressure on both carotid arteries for 10 seconds is required to cause loss of consciousness. But, if pressure is released immediately, consciousness will be regained in 10 seconds. To completely occlude the trachea a pressure 33 pounds is necessary. If strangulation continues for 4-5minutes, brain death
occurs. The time required to cause death is also dependent on the strength of the neck muscles, amount of force applied and duration of application of force. In the present case, it was admitted by the relative that the husband tried to strangle his wife and considering her dead left the house immediately. But, the wife later regained consciousness and tried to hang herself, and was rescued by her sister-in-law. So the possibility that the victim was strangulated first and later regained consciousness cannot be ruled out.

Self strangulation is very uncommon, and many investigators continue to believe that self strangulation is not possible. However, some cases of self strangulation have been reported. Homicidal strangulation is occasionally feigned to bring a false charge against an enemy. Hysterical women sometime feign without any motive. However, in the present case, the possibility of self strangulation was ruled out on the basis of initial inconsistent history regarding the manner of self strangulation as explained by the victim, victim’s physique and extensive congestion of eyes and face. Psychiatric opinion was also obtained to rule out hysteria. It was also corroborated by the final statement given by the sister-in-law of the victim.

CONCLUSION

From the present case, it can be concluded that opinion should be based on the clinical findings. However, an expert can correlate the clinical findings with the history.

It is the duty of a medical expert that the examination should not be guided by the history but should be totally independent. If the clinical findings and history provided are contradictory, then the expert opinion should be based on clinical findings and investigations.

Acknowledgement: I would like to thank all my seniors and my friends for their helpful attitude, valuable guidance and precious advice without which the present work would not have been possible.

Conflict of Interest Statement: This is to certify that the case study entitled “Hanging, Strangulation or Both? : A case report” submitted by us has not been submitted to any other journal for publication. Measures have been taken not to reveal identity of the victim. All of us have same conclusion.

Source of Funding: The work has been carried out without any financial help from any individual or institution.

Ethical Clearance: Ethical clearance is not required because it is case report.

REFERENCES

A Histopathological Study of Carotid Artery Injuries in Vehicular Accidents

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¹Associate Professor, ²Assistant Professor, Smt. Kashibai Navale Medical College, Pune

ABSTRACTS

The study was conducted in the Department of Forensic Medicine and Toxicology, Indira Gandhi Government Medical College, Nagpur. Total 100 cases were examined to study various patterns, anatomical location and histological extent of the cervical carotid artery injuries. Traumatic vascular injury to the extra cranial circulation appears relatively underdiagnosed in part because of frequent co-existence of traumatic brain injury. In this study, intimal tears were present in 15(57.69%) and compound intimo-medial tears were found in 15(57.69%) subjects of the 26 subjects with positive findings. Medial tears were noted in 12(46.15%) subjects and total 8 complete wall transections were present. It seems, the intimal tear is the basic and most common injury which leads to further thrombosis and occlusion.

Keywords: Road traffic accidents, Carotid artery injuries, Histopathological study.

INTRODUCTION

The frequency of blunt trauma to the neck is relatively high. However, the injury to the carotid arteries as a result of blunt trauma is uncommon. The blunt injury to carotid arteries is commonly associated with motor vehicle accidents. The true incidence of traumatic injury to extra-cranial carotid vessels because of blunt trauma is unknown.

The hyperextension of the neck resulting from sudden change in velocity as seen in motor vehicle accidents can cause stretching of the carotid arteries resulting in diffuse intimal tears which initiate thrombotic occlusion of the artery. These occlusions in turn may cause cerebral ischaemia. As these blunt injuries to carotid arteries are usually associated with concomitant head injury, alcohol or drug intoxication which leads to failure to consider the diagnosis. There is very little attention has been given to carotid artery injury in forensic settings and less work has been done regarding anatomical distribution of cervical artery injury and extent of damage on histological examination.

Hence in attempt to find out the incidence and to describe the anatomical distribution and histological extent of carotid artery injury seen on post-mortem examination and histopathological examination, the present study had been carried out.

MATERIAL & METHOD

The study is conducted in the Department of Forensic Medicine and Toxicology, Indira Gandhi Government Medical College, Nagpur during the time span of 12 months from March 2004 to February 2005 as a thesis for M.D. (Forensic Medicine) course. Total 100 cases were selected from those brought to the Department of Forensic Medicine and Toxicology, Indira Gandhi Government Medical College, Nagpur for post-mortem examination where the history of vehicular accident was present.

The autopsy data included external injuries with special mention to the injuries to the head and neck, and other associated injuries on the other parts of the body. For the dissection of the carotid arteries, “Y” or modified raquet incision was given. The arteries opened from below and its intimal surface examined.
In those cases where a contusion or disruption was noted, were considered as positive cases.

The adventitial surface of cervical portion of each common carotid artery and its respective internal and external branches up to 2cm beyond the bifurcation was examined for evidence of contusion or rupture. The arteries opened from below and its intimal surface examined. In those cases where a contusion or disruption was noted, the entire segment of vessel from its origin or the beginning of its cervical portion up to 2cm beyond the bifurcation was then excised and processed for histopathological examination. After processing slides were prepared which were stained by elastic–van Gieson’s or Verhoff’s stain in order to better delineate the elastic fibres of the media.

The slides were then examined by conventional light microscopy for tearing or disruption of the arterial wall.

**OBSERVATIONS**

**Table 1: Distribution of cases regarding presence of surface injuries over neck**

<table>
<thead>
<tr>
<th>Surface injuries over neck</th>
<th>No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total No. of cases (out of 100)</td>
<td>17</td>
</tr>
<tr>
<td>Cases with positive findings (out of 26)</td>
<td>11(42.3%)</td>
</tr>
</tbody>
</table>

As per above table, surface injuries were present in 17 of the total 100 subjects and in 11(42.3%) of the 26 subjects with positive findings.

**Table 2: Distribution of the cases regarding the cause of Death**

<table>
<thead>
<tr>
<th>Cause of death</th>
<th>No. of cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head injury</td>
<td>65</td>
</tr>
<tr>
<td>Injury to vital organs</td>
<td>32</td>
</tr>
<tr>
<td>Shock and hemorrhage</td>
<td>1</td>
</tr>
<tr>
<td>Head injury associated with injury to liver</td>
<td>1</td>
</tr>
<tr>
<td>Head injury associated with injury to arm</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>

As per the above table, it is obvious that maximum number of cases i.e. 65 died due to head injury.

**Table 3: No. of subjects and arteries with positive findings and anatomical and numerical distribution of the arteries involved:**

<table>
<thead>
<tr>
<th></th>
<th>No.</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of subjects with positive findings</td>
<td>26</td>
<td>26</td>
</tr>
<tr>
<td>No. of arteries with positive findings (out of total 600* arteries)</td>
<td>37</td>
<td>6.16</td>
</tr>
<tr>
<td>Artery involved (out of 37 arteries involved)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LCC</td>
<td>17</td>
<td>45.9</td>
</tr>
<tr>
<td>LEC</td>
<td>1</td>
<td>2.7</td>
</tr>
<tr>
<td>LIC</td>
<td>3</td>
<td>8.1</td>
</tr>
<tr>
<td>RCC</td>
<td>13</td>
<td>35.1</td>
</tr>
<tr>
<td>REC</td>
<td>1</td>
<td>2.7</td>
</tr>
<tr>
<td>RIC</td>
<td>2</td>
<td>5.4</td>
</tr>
<tr>
<td>Total</td>
<td>37</td>
<td>100</td>
</tr>
</tbody>
</table>

(* 6 arteries in each subject-
1. Left Common Carotid (LCC)
2. Left External Carotid artery (LEC)
3. Left Internal Carotid (LIC)
4. Right Common Carotid (RCC)
5. Right External Carotid (REC)
6. Right Internal Carotid (RIC) )

As per above table, 26 subjects out of total 100 and 37(6.16%) arteries out of total 600 arteries had positive findings. The left common carotid artery, 17(45.9%) was commonest followed by right common carotid artery, 13(35.1%).

**Table 4: Anatomical Distribution of Injury: Single Vessel Involvement and Multiple Vessel Involvement:**

<table>
<thead>
<tr>
<th>Vessel Involvement</th>
<th>Artery involved</th>
<th>No. of subjects</th>
<th>Percentage (out of total 26 subjects with positive findings)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single</td>
<td>LCC</td>
<td>7</td>
<td>26.92</td>
</tr>
<tr>
<td></td>
<td>RCC</td>
<td>6</td>
<td>23.07</td>
</tr>
<tr>
<td></td>
<td>RIC</td>
<td>1</td>
<td>3.84</td>
</tr>
<tr>
<td></td>
<td>LIC</td>
<td>1</td>
<td>3.84</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>15</td>
<td>57.69</td>
</tr>
<tr>
<td>Multiple</td>
<td>LCC+RCC</td>
<td>6</td>
<td>23.07</td>
</tr>
<tr>
<td></td>
<td>LCC+LIC</td>
<td>2</td>
<td>7.69</td>
</tr>
<tr>
<td></td>
<td>LCC+LEC</td>
<td>1</td>
<td>3.84</td>
</tr>
<tr>
<td></td>
<td>RCC+RIC</td>
<td>1</td>
<td>3.84</td>
</tr>
<tr>
<td></td>
<td>LCC+REC</td>
<td>1</td>
<td>3.84</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>11</td>
<td>42.31</td>
</tr>
</tbody>
</table>
As per above table, single vessel involvement was noted in 15(57.69%) while dual vessel involvement was noted in 11 subjects (42.31%) in both an ipsilateral and contralateral distribution.

**Table No. 5: Histological extent of vessel wall disruption:**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Vessel wall disruption</th>
<th>No. of tears</th>
<th>No. of vessels</th>
<th>No. of subjects</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Intimal tears</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(a) Superficial intimal</td>
<td>21</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(b) Intima to internal elastic lamina</td>
<td>15</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total:36</td>
<td>Single:13</td>
<td>Multiple:7</td>
<td>Total:20</td>
</tr>
<tr>
<td>2</td>
<td>Compound intimo-medial tears</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(a) Intima to inner third media</td>
<td>18</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(b) Intima to middle third media</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(c) Intima to outer third media</td>
<td>7</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total:31</td>
<td>20</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Medial tears</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(a) Single tears</td>
<td>11</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(b) Multiple tears</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total:17</td>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Adventitio-medial tears</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Adventitial tears</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Complete wall transections</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>LCC</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>RCC</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>LIC</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total:8</td>
<td>8</td>
<td>6</td>
<td></td>
</tr>
</tbody>
</table>

1. **Intimal tears:**

As per above table, intimal tears were present in 15(57.69%) subjects of 26 subjects with positive findings and 20(54.05%) arteries of the 37 arteries. Single intimal tears were seen in 13(35.13%) of the 37 vessels and multiple tears in 7(18.92%) of the 37 arteries with positive findings.

2. **Compound Intimo-medial tears:**

Compound intimo-medial tears were found in 15(57.69%) subjects of the 26 subjects and in 20(54.05%) arteries of the 37 arteries with positive findings. Out of which 18(58.06%) were extending from intima to inner third media, 6(19.36%) were extending from intima to middle third media, and 7(22.58%) were extending from intima to outer third media.

3. **Medial tears:**

Medial tears were noted in 12(46.15%) subjects of the 26 subjects with positive findings and 17(45.94%) of the 37 arteries with positive findings. Of these 17 arteries, 11(29.72%) had single tears while 6(16.22%) had multiple tears.
4. Adventitio-medial tears:

Adventitio-medial tears were present in the 2(7.69%) of the 26 subjects with positive findings and in 2(5.40%) of the 37 arteries with the positive findings. The total number of the adventitio-medial tears is 2.

5. Adventitial tears:

Adventitial tears were present in 1(3.84%) of the 26 subjects with positive findings and in 1(2.70%) of the 37 arteries with the positive findings.

6. Complete wall transections:

Total 8 Complete wall transections were present out of which 4(50%) were involving left common carotid artery; 3(37.5%) were involving right common carotid artery and 1(12.5%) were involving left internal carotid artery.

DISCUSSION

Just like this study, Towne J. B. et al (1972)\(^1\) found minimal injury over neck in their study while An T. L. (1989)\(^2\) did not found any surface injury in their subjects with carotid artery injuries. Martin R. F. et al (1999)\(^3\) observed that in more than 50% of the cases with carotid artery injury there was no visible evidence of any cervical trauma.

Head injury was the most common cause of death. This association is also observed by Towne J. B. et al (1972)\(^1\), Solheim K. (1979)\(^4\), Dragon R. et al (1981)\(^5\), Perry M. O. et al (1990)\(^6\), and Larsen D. W. (2002)\(^7\).


The finding that common carotid arteries are mostly involved is consistent with the findings observed in the studies by Mulloy John P. et al (1998)\(^12\) and Moar J.J. (1987)\(^8\). As mentioned by Mulloy John P. et al (1998)\(^12\), common carotid artery is relatively superficially located and is not protected by bone and thus is the most common location of the penetrating and blunt injuries.

If we consider histological extent, the incidence of the intimal tears is less than that seen in the study by Moar J.J. (1987)\(^8\) but it is the most common pathological finding in the both studies and also consistent with the findings mentioned in their study by Towne J.B. et al (1972)\(^1\), Mulloy John P. et al (1998)\(^12\) and Rozycki G.S. et al (2002)\(^14\). The incidence of the intimal tears extending up to internal elastic lamina is consistent with that seen in study by Moar J.J. (1987)\(^8\). In this type of intimal tears, there is extension of the tear to the internal elastic lamina with further longitudinal continuation along lamina without breaching it. Thus as observed by Moar J.J. (1987)\(^8\), the internal elastic lamina appears to have acted in these cases as a barrier to further radial disruption of the arterial wall. Diffuse intimal tears secondary to hyperextension injuries appear more likely to initiate extensive clotting. This finding substantiates that the intimal tear is the basic and most common pathology which leads to the further thrombosis and occlusion as observed by Towne J.B. et al (1972)\(^1\), Moar J.J. (1987)\(^8\), Carr S. et al (1996)\(^10\), Mulloy John P. et al (1998)\(^12\), and Rozycki G.S. et al (2002)\(^14\). But the findings in the present study regarding the high incidence of intimal tears is not consistent with Henderson S.O. et al (2001)\(^15\) who stated that arterial dissections usually are sub-adventitial i.e. between media and adventitia or within the media.

Though the number of compound intimo-medial tears (31) is less as compared to the study conducted by Moar J.J. (1987)\(^8\) in which total 91 compound intimo-medial tears were found, the distribution of the compound intimo-medial tears is relatively consistent.

The incidence of the medial tears and the distribution of the single tears and multiple tears are not consistent with the study conducted by Moar J.J. (1987)\(^8\), in which number of medial tears is higher and number of multiple tears is more than single tears in contrast with the present study. But the status of the medial tears (either isolated or in combination of the intimal tears) as second common injury after intimal tears is consistent with the studies of workers as Towne J.B. et al (1972)\(^1\), Moar J.J. (1987)\(^8\) and Larson P.S. et al (2000)\(^7\).

The number of adventitio-medial tears in the present study is less as compared to the study conducted by Moar J.J. (1987)\(^8\).

This finding in the present study is less in number
as compared to the study conducted by Moar J.J. (1987). Moar J.J. (1987) noted in his study that the complete transection of the carotid arteries in blunt trauma occurs due to the sudden stretching of the vessel.

Acknowledgement: Dr. A.P. Dongre, Former Professor & Head, Department of Forensic Medicine, Indira Gandhi Government College, Nagpur and Guide for this research work.

Conflict of Interest: None

Source of Funding: Self

Ethical Clearance: Yes (as a thesis for M.D., Forensic Medicine course).

REFERENCES


Head Injury Pattern in Fatal Road Traffic Accidents

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ABSTRACT
This study was conducted in mortuary of the Department of Forensic Medicine, Institute of Medical Sciences, Banaras Hindu University, Varanasi where 100 fatal Road Traffic Injury cases over a period of three years from 2012-2015. Pattern of distribution of head injury cases in fatal road traffic accidents were analyzed in detail during post mortem. In skeletal fractures overall fractures of whole calvaria + facial skeleton were the commonest, followed by temporo-parietal fractures. Subdural hemorrhage was the most common affliction of meninges.

Keywords: Road Traffic Accidents, Fatal, Head Injury, Post Mortem, Subdural hemorrhage.

INTRODUCTION
A WHO Advisory Group in 1956 defined accident as an “unpremeditated event resulting in recognizable damage” ¹. An accident has been defined as: “an unexpected, unplanned occurrence which may involve injury” ². Thus, the term “accident”, which is widely used, can give the impression, probably unintended, of inevitability and unpredictability – an event that cannot be managed. Contrary to 1956 definition, World Health Organization report on Road Traffic Injury prevention, 2004 prefers to use the term “crash”. This is to denote something that is an event, or series of events, amenable to rational analysis and remedial action³.

Worldwide, the number of people killed in road traffic crashes each year is estimated at almost 1.2 million, while the number injured could be as high as 50 million – the combined population of five of the world’s large cities. According to 1990 estimates, road traffic injuries (RTI) rank ninth in terms of disability-adjusted life years (DALYs) lost worldwide. They are projected to ascend to the third rank by 2020⁴.

India reports highest number of accident fatalities (1,37,423 in 2013) in the world. More alarming than the sheer number of accidents is their severity (persons killed per 100 accidents). It steadily rose from 21.2 to 28.3 from 2003 to 2013. National figures report 377 deaths per day and 1287 injuries per day due to Road Accidents. 66 Deaths per day are by Truck/Lorry and 94 deaths by Two-wheeler. Uttar Pradesh shared 11.3 % in 2010, 15.1 % in 2011, 11.7 % in 2012 and 11.6 % in 2013 of total national road traffic deaths⁵.

Accidental deaths in Varanasi are 40.3 %, higher than its parent State’s average of 15.8 %. Other cities from Uttar Pradesh in the list above are: Kanpur, Agra, Meerut, Allahabad and Lucknow which have higher accident rate than the State’s average⁵. A plane crash every day would make people sit up and take notice but 380 road deaths daily go ignored! Indian roads continue to kill more people than AIDS!

MATERIAL & METHOD
Present study was done on the cases selected from the dead bodies brought into the mortuary of the Department of Forensic Medicine, Institute of Medical Sciences, Banaras Hindu University, Varanasi, for medico-legal postmortem examination from the various police stations of Varanasi region. The data of the materials were sourced from 100 fatal Road Traffic Injury cases over a period of three years from 2012-2015. Condition of the scalp, cranial bones, meninges, intra-cranial hemorrhages’ and brain parenchymal involvement were noted at the time of autopsy.
**OBSERVATION**

Table 1: Age and Type of vehicle used by victim.

<table>
<thead>
<tr>
<th>AGE (Years)</th>
<th>TWO WHEELER</th>
<th>CYCLIST</th>
<th>TRUCK DRIVER</th>
<th>IN 3 WHEELER PASSENGER</th>
<th>IN 4 WHEELER PASSENGER</th>
<th>PEDESTRIAN</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-14</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>15-29</td>
<td>18</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>4</td>
<td>30</td>
</tr>
<tr>
<td>30-44</td>
<td>11</td>
<td>5</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>14</td>
<td>33</td>
</tr>
<tr>
<td>45-59</td>
<td>7</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>9</td>
<td>19</td>
</tr>
<tr>
<td>60-75</td>
<td>1</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td>1</td>
<td>7</td>
<td>14</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>37</strong></td>
<td><strong>15</strong></td>
<td><strong>2</strong></td>
<td><strong>5</strong></td>
<td><strong>4</strong></td>
<td><strong>37</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Table 1 shows that maximum number of fatalities associated with two wheelers was 18 (48.65%, n=37) in the age group 15-29 followed by 11 (29.73%, n=37) in 30-44 age group. Those in 45-59 were 7 and 1 in 60-75 age bracket. Similarly, cyclists numbered 6 (40%, n=15) and 5 (33.34%, n=15) in 15-29 and 30-44 age groups respectively out of total 15 cases studied.

Maximum number of pedestrian fatalities was 14 (37.84%, n=37) in 30-44 years old followed by 9 (24.3%, n=37) and 7 (18.92%, n=37) in 45-59 and 60-75 age groups respectively (out of 37 pedestrian fatalities). Thus, it stems out that pedestrian fatalities were more in above 30 years population, where as two wheeler fatalities were more in below 30 years aged population. In study of Kumar et al., 7 commonest age group affected was between 21-40 years involving 1341 (54.24%) cases.

Table 2: Fracture of bones of Skull and Face in traffic accident victims.

<table>
<thead>
<tr>
<th>Fracture of skull and facial bones</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calvaria (Whole skull)</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Calvaria + Maxilla + Mandible</td>
<td>13</td>
<td>13</td>
</tr>
<tr>
<td>Frontal</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Frontal + Parietal</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Frontal + Temporal</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Frontal + Temporal + Parietal</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Occipital</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Occipital + Parietal</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Occipital + Temporal + Parietal</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Parietal</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Parietal + Occipital</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Parietal + Temporal + Maxilla + Mandible</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Temporal</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Temporal + Occipital</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Temporal + Parietal</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>NORMAL</td>
<td>44</td>
<td>44</td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td><strong>100</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>
Whole skull (calvaria) excluding facial skeleton was involved in typical crush injuries in 3 (3%) cases, calvaria + facial bones (maxilla + mandible) was crushed in 13 (13%). Fractures of frontal bone alone were seen in 8 % cases, frontal + parietal in 3 %. Frontal + Temporal fractures were seen in 2 %, Frontal + Temporal + Parietal fracture in 3 %.

Occipital injuries resulting in its fracture were seen in 5 %. Temporal + parietal fractures were seen in 9 % cases. Parietal alone and parietal + occipital fractures were 2% each. Occipital + Parietal, Occipital + Temporal + Parietal, Temporal + Occipital were 1 % each. No injury was seen in 44 % cases.

Thus, overall fracture of whole calvaria + facial skeleton were the commonest, followed by temporo-parietal fractures, frontal and occipital bones were the next most common individual bones in single to sustain fractures.

Temporo-parietal fractures can be attributed mainly due to side impact on the skull on pitched roads due to high speed falls from vehicle after crash impacts. Types of fractures noted had various combinations such as comminuted, hair line, depressed, fractures involving both inner and outer table of skull etc.

<table>
<thead>
<tr>
<th>Brain/meninges</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Congestion</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>Extra Dural Hemorrhage + subdural Hemorrhage</td>
<td>11</td>
<td>11</td>
</tr>
<tr>
<td>Subdural Hemorrhage</td>
<td>26</td>
<td>26</td>
</tr>
<tr>
<td>Subdural Hemorrhage + Contre Coup</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Subarachnoid Hemorrhage</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Loss of Brain Substance</td>
<td>13</td>
<td>13</td>
</tr>
<tr>
<td>Pale</td>
<td>29</td>
<td>29</td>
</tr>
<tr>
<td>Normal</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Total:</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 3 is summary of brain/meningeal involvement in traffic accident victims. Congestion was seen in 12 (12%, n=100) cases. Subdural hemorrhage alone was in 26 (26%) victims, Subdural + Extradural hemorrhage was seen in 11 (11%) cases.

Subdural hemorrhage + contre coup injuries were noted in 3 (3%) cases. 1 (1%) case had sub-arachnoid hemorrhage. 13 (13 %, n=100) cases were severe crush injuries of calvaria resulting in loss of brain substance. 29 % cases had pale brain substance primarily due to hemorrhagic shock. Brain substance was normal in rest 5% cases.

DISCUSSION

In present study 43 cases out of 100 died on the spot. Out of these 42, 18 (42.9%) died instantaneously due to extensive crush injury. Next instantaneous death sufferers were those who died due to coma and hemorrhagic shock, 10 each in numbers (23.8%), coma + hemorrhagic shock were 3 (7.1%), syncope due to myocardial infarct case was 1 (2.4%).

![Figure 1: Cause of Death In On Spot Death cases in Traffic Accidents.](image)

Thus, instantaneous death due to extensive crush injury remained the leading on the spot killer followed by coma alone or in association with hemorrhagic shock as the next leading cause. The mean duration of survival following road traffic accident was 6-7 days which are similar with the findings of studies of Toro K and Kumar A et al. In general, traffic accidents with fatal outcome lead to miscellaneous injury panorama in different groups of road users.
In present study 56 % cases had skull fractures. Toro K et al., found skull fracture in 61 % pedestrians and cyclists and in 46 % cases of motor vehicle occupants. Temporo-parietal fractures were attributed mainly to side impact on the skull on pitched roads due to high speed falls from vehicle after crash impacts. Skull and whole of facial skeleton were involved in extensive crush injuries leading to instantaneous deaths.

Types of fractures noted had various combinations such as comminuted, hair line, depressed, fractures involving both inner and outer table of skull etc. Kumar A et al found Skull fractures in 1183 (69.63%) cases of head injury; most common bone fractured was temporal bone (n=559, 47.25%).

Menon A et al., reported skull fractures in 88.88 % cases. Kanchan T et al., in their study found head injuries in 75 % cases followed by 6.7 % abdominal injuries as cause of death. Ravikumar R mentioned linear fracture (55.43%) as the commonest pattern of fracture in road traffic accidents.

In this study Subdural hemorrhage (26 %, n=100) was the most common affliction of meninges; apart from paleness of meninges seen in 29 %. Menon A et al., in their study too reported 52.63 % and 89.11 % subdural haemorrhage respectively. Second most common involvement was Subdural + Extradural hemorrhage seen in 11% cases. SDH is seen in relatively severe trauma and is associated with 50 % mortality (Williams N.S, et al., eds.). This indicates the severity of impact and fatal consequences associated with it, which the predominance of Subdural hemorrhages in our study suggests.

In contrast to this, EDH can occur in the context of apparently minor trauma. It shows lentiform lesion on CT. In present study, EDH was seen in combination with SDH hemorrhage & no case was recorded with isolated EDH injury. Even Cervical spine injury is common in patients with head injuries. Carotid dissection may be a delayed complication of skull base fracture. Rowbotham states that injuries of the brain may be caused (1) by distortions of the skull, or (2) by movements of the brain in relation to the skull.

29 % cases had pale brain substance primarily due to hemorrhagic shock. 13 (13 %, n=100) cases were severe crush injuries of calvaria resulting in loss of brain substance. Thus, out of 18 instantaneous deaths due to extensive crush injury (chart 16 above), 13 had severe crush injuries of calvaria resulting in loss of brain substance. This highlights the severity of high speed impacts that accident victims have to suffer.

In study of Kyada H.C. et al., maximum 99(33.22%) cases were observed in the age group 21-30 years and Fatal RTAs were common in males 272(91.27%) as compared to females 26(8.73%) with male to female ratio of 10.5:1. Injuries to brain were observed in 81(80.20%) cases of pedestrians, 14(100%) cases of bicyclist, 61(92.42%) cases of motorcyclist, 27(55.1%) and 49(72.1%) cases in driver and occupant of three and four wheeler respectively. Head injury was observed as a single and most prominent cause of death in 161(54.03%) cases followed by death due to shock and hemorrhage on account of poly trauma in 51(17.11%) cases. This study too finds 56 % affliction by head injuries.

Kanchan T, et al., in their study of fatal road traffic accidents in a coastal township of South India found that out of 879 autopsies conducted from January 2005 to December 2009, 39% were due to RTAs. Among the victims, 89.8% were males and 10.2% were females. The mean age of victims was 38.7 years, which was slightly higher in females compared to males. Most of the male victims belonged to the age group 20-29 years. The head injuries were responsible for nearly 3/4th of deaths followed by abdominal injuries (6.7%).
Edirisinghe Dr. P et al., in their study on Injuries in the Vulnerable Road User (VRU’s) Fatalities found that: Out of the 328 cases 48% (n=157) were pedestrians while 45% (n=147) were riders/pillion riders of two wheeled vehicles and 5% (n=16) were drivers/occupants of three-wheelers. The majority (87%) of them was males and 43% of pedestrians were elderly. 59% had 10-25 injuries and 87% had external injuries in the head, face and neck. The majority of skeletal injuries were in the skull followed by ribs.

Analysis of different variables of pedestrians to other types of VRUs showed that the variables of, elderly male, road crosser, skull injuries, brain injuries, cause of death being head injuries and multiple injuries were significantly greater among pedestrian group (p:<0.001).

Ravikumar R studied patterns of skull fractures in Road Traffic Accidents involving Two Wheelers. Out of 245 cases riders constituted (76.33%) and pillion riders (23.67%). Most victims were male (87.75%), skull fractures (67.75%) were observed in the two wheeler accidental death. Sub-dural haemorrhage was the commonest intracranial haemorrhage associated with head injuries.

Thus, this study too is consistent with findings of other studies with skull fractures especially temporo-parietal and subdural hemorrhage as the most common head injuries observed in Fatal Road Traffic Accidents.

CONCLUSION

In present study 56% cases had skull fractures. Fracture of whole calvaria + facial skeleton was the commonest, followed by temporo-parietal fractures. Subdural hemorrhage was the most common affliction of meninges followed by Subdural + Extradural hemorrhage combination. Coma and hemorrhagic shock dominated almost equally resulting in Fatal Road Traffic Accidents.

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REFERENCES

Overview of Legal Importances of Medical Recording

D Rama Manohara Reddy¹, Kiran G T²
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ABSTRACT

Medical recording is assuming more and more importance in the recent days due to increasing mistrust between the doctor and the patient. The Courts and the Medical Council of India are relying mainly on the medical records in deciding the fate of the doctor and his team in alleged negligence cases. However in practical reality, the medical recording is not given due attention, especially the new doctors, though many are performing their duties with diligence, medical recording is not done with the same care and attention. Here the authors have made an effort to compile all the laws and legislations where medical recording is the basis of execution. It is a bird’s eye view of many related laws which are intended to awaken the doctor and supporting staff towards diligent medical recording.

Keywords: Medical recording, related laws, medical negligence, overview.

INTRODUCTION

It is very important for a doctor to document the management of a patient. They are the documentary evidences to prove or disprove the question of negligence. Medical recording needs the concerted effort of a number of people involved in patient care where doctor is the prime person.

POOR RECORD means POOR DEFENCE. NO RECORDS means NO DEFENCE

It is important for the doctors and institutes to properly maintain the records of patients for two reasons

1. Help in scientific evaluation of the patient’s profile, help in analysing the treatment results and to plan treatment protocols
2. Helps in planning government strategies for future medical care¹

WHAT ARE MEDICAL RECORDS?
The medical record is the why, where and when and what of patient care in a hospital

HOW DO THEY HELP MEDICO LEGALLY?

TO THE PATIENT: It is a documentary evidence for them in case they suffer negligence.

TO THE DOCTOR: It is again a documentary evidence for them in case they are wrongly accused of negligence.

TO THE THIRD PARTY: It is a source of information for purposes like insurance.¹

USES OF MEDICAL RECORDS

- To provide a means of communication among physicians, nurses and other allied healthcare professionals.
- To serve as an easy reference for providing continuity in patient care
- It provides documentary evidence of care provided in the healthcare facility
- To serve as an informational document to assist in the quality review
- WORKMEN’S COMPENSATION ACT– to assess the disability
- PERSONAL INJURIES – related to COPRA
- MALPRACTICE – Documentary evidence for negligence
- WILL CASES – ascertain the mental health of the person
• INSURANCE ACT – to assess the compensation\textsuperscript{2,3}

WHAT IS NEGLIGENCE

• It is the lack of reasonable care and skill or wilful negligence on the part of the medical practitioner in course of professional attendance on his patient leading to bodily injury, sufferance or even loss of life.

Legal standard of negligence:

Negligence connotes
• either omission to do something
• which a reasonable man
• guided by his ordinary sense of human conduct will do
• Or by doing something (commission) which a reasonable man will not do

If the work is not documented, the court considers it is not done!!

INGREDIENTS OF NEGLIGENCE

1. Duty: There should be duty owed to the doctor towards the patient. Doctor is not liable if no duty is owed to him.

2. Dereliction of the duty: There should be dereliction of the duty owed to the doctor.

3. Direct causation: The dereliction of duty of doctor should be the direct causation of the damage caused to the patient.

4. Damage: There should be damage caused to the patient as a result of dereliction of duty on the part of the doctor.

5. Damages: The compensation the doctor owes to the patient in case of proved negligence.\textsuperscript{4,5}

CONSENT

• General consent: It is applicable for routine medical examination, investigations & treatment.

• Special consent: Special consent has to be taken in surgical procedures, amputation, discharge against medical advice, organ donation.

• Emergency operation – In cases where consent was not possible to be taken from the patient due to unconsciousness or disorientedness or lack of availability of relatives to give consent; Two doctors including surgeon have to sign along with hospital administrator for performing an emergency operation on the patient.\textsuperscript{2}

Without consent, any procedure amounts to battery/assault of the patient and attracts punishment under Sec 351 IPC!!

• Informed refusal: After understanding all the consequences of not undergoing a particular treatment or surgery, the patient refuses to undergo the treatment or surgery.

• Advanced directives: The patient issues in writing preventing the medical staff from resuscitating him in the event of stoppage of his vital functions.

Informed refusal and Advance directives are currently not practicing in India.

Discharge against medical advice

The signature of the patient and signature of nearest relative should be obtained in a prescribed after informing of the consequences or risks involved and the hospital is not responsible for any adverse effects.

In the event or relative refuses to sign, the record should contain a statement signed by the physician and duly witnessed setting forth the circumstances, reasons and warnings against such premature departure.

Absconding patients

• The staff nurse has to inform the attending physician.

• The attending physician has to note the same with time and date.

• In case the absconded patient returns back, time of absence has to be noted if it is within few hours

• If absconded for few days, patient has to be readmitted.

• In Medicolegal cases, absconding patient should be informed to the police.
PROOF OF NEGLIGENCE

- DOCTRINE OF COMMON KNOWLEDGE:
  Issue may not be a medical/technical matter. Like in gastroenteritis, it is common sense that fluids have to be given.

- RES IPSA LOQUITUR:
  In the absence of negligence the injury would not have happened. The thing that caused the injury is under the exclusive control of the doctor. There is should be no contributory negligence.⁵,⁶,⁷

COURTS OF LAW

- CONSUMER COURT: For the damages in a civil case, patient may approach.

- CRIMINAL: Liability for Medical Negligence—Death due to medical negligence
  When there is a gross and grave negligence present on the part of the treating doctor
  Sec 304 A, Sec 337 & 338 IPC

(1) CIVIL SUIT CONSUMER COURT

Civil Remedy where the relief is sought in compensation under the Consumer Protection Act 1985.

- Cases deal in medical negligence and medical practice

(2) CASE IN MEDICAL COUNCIL

A case against a doctor can be filed in Medical Council of the concerned system of medicine.

- Medical Councils do not have powers to award compensation or to imprison

- It can only warn the doctor, suspend or revoke the license.

(3) CASE OF CRIMINAL NEGLIGENCE

- The main section under which a criminal case is filed against doctors is Section 304A of the Indian Penal Code which deals with causing death due to rash and negligent act. The punishment is two years imprisonment or fine or both.

- Sec 175 CrPC – A police officer proceeding under Sec 174 may by order in writing summons two or more persons for the purpose of the said investigation. The persons who have summoned shall be bound to attend and answer truly all questions

RELATED LAWS

- Sec 39 CrPC – duty to inform the police by a citizen; for doctors in S 302, 303 and 304 IPC (Offences affecting life of a person)

- Sec 175 IPC – Omission to produce (document or electronic record) to public servant by person legally bound to produce it.

- Sec 176 IPC – Omission to give notice or information to public servant by person legally bound to give it (as per 39 CrPC)

- Sec 177 IPC – Furnishing false information which he knows or has reason to believe to be false.

- Sec 179 IPC – Refusing to answer public servant authorized to question.

- Sec 187 IPC – Omission to assist public servant when bound by law to give assistance

- Sec 192 IPC – fabricating false evidence; whoever cause any circumstance to exist or one makes any false entry in any book or record

- Example: A makes a false entry in his office book for purpose of using it as a corroborative evidence in the court of justice. A has fabricated false evidence

- Sec 197 IPC – Issuing or signing false certificate; whoever issues or signs any false certificate to the court as an evidence, knowing or believing that it is false, is punishable.

- Sec 201 IPC – Causing disappearance of evidence of offence or giving false information to screen offender

- Sec 202 IPC – Intentional omission to give information of offence by a person bound to inform

Sec 218 IPC – public servant framing incorrect record or writing with intent to save a person from punishment or property from forfeiture.⁵,⁶,⁷

CONSENT RELATED LAWS

- Sec 87 IPC – a person above 18 years of age
can give valid consent to suffer any harm which may result from an act not intended or not known to cause death or grievous hurt.

- **Sec 88 IPC** – a person can give consent to suffer any harm done in good and for his benefit
- **Sec 89 IPC** – child below 12 years and an insane person cannot give valid consent
- **Sec 90 IPC** – consent given by an insane or an intoxicated person is invalid
- **Sec 92 IPC** – any harm caused to a person in good faith even without the person’s consent is not an offence (unconscious person with no relatives)
- **Sec 52 IPC** – Nothing is said to be done or believed in good faith which is done or believed without due care and attention.

**Confidentiality of the medical records**

Confidentiality is an important component of the rights of the patient. The hospital is legally bound to maintain the confidentiality. The patient can claim negligence against the hospital or doctor for a breach of confidentiality. Types of records may be:

**Personal document**

- Information is confidential
- Should not be released without consent of the patient except in specific situations

**Impersonal document**

- Patient permission is not required
- Could be used for research purposes

Information in the medical records can be revealed in the following cases:

1. **During referral**
2. **When demanded by the court or by police on a written requisition**
3. **When demanded by insurance companies**

as provided by the insurance act when patient has relinquished his rights on taking the insurance

4. **When required for specific provisions of workman’s compensation cases, COPRA**

How long should medical records be preserved?

It is advised to maintain RECORDS

- 3 years for inpatient and surgical cases
- 2 years for outpatient cases

(Under the provisions of the Limitation Act 1963 and Sec.24A of COPRA, 1986)

- The MCI guidelines insist the preservation of record in a standard proforma for 3 years from the commencement of treatment (Sec. 1.3.1 and appendix 3)
- Documents should be issued within 72 hours on the request of patient/authorised attendant (Sec. 1.3.2)
- Maintain a register of certificates with full details of the certificates issued with one identification mark (Sec. 1.3.3)
- Efforts should be made to computerize the medical records for quick retrieval (Sec. 1.3.4)
- In medico legal case they should be maintained until final disposal in the courts of law
- According to PNDT, environmental Act records should be maintained for a period of 2 years or until the disposal of the proceedings
- When the records are maintained on a computer, a PRINTED COPY should be preserved after the signing of the responsible person for such record (PNDT 1996)

**OWNERSHIP OF MEDICAL RECORDS**

- **THE MEDICAL RECORDS ARE THE PROPERTY OF THE HOSPITAL**
- **THE DATA IN THEM IS THE PROPERTY OF THE PATIENT**

**CONCLUSION**

Consistent, up to date and complete documentation in the medical record is an essential part of quality medical care. Patient identity details
should be in every page. All entries in the medical record should have the doctor’s identification and date. The handwriting should be legible. All relevant history, physical examination findings, diagnosis, laboratory findings should be clearly and unambiguously recorded. Consent related issues should be addressed. Patient should not be placed at inappropriate risk at any part of medical care.

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Histopathology Findings of Asphyxia in Lungs of Hanging and Drowning Deaths

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ABSTRACT

Sometimes mysterious circumstances accompanied by inadequate external and internal findings related to ligature mark in hanging deaths as well as scarcity of classical lung features in drowning deaths makes it difficult to conclude or rule out cause of death as asphyxia. To form opinion regarding cause of death as hanging and drowning in such cases, documenting histopathology findings of lungs as supplementary autopsy evidence based on the theory that asphyxia comprises different kinds of lesions that can produce varied histopathology findings is really a meaningful exercise. Hanging and drowning being the most common prevalent asphyxia types in India, 47 hanging and 28 drowning deaths were studied to find more common histopathology findings for each group of asphyxia. Cause of deaths of the cases confirmed after meticulous post mortem examinations and police investigations. Histopathology section from lungs of every case was prepared and stained with Haematoxylin-Eosin. As compared to drowning, the histopathology findings of alveolar tissue collapse, alveolar overinsufflation, bronchiolar constriction and bronchiolar dilatations, congestion, interstitial edema and alveolar hemorrhage were more commonly observed in lungs of hanging. The only histopathology finding that was more commonly noticed in lungs of drowning was intra-alveolar edema.

Keywords: - Asphyxia, Hanging, Drowning, Histopathology, Lungs.

INTRODUCTION

Most of the times external and internal findings related to ligature mark and asphyxia related autopsy findings, accompanied by known circumstantial crime details in hanging deaths are sufficient enough to form opinion as to the cause of death as hanging. Similarly presence of the gross lung features and respiratory tract findings, with external autopsy features in drowning deaths are enough to conclude cause of death as drowning in known death scene conditions. But in certain uncommon circumstances like when the ligature material is very soft and broad, or the body is immediately removed by the relatives of the deceased after hanging; the classical external and internal autopsy findings may not be observed in the hanging cases. Similarly it’s not uncommon to have certain drowning deaths where classical lung features and other autopsy features of drowning are missing. In such cases, the microscopic lung findings in these asphyxia deaths may be an added supplementary evidence to form opinion regarding particular type of asphyxia as hanging or drowning.

In medico legal cases, the cause of death determined as asphyxia after post mortem examination has always been a deciding factor in conviction or acquittal of accused. Gordon I. (1944) states that “The records of certain criminal trials in South Africa have shown that penalties, including a death sentence, have been inflicted where medical testimony, based upon the view that asphyxia is a pathological entity, has been a major factor in securing the convictions”. But there is lack of sufficient number of studies based on the histopathology changes observed in the lungs of various types of asphyxia deaths and
their subsequent statistical evaluation to attribute the significant changes to a particular group of asphyxia. Present study attempts to identify the qualitative histopathology findings observed in the lungs of hanging and drowning deaths with their quantitative incidence in the studied cases.

MATERIAL & METHOD

The present study was carried out in the Department of Forensic Medicine and Toxicology, Indira Gandhi Govt. Medical College, Nagpur, India over a period of two years. After meticulous postmortem examination (Virchow’s method of autopsy) and study of all circumstantial evidences as revealed from the police investigations, the cases having cause of death confirmed as asphyxia due to hanging and drowning were included in this study. The cases with other injuries or pathological conditions, besides asphyxia, contributing to the patho-physiological process of death were excluded from the study. The cases showing decomposition signs were not included in the study as all the internal organs including the lungs have distorted parenchyma due to the autolysis. Those cases having known history of or showing pulmonary pathology as asthma, chronic pulmonary obstructive disease (COPD) or bronchitis, etc in the histopathology sections were excluded from the study to avoid misinterpretation of the pathological findings. The deceased with more than 54 years of age were not included in the study as they are likely to show senile emphysematous changes leading to misinterpretation of the histopathology changes under the study. After excluding many such cases with these exclusion criteria, 75 cases of asphyxia comprising 47 cases of hanging and 28 cases of drowning were included in the present study.

Each lung is cut into one to two cm thick horizontal slices. This is done on the dissecting board by laying the lung flat with the medial side of the lung facing down towards the board. Lung parenchymas showing any mass lesions or any other microscopic pathological abnormalities were excluded from the study. A histopathology section from every case was preserved for the conventional histopathology tissue processing to make the histology slides. Their subsequent histopathology examination done by an unbiased pathologist who was unaware of type of asphyxia lung histology sections he is observing.

OBSERVATIONS

Out of the 75 studied cases of asphyxia, 47 (62.66%) cases were of hanging and remaining 28 cases (37.34%) belonged to drowning deaths. Among all the 75 studied asphyxia cases, males comprised maximum number with 55 cases (73.33%) and females contributed 20 cases (26.67%).

Age and Sex

Among the 47 cases of hanging, males have more number of cases i.e. 35 cases (74.46%) and remaining 12 cases (25.54%) comprised females. In the hanging deaths, maximum number of cases observed in the age group of 21-30 years was 16 and minimum number of 4 cases was found in 41-50 years age group. Hanging was not observed in the age group of 0-10 years.

Out of the 28 cases of drowning, 20 cases (71.42%) were males and 8 (28.58%) were females. Among the drowning group of asphyxia deaths, maximum number of drowning cases was seen in the age group of 11-20 years comprising 11 cases. There was a single male case of 5 years old seen in the age group of 0-10 years, who accidentally fell in a well while picking fruits from a tree.

Circumstances of death

The most common circumstances of deaths observed were suicidal in nature comprising 53 (70.66%) cases out of the 75 asphyxia deaths of hanging and drowning. Accidental deaths included 18 cases (24.00%). Despite having exact cause of death as drowning, in 4 cases (5.33%) manner of death could not be decided by the investigating agencies.

In the 47 cases of hanging, almost all cases i.e. 46 were found in suicidal circumstances of deaths. In the single accidental hanging case, Dupatta (a piece of cloth wearied around chest and shoulders of Indian females) of a 17 years old deceased female was entangled around her neck while working on a machine. Among the 28 drowning deaths, 17 cases were found in accidental circumstances. Suicidal death circumstances contributed in 7 drowning cases. Four drowning cases remained uncertain regarding their exact manner of death.
Histopathology Picture

Eight histopathology changes are identified at low magnification view in the microscopic histopathology sections of lungs of all the studied cases of hanging and drowning (Fig 1 - 4). Histology picture of these changes is described below.

1) Alveolar tissue collapse - observed as collapse of the alveolar framework, involving alveolar sacs and ducts leading to overlap of the alveolar septa and reduction of the space for gas exchange.

2) Alveolar overinsufflation - revealed by heterogeneous enlargement of the ducts, sacs, and alveoli, contrasting with the adjacent collapsed areas.

3) Bronchiolar constriction - characterized by luminal reduction of the membranous and respiratory bronchioles, enhanced by virtual increase in the thickness of muscle layer and epithelium corrugation.

4) Bronchiolar dilatation - shown by increase of internal diameter of the membranous and respiratory bronchioles and consequent thinning wall.

5) Interstitial edema - proteic, amorphous, eosinophilic material is present inside the alveolar septa.

6) Intra-alveolar edema - amorphous material filling the alveolar spaces in a uniform and homogenous pattern.

7) Congestion - capillary distention, in which dilatation and sinuosity of the capillaries also observed.

8) Interstitial hemorrhage - presence of blood inside the alveolar spaces or along the alveolar septa.

The occurrence of the histopathology changes identified in the tissue sections of lungs of 47 hanging and 28 drowning cases is shown in table 1.
### Table: 1

<table>
<thead>
<tr>
<th>Histopathology change</th>
<th>Hanging (47 cases)</th>
<th>Drowning (28 cases)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alveolar Tissue Collapse</td>
<td>47 (100%)</td>
<td>02 (07.14%)</td>
</tr>
<tr>
<td>Alveolar Overinsufflation</td>
<td>45 (95.74%)</td>
<td>20 (71.42%)</td>
</tr>
<tr>
<td>Bronchial Constriction</td>
<td>47(100%)</td>
<td>02 (07.14%)</td>
</tr>
<tr>
<td>Bronchial Dilation</td>
<td>47(100%)</td>
<td>04 (14.28%)</td>
</tr>
<tr>
<td>Interstitial Edema</td>
<td>44 (93.61%)</td>
<td>26 (92.85%)</td>
</tr>
<tr>
<td>Intra-alveolar edema</td>
<td>12 (25.53%)</td>
<td>28 (100%)</td>
</tr>
<tr>
<td>Congestion</td>
<td>45 (95.74%)</td>
<td>27 (96.48%)</td>
</tr>
<tr>
<td>Hemorrhage</td>
<td>47(100%)</td>
<td>06 (21.42%)</td>
</tr>
</tbody>
</table>

Histopathology changes of alveolar tissue collapse, bronchial constriction, bronchial dilation and hemorrhage are seen all 47 cases of hanging; while the same changes are observed in 02, 02, 04 and 06 respectively out of 28 cases of drowning. Alveolar overinsufflation, interstitial edema and congestion are seen in 45, 44, 45 cases of hanging and in 20, 26, 27 cases of drowning respectively. Only histopathology finding of intra-alveolar edema which is more widespread in drowning cases and is shown by all 28 cases of drowning while only 12 cases out of the 47 hanging cases shown the histopathology picture.

### DISCUSSION

Asphyxia is lack of oxygen in blood and tissues due to impaired or absence of exchange of oxygen and carbon dioxide on a ventilatory basis. It is also understood as a ‘state of low oxygen’ which is often termed with terminologies like anoxia, anoxemia, suboxia, hypoxia, etc. Some authors believe that ‘Asphyxia’ is a name given to different kinds of lesions that can produce similar histopathology findings.

In certain uncommon circumstances, the external features of hanging may not be clearly evident on the dead body when the body is removed very quickly after commencement of hanging or if a soft and wide ligature material is used or where in few instances typical autopsy findings in hanging deaths are very difficult to ascertain. Similarly, it is not uncommon to have certain drowning death cases showing scarcity of the classical gross lung features as well as other drowning autopsy features. In these kinds of unusual asphyxia deaths, the histopathology changes observed in the lungs may be additional supplementary evidence along with the circumstantial evidences to conclusively form the opinion regarding the particular type of asphyxia as the cause of death.

In the present study, we observed eight qualitative histopathology findings in the histology sections of the lungs from the 47 hanging and 28 drowning deaths. The histopathology findings seen included alveolar tissue collapse, alveolar overinsufflation, bronchial constriction and dilatation, interstitial and intra alveolar edema, congestion and hemorrhage.

Grellner W et al studied pulmonary histopathology in a group of 106 deaths due to compressions around neck including 55 hanging cases. They found intra-alveolar edema of different degree. Strong hyperemia or congestion was also regularly observed in nearly all cases, especially in fatal hanging deaths. Besides they also observed perivascular and intra-alveolar hemorrhages, local dystelectasis (incomplete expansion of air spaces without deformation of shape) and focal emphysema. Present study found similar microscopic findings, with the histopathology finding of congestion seen in 45 out of 47 hanging cases. Similarly, intra-alveolar edema is observed in 12 hanging cases. Alveolar tissue collapse observed in all 47 hanging cases while alveolar tissue overinsufflation observed in 45 hanging cases.

Delmonte C et al analyzed histological data for 167 autopsy cases of various asphyxia groups comprising 35 cases of aspiration, 88 cases of suffocation, 27 cases of drowning and 17 cases of death due to compression around neck. Among the 17 cases of death due to compression around neck, 14 were suicidal hanging deaths. In lungs associated with death due to compression around neck, the histological changes such as alveolar hemorrhage, congestion, alveolar collapse, alveolar...
overinsufflation, bronchiolar constriction and bronchiolar dilatation were found significantly higher as compared to the drowning group in particular. By discriminant analysis, they also found that the only semi quantitative histopathology parameter of intra-alveolar edema was statistically more significant in the drowning deaths when compared with the deaths due to compression around neck; though the statistically significant parameters mentioned for hanging were also observed in lungs of the drowning cases. In the present study all qualitative histopathology findings mentioned by Delmonte C et al study are observed in hanging and drowning death lungs to various extents.

Puschel K et al 5 in their review article found references of microscopic findings of lungs in asphyxia related deaths such as emphysema, hemorrhagic edema and micro hemorrhages. Similarly, in present study microscopy observations of alveolar overinsufflation, interstitial and intra-alveolar edema, and interstitial as well as intra-alveolar hemorrhages were observed among the hanging and drowning death cases.

Piette MHA et al 6 had discussed reviews of reported diagnostic methods of drowning regarding microscopic autopsy findings in lungs of death due to drowning. He reported findings of intra-alveolar edema and dilatation of alveolar spaces with secondary compression of the septal capillaries. In the present study, the microscopy finding of ‘intra-alveolar edema’ was observed in all the 28 drowning cases. Alveolar tissue collapse was seen in only two cases out of the 28 drowning cases in the present study while the histopathology change of ‘alveolar overinsufflation’ is seen in 20 drowning cases.

**CONCLUSIONS**

Although the qualitative histopathology changes identified in hanging and drowning cases were similar, with exception of ‘intra alveolar edema’ which is observed in every case of drowning, all other histopathology findings of alveolar tissue collapse, alveolar overinsufflation, bronchial constriction and dilation, interstitial edema and hemorrhage are more commonly noted in the lungs of hanging cases when compared to the drowning cases. Also the histopathology changes of alveolar tissue collapse, bronchial constriction, bronchial dilation and hemorrhage are very less frequently observed in the drowning cases.

With the low cost method of histology processing which is ‘within reach of available resources’ at most places, these histopathology findings in lungs of hanging and drowning may help to form exact opinion as to the cause of death amid insufficient typical autopsy findings accompanied with dubious crime scene details.

**Declaration** - We hereby declare that this original article is not under consideration, accepted or already published elsewhere.

**Conflict of Interest** - None.

**Source of Funding** - This research has not received any specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

**Ethical clearance** - The research is approved by the ‘Institutional Ethics Committee’ of Indira Gandhi Govt. Medical College, Nagpur, Maharashtra, India.

**Acknowledgement** – I am very thankful to Dr Vijay T Jadhao, Assistant Professor, B J Medical College, Pune and Dr Pankaj Ghormade, Assistant Professor, Indira Gandhi Government Medical College, Nagpur for their persistent motivation as well as great help in completing this research work.

**REFERENCES**

Study of Attitude and Knowledge of Medical Students of 2nd Year on Forensic Autopsy in Bengaluru City

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ABSTRACT

Most of the undergraduates in medical schools are unaware of the importance of medico legal autopsy. Once the student are admitted to second year the student, many a times are in a dilemma why autopsies are to be witnessed by them at that point of time and are ignorant of the legal procedure which imbibes the medical professional to conduct autopsy in many cases of un-natural deaths where the cause of death is not known. Once the medical undergraduate gets the awareness regarding the Medico legal autopsy or forensic autopsy he has a different approach towards it. One such study was conducted at Bengaluru involving 200 students of 5th term on voluntary basis, who had ample knowledge regarding medico legal autopsy. A set of questionnaires were given to them and results tabulated and was concluded. This study shows the emotional reaction of the students and it indicates that the necropsy is of value in medical education.

Keywords: Medico legal autopsy, forensic autopsy, Medical education, Forensic Medicine.

INTRODUCTION

At the beginning of the 19th century, Xavier Bichat, a brilliant young rising star of the Paris school, declared, “You may takes notes for twenty years, from morning to night at the bedside of the sick, upon the diseases of the viscera, and all will be to you only a confusion of symptoms - a train of incoherent phenomena. Open a few bodies and this obscurity will disappear”¹. Autopsy is a research tool which has been used for centuries. The word autopsy is derived from the Greek word autopsia- “to see with one’s own eyes”. Autopsy can be divided into medico legal and clinical or academic autopsies. A clinical autopsy is the final step in the identification of a person’s illness or cause of death. The medico-legal autopsy plays an important role in the administration of justice². The adult clinical necropsy has been declining for many years and is nearing extinction in many hospitals³. The autopsy can make an important contribution to medical education. The decline in the hospital autopsy rate threatens this role. This article examines the educational opportunities that the post-mortem still provides⁴.

Over the years especially during the latter part of the 20th century, a decline in the rate of autopsies performed occurred world-wide. The demise of the educational role of medical autopsy has followed its decline in hospital practice. Decline in the autopsy rates has occurred world-wide over the past 40 years especially in New Zealand, the United Kingdom and the United States⁵.

In India, factors responsible for decline are complex and include financial constraints, unfavorable attitude of healthcare professionals towards autopsies, clinicians not asking for permission to have the autopsy performed on their patients. Forensic or medico-legal autopsy is a special type of autopsy performed as a part of inquest (legal investigation into cause of death) and carried out in unnatural deaths or deaths occurring in mysterious or suspicious circumstances.

The overall scenario of medico-legal work is substandard in India. In hospitals, except those attached to medical colleges, most of the Forensic autopsies are being conducted by medical practitioners
who are not specialists in Forensic Medicine, resulting in unsatisfactory quality autopsy reports. Medico-legal knowledge is imparted to the undergraduate medical students during 2nd year under the subject of Forensic Medicine and Toxicology.

The undergraduate students are supposed to witness medico-legal autopsies so as to be capable of interpreting medico-legal autopsy findings. The knowledge and attitude of medical students and interns towards Forensic autopsy is a significant factor that influences the quality of autopsy reports.6

**MATERIALS & METHOD**

Students of 2nd MBBS, 5th semester at Bangalore Medical College & Research Institute, Bengaluru, Karnataka, were asked to fill a self administered, predesigned, multiple choice questionnaire during the year 2014. Participation in the study was voluntary. A total of 200 students were provided with the Performa of questionnaire. The survey consisted in several questions relating to the autopsy practice, the knowledge of the procedure and attitude and perception towards postmortem examination.

**OBSERVATION AND RESULT**

The results are tabulated in the Table No.1

When asked whether Medico-legal postmortem examination is mandatory in all unnatural and sudden unexpected and suspicious death cases, the answer was yes by 95% and no by 5%. Was taking out of viscera for Histopathological examination and toxicological analysis for medico legal autopsy required was answered by 97.5% as yes and 2.5% as no. When asked regarding why Post mortem examination is done with 4 answers 99% said to it’s done to know the cause of death, 95% said it’s done to help out to reach out of crime, 10% said it is a legal formality and 5% said it’s a harassment to the relatives concurrently. The reaction of the students on the first exposure to postmortem examination said that 40% were comfortable, 60% were slightly comfortable, 60% moderately comfortable and 40% very uncomfortable. Should students watch more postmortem examination? Was asked to which 90% said yes and 5% said no. Question regarding that student wished to have postmortem examination on self/relative when required was answered as yes by 80% and no by 20%. Given a chance would you choose not to watch P.M examination at all? 20% students said yes, 80% said no. Regarding the utility of P.M examination in medical education 95% said it’s useful, 5% said it’s not useful and should be scrapped from medical curriculum. When asked whether there is Disfigurement by postmortem examination 80% said no and 20% said yes. Is Postmortem examination is disrespect to human body was asked and 97.5% said no and 2.5% said yes. When asked what was the source of information and knowledge about Postmortem examination 90% said medical curriculum, 10% as Magazine and newspaper, 20% as T.V, 20% as Internet, 5% as friend and relative.

**DISCUSSION**

The autopsy is instrumental in accurately establishing the cause and manner of death in both clinical and forensic cases. Autopsies also allow confirmation, clarification, and correction of ante mortem diagnosis, as well as the identification of new and re emerging diseases, and thus they are important in both protecting the public health and improving the accuracy of vital statistics. The hospital autopsy continues to decline; despite good evidence of its clinical value and relevance (the medico-legal rate remains relatively constant).7

**CONCLUSION**

The medico legal autopsy has lost its charm in the minds of medical graduates not only in India but everywhere. The use of internet, 3D imaging techniques and other sophisticated techniques are a setback to the routine autopsy. The environment and the hygienic conditions of most of the autopsy rooms are not up to the mark and this is one of the drawbacks added to it. Though some medical colleges in India have autopsy rooms, they are not maintained in a proper manner. The emotional feelings of the medical graduate during dissection of dead bodies are to be considered. A study of this type would help the medical fraternity to develop a better curriculum which provides a greater understanding of Medico legal autopsies and related things.
## Table 1. Observation and Result

<table>
<thead>
<tr>
<th>Questions</th>
<th>Reply (200 students)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>1. Medico-legal postmortem examination is mandatory in all unnatural and sudden unexpected and suspicious death cases</td>
<td>190 (95%)</td>
</tr>
<tr>
<td>2. Taking out of viscera for histopathological examination and toxicological analysis for medico legal autopsy</td>
<td>195(97.5%)</td>
</tr>
<tr>
<td>3. Students should watch as much as possible postmortem examination:</td>
<td>190 (95%)</td>
</tr>
<tr>
<td>4. Wished to have postmortem examination on self/relative when required</td>
<td>160(80%)</td>
</tr>
<tr>
<td>5. Given a chance would you choose not to watch P.M examination at all?</td>
<td>40(20%)</td>
</tr>
<tr>
<td>6. The utility of P.M examination in medical education: should be scrapped from medical education.</td>
<td>10(5%)</td>
</tr>
<tr>
<td>7. Does would body be disfigured by postmortem examination</td>
<td>40(20%)</td>
</tr>
<tr>
<td>8. Postmortem examination means disrespect to human body</td>
<td>5(2.5%)</td>
</tr>
<tr>
<td>9. Postmortem examination is done (Multiple choice)</td>
<td>a. To know the cause of death- 99%</td>
</tr>
<tr>
<td></td>
<td>b. Mere legal formality - 10%</td>
</tr>
<tr>
<td></td>
<td>c. Harassment to the relatives of the deceased – 5%</td>
</tr>
<tr>
<td></td>
<td>d. Helpful in reaching the culprit of crime – 95%</td>
</tr>
<tr>
<td>10. The reaction of the students on the first exposure to postmortem examination (Multiple choice)</td>
<td>a. Comfortable - 40(20%)</td>
</tr>
<tr>
<td></td>
<td>b. Slightly uncomfortable - 60 (30%)</td>
</tr>
<tr>
<td></td>
<td>c. Moderately uncomfortable - 60(30%)</td>
</tr>
<tr>
<td></td>
<td>d. Very uncomfortable - 40(20%)</td>
</tr>
<tr>
<td>11. Source of information and knowledge about Postmortem examination</td>
<td>a. Medical curriculum – 180(90%)</td>
</tr>
<tr>
<td>(Multiple choice)</td>
<td>b. Magazine and newspaper – 20(10%)</td>
</tr>
<tr>
<td></td>
<td>c. T.V – 40(20%)</td>
</tr>
<tr>
<td></td>
<td>d. Internet – 40(20%)</td>
</tr>
<tr>
<td></td>
<td>e. Friend and relative - 10(5%)</td>
</tr>
</tbody>
</table>

**Acknowledgement:** We acknowledge cooperation of Faculties of the Department of Forensic Medicine & Toxicology, Bangalore medical college & research institute, Bengaluru. And Dean cum Director Dr. Devadass PK, Bangalore medical college & research institute, Bengaluru for his support.

**Source of Support:** Nil

**Conflict of Interest:** None Declared

**Ethical Clearance:** The Ethical clearance was taken prior to the study from the institution’s ethical committee (Bangalore medical college & research institute Ethical committee).
REFERENCES


Child Rape and Mob Justice

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ABSTRACT

Children are easy victims of sexual crime as they are ignorant, defenceless and helpless. Such cases are not immediately reported as they are unaware of what is actually happening to them or are threatened by the assailant not to reveal. This makes the picture all the sadder as due to their weaker physique, death is an imminent threat. In the present case, an 8 year old girl was sexually assaulted by her neighbour and then killed after the act to conceal the crime. The facts that perpetrators are usually people in the vicinity of the victim, killing as a means of concealing the crime and lynching of the perpetrator by mob are highlighted in this case.

Keywords: Child rape, murder, assailant, mob justice, lynching.

INTRODUCTION

Rape is one of the most under reported crimes and 63% of sexual assaults are not reported to police¹. Children are easy victims of sexual crimes as they are ignorant, defenceless and helpless. According to the National Crime Records Bureau (NCRB) of India, in the year 2013, 13.1% (4,427 out of 33,764) of the total victims of rape were girls under 14 years of age. In the United States, only 11.9% of child sexual abuse is reported to the authorities² as children are unaware of what is actually happening to them or they are threatened by the assailant not to reveal. Moreover, due to their weaker physique, death is an imminent threat.

In India, one of the biggest obstacles to winning justice for rape victims is the length of the trials as these trials may last many years. Following the 2012 Dehi gang rape case, the Indian government has implemented a fast-track court system to rapidly prosecute rape cases even though fairness of such courts is questioned by legal experts and scholars³. On the other hand, mob justice is practiced in many societies across the world; the mob serves as prosecutor, judge, jury and executioner⁴. It is a known fact that people resort to mob justice when they lose faith in the justice system.

CASE REPORT

On 5-11-2014 at around 3.30 pm, an 8 year old girl was passing through a paddy field on some errand when her neighbour, a 24 year old man, waylaid her and sexually assaulted her and then smashed her head with a heavy stone. On autopsy of the girl the next day, the lower clothes were missing and the T-shirt she wore was blood and mud stained. There were dry mud and blood stains with straw particles on various parts of the body. Multiple abraded contusions were present all over the body indicating struggle (Fig 1). There were multiple lacerations on the scalp with the frontal and both parietal bones fractured and laceration of the brain (Fig 2-4). The hymen was found torn at 6 o’clock position including the vaginal wall (2cmX1cmX0.5cm) and fourchette (1cmX0.5cmX0.3cm) as shown in Fig 5. The child died of head injury due to homicidal blunt force after being sexually assaulted. The accused was caught by the local people the next day and hospitalised after being thrashed and lynched by an irate mob (Fig 6).

DISCUSSION

According to Rape, Abuse and Incest National Network of America⁵, child sexual abuse includes sexual activity with a minor in the form of: (i) Obscene
phone calls, text messages, or digital interaction (ii) Fondling (iii) Exhibitionism, or exposing oneself to a minor (iv) Masturbation in the presence of a minor or forcing the minor to masturbate (v) Intercourse (vi) Sex of any kind with a minor, including oral, anal or vaginal (like the present case) (vii) Producing, owning, or sharing pornographic images or movies of children (viii) Sex trafficking (ix) Any other sexual conduct that is harmful to a child’s mental, emotional, or physical welfare.

Certain aspects of the present case bear some established facts like 1 in 4 girls and 1 in 6 boys will be sexually abused before they turn 18 years old; 34% of people who sexually abuse a child are known persons; 12.3% of women were aged 10 or younger at the time of their first rape/victimization. Abusers can manipulate victims to stay quiet. Sadly, silence was bought at the cost of death and this case has been presented considering the gruesome nature of the sexual crime on a girl child by a person who was known to her.

On the other hand, mob justice is the practice whereby a mob, usually several dozens or several hundred persons take the law into their hands in order to injure and kill a person accused of wrongdoing. Sadly, mob justice is frequently seen in this part of the country. Weak public administrative systems propel people to take the laws into their own hands to engage in mob action or instant justice. Moreover, loss of faith in the justice system is a contributing factor for such public uproar. In the present case, the assailant was thrashed almost to death by an irate mob.

FIGURES

Child rape and mob justice

Fig 1: Showing the victim girl with multiple abraded contusions

Fig 2: Showing laceration of the scalp

Fig 3: Showing fracture of the skull

Fig 4: Showing intracranial haemorrhage and brain injury

Fig 5: Showing torn hymen and fourchette
Fig 6. Showing assailant after being beaten by the mob

CONCLUSION

Child sexual abuse can occur anywhere viz. home, school, or work. Warning signs like difficulty in walking or sitting; bloody, torn, or stained underclothes; bleeding, bruises, or swelling in genital area; trouble in school and regressive behaviours, etc. should be noted. This is when one should talk to the child and create a dialogue so that the child will confide.

Furthermore, prompt police action and expedited trials are required in such sensitive cases so as to avert unwanted mob justice.

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Nuclear Organizer Region in Establishing Postmortem Interval

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ABSTRACT

A recurring problem in forensic medicine is the need to fix the time of death within the limits of probability. It is known fact that the longer the interval of time between death and the examination of the body wider will be the limits of probability. Establishing the time of death or postmortem interval (PMI) of a deceased individual is one of the extensively investigated problems in the field of forensics. AgNOR-(Argyrophilic Nucleolar Organizing Region) Nucleolar Organizer Regions are focal aggregates of intranuclear non-histone proteins that are associated with potential sites of ribosomal DNA transcription. There is a close relationship between NORs and cellular activity, NOR size and number can reflect or predict cell proliferation & transformation.

Aims and Objective: Postmortem changes of nuclear organizer region will be qualitatively analysed in the oral mucosa to see for the relationship between postmortem interval and agnors.

Variation of shape and color of agnors at different time interval will be examined.

Materials and Method: Twenty tissue samples were obtained from oral mucosa ( Labial Mucosa) of dead persons during autopsy procedure performed at Dept of Forensic Medicine, District Hospital, Tumkur District, Karnataka.

Tissue was processed and stained with AgNOR stain. The stained sections were observed microscopically and examined for Nuleolar Organiser Region changes in the oral mucosal tissue at Dental Care and Research Center, Bengaluru.

Results: there was a clear variation of morphology within the AgNOR Region.

Conclusion: Approximate postmortem interval can be established using AgNOR method. Study on large scale is necessary to reinforce our findings.

Keywords: Postmortem Interval, Nuclear Organizer region, Chromosome, Argyrophilia.

INTRODUCTION

Postmortem interval (PMI) is the time elapsed from death until discovery and medical examination of the body. A recurring problem in forensic medicine is the need to fix the time of death within the limits of probability. Establishing time of death is necessary for administrative purposes, legally and also in some civil cases. PMI is one of the extensively investigated problems in the field of forensics.1 In past few years many scientists and researchers have used various methods and tried to develop a method establish the definitive time of death and none of them found to be successful for establishing exact time of death.2,3,4 Especially in homicide cases establishing PMI is
very important because helps the legal authorities to condemn a convict or eliminate a suspect.\textsuperscript{3}

Nucleolar organiser regions (NORs) are defined as nucleolar components containing a set of argyrophilic proteins, which are selectively stained by silver methods. After silver-staining, the NORs can be easily identified as black dots exclusively localised throughout the nucleolar area, and are called Argyrophilic Nucleolar Organizing Region (AgNORs). The NORs' argyrophilia is due to a group of nucleolar proteins, which have a high affinity for silver (AgNOR proteins).\textsuperscript{6}

Nucleolar organiser regions (NORS) are chromosomal segments, which contain ribosomal genes. NORs also contain a set of acidic, non-histone proteins that bind silver ions and are selectively visualised by silver methods in routinely processed cyto-histological samples. They are encoded for ribosomal RNA, and are present on specific loop of DNA which projects into nucleoli where they can be seen by electron microscopy as ill-defined pale staining region within the more electron dense areas.\textsuperscript{7}

Some of the NORs can be identified in the histological section by using silver nitrate method which demonstrates an acidic protein with which some of the site is associated. Recent studies show that the number and/or the size of the AgNOR dots in a nucleus are correlated positively with the ribosomal gene activity and therefore with cellular proliferation. It was noted in literature that there is a close relationship between NORs and cellular activity, NOR size and number can reflect or predict cell proliferation & transformation.\textsuperscript{7,8}

**Aims and Objective:**

- Postmortem changes of nuclear organizer region will be qualitatively analysed in the oral mucosa to see for the relationship between postmortem interval and agnors.
- Variation of shape and color of agnors at different time interval will be examined.

**Materials and Method:**

Twenty tissue samples were obtained from oral mucosa (Labial Mucosa) of dead persons during autopsy procedure performed at Dept of Forensic Medicine, District Hospital, Tumkur District, Karnataka. Death was due to non-poison reasons like Road traffic accident, hemorrhage, shock, hanging etc. Informed consent was obtained from the legal representative of the dead person. Data regarding the persons age, gender, estimated time of death, was recorded in the Proforma.

Oral mucosal tissue samples of approximate size of 2cm x 1cm x 5mm tissue were obtained from labial mucosa. Tissue was cut into four pieces of sizes 1cm x 1cm x5mm. Each tissue sample was fixed with 10%formalin at around 12hrs, 24hrs, 36hrs and 48hrs. Tissue was processed and stained with AgNOR stain.\textsuperscript{6} The stained sections were observed microscopically and examined for Nucleolar Organiser Region changes in the oral mucosal tissue at Dental Care and Research Center, Bengaluru.

**RESULTS**

The morphological assessment of AgNORs based on their size, shape and the pattern of distribution revealed certain differences among the cells at different time interval.

Observation were as follows,

At 12th hour: AgNOR stained sections at low power and oil immersion (100x) showed

![Fig I (40x) AgNOR noted predominately. Inner (100x) AgNOR was uniformly round to Oval in shape.](image-url)
At 24\textsuperscript{th} Hour: AgNOR stained sections at 40x and oil immersion (100x) showed

![Fig II](image1.png)

Fig II (40x) AgNOR reduced in number. Inner (100x) AgNOR morphology of round to ovalness was lost.

At 36\textsuperscript{th} Hour: AgNOR stained sections 40x and oil immersion (100x) showed

![Fig III](image2.png)

Fig III (40x) AgNOR dots which were dramatically reduced in number with Inner (100x) showing varied morphology.

At 48\textsuperscript{th} Hour: AgNOR stained sections at 40x and oil immersion (100x) showed

![Fig IV](image3.png)

Fig IV (40x) AgNOR was not noted. Inner 100x

DISCUSSION

Nucleolar organiser regions (NORS) are chromosomal segments, which contain ribosomal genes. NORS also contain a set of acidic, non-histone proteins that bind silver ions and are visualized in routine histopathological labs. Under compound microscope NORS stained by silver and the argyrophilic NOR-associated proteins appear as well-defined black dots, which in interphase cells are exclusively located within nucleoli.\textsuperscript{6} Linder L E\textsuperscript{10} (1993) mentions that the nucleolar organizer regions (NORS) found on human chromosomes 13,14,15,21, and 22 (5,9,20) are the sites of the transcription of ribosomal RNA. Warnakulasuriya et al. (1993), identified three types of AgNOR patterns in histological sections and explained as follows,\textsuperscript{9}

Type 1: Single or few large dots within the nucleolus.

Type 2: Discrete small dots within the nucleolus.

Type 3: Numerous small dots dispersed throughout the nucleolus.

Various studies\textsuperscript{6,8,9,11,12} show that the number and/or the size of the AgNOR dots in a nucleus are correlated positively with the ribosomal gene activity and therefore with cellular proliferation. It was noted in literature that there is a close relationship between NORS and cellular activity, NOR size and number can reflect or predict cell proliferation & transformation. The number of AgNORs in the cell is believed to reflect nucleolar activity and to be related to cellular proliferative activity.

Electronic search of the literature didn’t reveal any study regarding AgNOR in necrosed cell. Within our study we attempted to to observe AgNOR in necrosed cell. The morphological assessment of AgNORs based on their size, shape and the pattern of distribution revealed certain differences among the cells at different time interval. During postmortem autolysis, cellular organelles and nuclear DNA break down into their constituent parts. Since similar research work in literature was not found, we were unable to correlate the findings. In this study we have attempted to draw certain criteria to establish postmortem interval with AgNOR changes. Which includes,
AgNOR Finding

At 12<sup>th</sup> hour
AgNOR dots were medium sized, uniformly round or oval and was noted predominantly. (Fig Ia, Ib, Ic,Id,le)

At 24<sup>th</sup> hour
AgNOR were not so uniformly round or oval and were reduced in number. (Fig IIa, IIb, IIc,IIId,IIHe)

At 36<sup>th</sup> hour
AgNOR dots were varied in size, irregular in shape and was dramatically reduced. (Fig IIa, IIIb, IIIc,IIIId,IIIHe)

At 48<sup>th</sup> hour
AgNOR dots were negligible in number/absent. (Fig IVa, IVb, IVc,IVd,IVe)

CONCLUSION

Our study showed that AgNORs based on their size, shape varies at different time interval. It is noted from our study that postmortem interval can be established with the help of changes in the morphology of Nuclear Organiser Region using AgNOR Method.

Approximate postmortem interval can be established using AgNOR as an adjunct method. Study on large scale is necessary to reinforce our findings.

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Conflict of Interest  – NIL

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Study on Documentation of Medical Records

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ABSTRACT

Documentation is the most essential part in Medical practice, it should be timely, accurate and complete. Whenever a case of medical negligence filed against a hospital, the only defence is medical record. Good records always provide a good defence. A cross sectional study was done on Medical record documentation at a rural medical college hospital, with an objective to appraise the importance of Medical record documentation with regard to various medico legal aspects. 100 case sheets were collected from the medical record department of the hospital and information from the case sheet was collected in to a data sheet and analysed for errors. None of the case sheet was free from documentation errors. We observed too many lacunae in the case sheets and explained how it leads to medico legal issues.

Keywords: Hospital case sheet, documentation, medico legal aspects.

INTRODUCTION

Documentation is any written or electronically generated information about the care and services provided to the patients. Hospital case sheet is an important medico legal record.

Medical record documentation is required to record relevant facts, findings, and observations about a patient’s health history, including past and present illness, examination findings, investigation reports, treatment and outcome. Writing something that is not given to the patient is fraud, unprofessional and unethical.

Many malpractice claims result in a victory for the plaintiff because of the poor quality of medical records, even in cases where appropriate medical care was provided. An appropriately documented medical record can reduce many of the hassles associated with legal issues. Good records always provide good defence; poor records mean poor defence and no record mean no defence.

Medical record can be used as the basis for the quality of patient care; this will be the only way for the doctor to prove that the treatment was carried out properly. The insurance companies also require proper record keeping for claiming the medical expenses. It is legally more acceptable as documentary evidence, as it is difficult to tamper with the records without detection.

THE MEDICAL RECORDS FACILITATE

1. To promote good health care. Medical records act as a communication between a patient and the doctor.

2. Communication and continuity of care among physicians and other healthcare professionals involved in the patient care.

3. Collection of data that may be useful for research and education.

4. To meet legal issues in case medical negligence is filed against the doctor.

HISTORY OF MEDICAL RECORDS

The history of medical records runs parallel with the history of medicine. About 2500 BC in Spain ancient people recorded surgical notes on amputation of fingers that was explained on the walls of the caves. In the caves of Ajanta, Ellora and Buddhist stupas of Amravati and Nagarjunakonda ample evidence
of medical records have been reported. The first Indian textbook Atreyasamhita also mentioned about medical documentation, including Athervaveda.

AIM AND OBJECTIVE

The main aim of this study is to create awareness in medical community about the importance of documentation of medical records. This study highlights the mistakes that are commonly committed in the hospital case sheets and explains how it leads to various medico legal issues.

MATERIAL & METHOD

A retrospective, cross sectional study was conducted at a tertiary care hospital. 100 case sheets were collected randomly from 1st January 2013 to 31st December 2013 from the Medical record department of the hospital. Case sheets from major departments of the hospital General Medicine, Surgery and Obstetrics and Gynecology departments were collected.

The following data collected from the case sheets was taken into a data sheet for systematic evaluation.

1. Patient Identification details.
2. Case history and examination findings.
3. Provisional and Final diagnosis.
4. Investigation record.
5. Daily progress.
6. Treatments advised and follow up.
7. Specific procedure / operative notes.
8. Adverse effects of drugs.
9. Instructions to the patient.
10. Dietary chart and advice.
11. Name and signature of the doctor who attended the patient.
12. Legibility of the record and abbreviations in the record.
13. Referred to any specialist.
15. Nursing details like Vitals, Treatment chart, any other nursing aid.
17. Difference in provisional and final diagnosis.
18. Any irrelevant investigations are advised.

REVIEW OF LITERATURE

The SOAP note is a method of documentation employed by health care providers. The four components of a SOAP note are **Subjective, Objective, Assessment, and Plan.**

**Subjective component:** It includes History of Present and past Illness, family history, and social history, along with current medications, smoking status, drug / alcohol /caffeine use, level of physical activity and allergies.

**Objective component:** This includes clinical examination findings, results of laboratory and other diagnostic tests.

**Assessment:** Includes differential diagnosis and a list of other possible diagnoses usually in an order of most likely to least likely.

**Plan:** The plan is what the health care provider will do to treat the patient’s concerns - such as ordering further lab investigations, radiological work up, referrals required and medications to be given.

The Golden rule in documentation is if it is not written down, you did not do it.¹

Five important factors that improve the quality of documentation are.

1. **Accuracy:** Inaccuracies may lead to improper medical advice being given which may result in adverse healthcare and legal outcomes.
2. **Relevance:** only relevant information about patient health condition.
3. **Completeness:** medical records must be complete. The service that is not recorded in the case sheet is considered as no service given to the patient.
4. **Timeliness:** Timely charting will resolve unnecessary hassles. When a medical negligence case is filed against the hospital, the law enforcing authority will cease the medical records, and the same will be forward to the honorable court as evidence.
5. **Confidentiality:** Absolute confidentiality must be maintained in medical records. Indian
Medical Council (Professional conduct, Etiquette and Ethics) Regulations, 2002, states that violation of professional secrecy comes under infamous conduct.

The following information is must in medical record:

**Personal Identification details:**

Medical records must begin with Personal biographical data including the Name, detailed address, telephone number, and marital status. Each page in the record should contain the patient’s name, age, sex, and IP number. Medical record should be preferably in a booklet form, loose papers should not be used.1,6,8,9

**Case details:**

Doctor should record the complete health history that includes history of present illness, past history, personal history and family history. Clinical examination findings must be recorded. Doctor should record the provisional or final diagnosis based on clinical findings. Vital data must be recorded every time the patient is examined.6,7

Doctor must write daily follow up record, which includes examination findings, any specific advises and treatment. Doctor must write his name and sign on the bottom of the record.

**Investigation chart:**

Doctor must advise appropriate investigations. Unnecessary investigations should be avoided, it is cost bearing and not useful for patient well being. All the investigations results must be recorded in the case sheet. All the entries must be dated, and doctor name and signature is necessary for each entry.

**Treatment and follow up:**

Doctor must write the treatment chart in capital letters should not use abbreviations and should not write brand names.4 All the drugs must be written in generic formula.4 Doctor should write dose, number of times to be taken, and route of administration. Not writing the drug name in capital letters comes under infamous conduct as per the latest guidelines issued by Medical council of India.1,3 Doctor should record drug allergies if any. Do not write in cursive handwriting or in private formulae, it is dangerous and misleads the pharmacist. Drug chart must be written carefully every time and if any changes like addition or deletion of the drugs should be informed to the nurse. Doctor must record any specific procedures or operative notes immediately without any delay.

**Informed consent:**

Consent must be taken before performing any procedure on the patient; care should be taken while recording the consent. Rules of the consent are to be followed, and any deviation may lead to a medico legal problem. Use simple language while recording; do not use too many medical terminologies. Write legible, clear, and short sentences. Consent must always be recorded before a witness, and it is preferable to write in the language known to the patient. Doctor should also explain about the right to refuse the procedure at any time before the commencement.8,9,4

Section 2(1) of the Consumer protection Act: Any services provided to the patient without consent is considered as deficiency of service and treated as a case of medical negligence.

**Referral service:**

It is wise to take help from a specialist whenever the patient develops some complications other than the treating doctor’s specialty. The information and advice of referral doctor should be recorded in the case sheet.

**Medico legal cases:**

All Medico legal cases must be informed to the police. Doctor must maintain Medico legal case register and accident register in the hospital, all the information must be recorded in the register. Non-compliance is punishable according to sec IPC 202.8,9 Medical records are acceptable in a court of law as evidence as per Section 3 of the Indian Evidence Act 1872 (amended in 1961). Medical records are the property of the hospital and it is the responsibility of the hospital to maintain it properly.

**Discharge summary:**

Doctor must write the discharge summary, the discharge summary should be a mirror of the case notes. The date of admission and discharge, brief of case history, relevant investigations, and the operative
procedures must be recorded. It is also important to include instructions to be followed by the patient after discharge including medication, dietary advice, and date of next follow-up. The doctor will be held negligent if proper instructions are not given to the patient. Doctor should explain physical care that is required, and the need for urgent reporting if any untoward complication arises before the advised time of review.

Legibility:

Illegible handwriting is the handwriting that cannot be read and understood by others. This includes sloppy writing, misspelled words and poor grammar. Illegible or poorly written documentation gives an impression of carelessness. Everyone who writes in the medical record must ensure that the entries are legible.

Confidentiality of Medical records:

Confidentiality is an important component of the rights of the patient. The hospital is legally bound to maintain the confidentiality of medical records. The patient can claim negligence against the hospital or the doctor for a breach of confidentiality. Patient can also file a case of defamation.

Avoid criticism of other professionals in chart notes:

Physicians should not use the patient medical record to criticize nurses or to comment on the quality of services provided by others.

Abbreviations:

Doctor should not use abbreviations in medical record. Abbreviations have multiple meanings and confuse the other health care providers and sometimes it is dangerous to the patient.

Special Notes:

Doctor must record the notes in intensive care units and other emergencies. Care must be taken while recording this information. Sometimes doctors are supposed to record minute-to-minute events.

Medical council of India guidelines on medical records:

According to Medical Council of India code of ethics, Regulations 2002 (Section 1.3) issued guidelines on medical records.

- Medical records must be issued to the patient within 72 hours of his request.
- Maintain a register of Medical certificates. One identification mark of the patient and his signature is must on medical certificates.
- Efforts to be made to computerize the medical records for quick retrieval.
- It is advisable to maintain records for 2 years for outpatient records and 3 years for inpatient records and there is no time limit for medico legal cases.

OBSERVATION AND DISCUSSION

Study on medical documentation was conducted in a hospital with intent to scrutinize and minimize the following observations are made.

1. Patient Identification details like Name, age, sex was mentioned correctly in all the case sheets. Patient detailed address was absent in 6 case sheets, detailed address is important for every patient to contact their family members during emergency. Case details General history was incomplete in 28 case sheets and examination findings were incomplete in 57 case sheets. Case history and examination findings are very essential in clinical practice, in majority of the cases provisional diagnosis to be made based on the case history and clinical examination findings.

2. Provisional diagnosis was not recorded in 19 cases and final diagnosis was not mentioned in 2 cases. Diagnosis details are very important in medical records, treatment and follow up based on the clinical diagnosis, if a patient develops complications due to wrong treatment the doctor will be held negligent.

3. Investigations record must be documented in the case sheet. In my study in 98 case sheets the lab investigations results were not recorded. Loose lab reports present along with the case sheet are difficult to segregate and may be lost in handling.

4. Daily progress information must be documented in the case sheet, it is essential to know the patient condition and to assess response to treatment. In 90 percent of case sheets it was
incomplete.

5. Treatment is an essential part in the case sheet. It should be recorded in capital letters and written in generic formulae, abbreviations should not be used. In the present study in 11 cases the treatment part was incomplete.

6. Specific procedures or operative notes if at all carried out must be recorded in the case sheet. In 9 cases this information was in complete.

7. None of the case sheet contained drug allergy notes, adverse effects of the drugs were not mentioned in any case sheet.

8. Doctor should give specific instructions to the patient and it is one of the fundamental duties of the doctor, none of the case sheet contained these details. If the doctor fails to give instructions to the patient and due to which the patient develops any damage, the doctor will be held negligent.

9. Diet chart is important to every patient; doctor must specify the diet to his patients, especially a diabetic, and hypertensive patients. Only 3 case sheets contained diet chart. In 97 case sheets, it was not recorded.

10. Name and signature of the doctor is necessary in a case sheet, doctor is supposed to write his name and sign after recording the data. Date and time also must be recorded for every entry. In 69 percent of case sheets this information was not recorded.

11. Legibility of the record, doctor should write the records legibly. Treatment chart should be written in capital letters. 90 percent of the case sheets were illegible.

12. Informed consent is necessary in medical practice. In 92 case sheets it was incomplete.

13. The treating doctor must write discharge summary at the time of discharge, in 57 case records it was in complete.

14. Nursing record is equally important like a doctor’s record. In 50 percent of records, the nursing data was incomplete.

15. In five case records, the diagnosis was not matching with the clinical examination findings, in three case sheets the investigation chart was irrelevant to the diagnosis and in eight case records the treatment chart was not matching with the diagnosis.

16. There should not be any corrections in medical records, whenever a wrong entry is made in the record that should be struck off by a horizontal line and the doctor should sign over the struck off portion. Too many corrections will be discredited in the court of law as it amounts to be tampering of the record. In four case sheets we found corrections without any signature.

CONCLUSION

Documentation is the fundamental duty of every doctor. Inspite of providing excellent services to the patient but not recording in the case sheet will be treated as no service given to the patient. Every hospital must have the standard operative guidelines including guideline of medical record documentation.

Documentation is an art, it can be learned by means of practice only, and every doctor must cultivate the habit of neat and accurate documentation. Doctor must supervise the documentation of nursing and other paramedical staff of the hospital. Regular workshops on documentation should be conducted in every hospital and awareness on medico legal issues should reach to every hospital employee.

Acknowledgement: We thank our Principal and Medical superintendent of the Hospital who constantly supported and encouraged us to conduct this study.

Conflict of Interest: Nil.

Source of Funding: Self.

Ethical Clearance: No ethical issues in this study. We obtained permission before commencement of the study.

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Drug Induced Rash – Spurious Contusions

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ABSTRACT

Drug induced rash is one of the most commonest type of adverse reaction to a drug therapy. There are different presentation types of drug-induced eruptions. The severe forms are easy to diagnose. But milder is a little difficult both clinically as well as at autopsy. Bleomycin-induced rash poses difficulties during gross examination, which can be interpreted as contusions. We highlight the importance of history of the case and suspicion of spurious contusions in the form of drug-induced eruptions.

Keywords: Drug induced rash, bleomycin, spurious contusions.

INTRODUCTION

Drug induced rash is one of the most commonest type of adverse reaction to a drug therapy. The pathogenesis of drug-induced rash may be either immunological or non-immunological. Immunological is the commonest and results from hypersensitivity reaction with an underlying immune mechanism. Non-immunological causes include cumulative toxicity, photosensitivity, overdose, etc. There are different presentation types of drug-induced eruptions. The severe forms are easy to diagnose. But the diagnosis of milder and more importantly the non-immunological is a little difficult both clinically as well as at autopsy.¹ Bleomycin-induced rash, which is completely different from that of a most common drug induced rash (immunological basis) on gross appearance, can create a dilemma in diagnosis, sometimes which can be interpreted as contusions with confidence.

CASE DETAILS

A 45-year-old male presented with rash on the back of chest and abdomen and on shoulders with scattered areas of hyper pigmentation. The rash was red in colour with raised margins. Histopathology of the lesions showed superficial perivascular dermatitis with eosinophils, features suggesting a drug-induced adverse reaction.

DISCUSSION

The bleomycins, are a unique group of DNA-cleaving antibiotics, have significant antitumor activity against both Hodgkin’s lymphoma and testicular tumors. They are minimally myelo and immunosuppressive but are known to cause unusual cutaneous side effects and pulmonary fibrosis. Bleomycin is degraded by a specific hydrolase found in various normal tissues, including liver. Hydrolase activity is low in skin and lung, perhaps contributing to the serious toxicity at those sites. Cutaneous side effects include increased pigmentation, hyperkeratosis, erythema, and even ulceration. Healing of these lesions often leaves a residual hyper pigmentation, and lesions may recur when patients are treated with other antineoplastic drugs. Rarely, bleomycin causes a flagellate dermatitis consisting of bands of pruritic erythema on the arms, back, scalp, and hands.²

Minor trauma to the skin, such as pressure over bony prominences and scratching increases blood flow and cause local accumulation of bleomycin. Dermatitis and subsequent hyper pigmentation in
the skin is fairly common among patients receiving bleomycin, with reported incidence between 8% and 22%. Dermatitis was typical type of dermatographic urticaria (also known as dermographism, dermatographism or “skin writing”) is a skin disorder seen in 4–5% of the world’s population and is one of the most common types of urticaria where the skin becomes raised and inflamed when gentle stroke, scratching, rubbing, and slapping. Treatment mostly involves management of symptoms to limit trauma to the skin. The lesions usually resolve in six months after the withdrawal of drug and respond well to corticosteroids.

MEDICO-LEGAL SIGNIFICANCE

1. It can be presented as a fabricated injury

2. It can be interpreted as a contusion, when presented as a fabricated injury by an inexperienced doctor who is working in the causality.

3. When proper history of drug intake is not present, especially in cases of unknown bodies, there is a scope for interpreting the drug induced rash as injuries, as they are little difficult to diagnose.

4. The rash is produced by minimal force like mild pressure, so when that force is in the form of assault, there may be misinterpretation of the force used for assault.

5. Some times it may be difficult even to differentiate them from true contusions by incision at the suspected area, as there can be presence of blood in the subcutaneous spaces in areas of rash

CONCLUSION

Drug induced rash should be considered when there are diffuse lesions on the body with areas of hyper pigmentation and scarring. Difficulty or misinterpretation occurs most of the times when there is no proper history. Established history and attentive examination of the alleged lesions in living subjects and dead bodies can exclude the confusion for diagnosing the contusions. In case of dead bodies, confirmation is by giving an incision at the site of alleged lesion and observing the subcutaneous spaces.

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Postmortem Study of Hyoid Bone Fracture in Cases of Antemortem Hanging

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ABSTRACT

Hanging is a common method of suicide in India. During autopsy of hanging cases, hyoid becomes one of the integral parts of examination. Many previous research studies in the forensic literature have reported considerable difference in frequency of hyoid fracture in hanging cases. Beside this, there is also lack of unanimity of opinion regarding the relation of different variables of hanging with the hyoid fracture except age of the deceased.

The present study is a retrospective analysis of all cases of death due to hanging brought to the department of Forensic Medicine, Assam Medical College & Hospital for medicolegal autopsy from 1st June, 2012 to 31st May, 2013. The purpose of the study is to evaluate the incidence and pattern of hyoid fracture in the study group and relation of 6 different variables of hanging with the hyoid fracture viz. age, sex, nature of ligature material, level of ligature mark, position of knot and manner of suspension of body.

Keywords- Hanging, hyoid, fracture, medicolegal autopsy.

INTRODUCTION

The term “Hyoid” comes from the Greek word “hyoeides”, which means “upsilon-shaped.” The Greek letter upsilon is shaped much like the Roman letter U. The hyoid bone, which is also known as lingual bone, is situated in the anterior midline of the neck between the chin and the thyroid cartilage. At rest, it lies at the level of the base of mandible in the front and the third cervical vertebra behind. It is a very special bone in human body which is unique in that it is not attached to any other skeletal elements in the head and neck. In addition to being of interest to living humans, the hyoid is also sometimes important in forensic analysis. When the hyoid bone is broken, it is a strong indicator that someone was strangled, as the bone is otherwise extremely difficult to break. So when any case of hanging, strangulation or throttling comes to the Department of Forensic medicine for postmortem examination, the hyoid becomes the most integral part of internal examination at the autopsy table. However, there is lack of unanimity of opinion concerning the frequency with which fracture of the hyoid bone occurs in hanging. Several previous studies have showed that hyoid bone fracture is rare in hanging in age group below 40 years. Observing the importance given to hyoid bone fracture in hanging, ligature strangulation and throttling cases by many authors in the past and present days, the present study has been undertaken to evaluate percentage of hyoid bone fracture in antemortem hanging cases brought to the mortuary of the Assam Medical College, Dibrugarh for postmortem examination and their relationship with age, sex, nature of ligature, level of compression, manner of suspension and position of knot etc.

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MATERIALS & METHOD

The present retrospective study is based upon the analysis of all cases of death due to hanging which were autopsied in the mortuary of the Department of Forensic Medicine, Assam Medical College, Dibrugarh, from 1st June, 2012 to 31st May, 2013.

Detail information related to the deceased like epidemiological data, circumstances and motive leading to death of the victim, medical and mental condition of the victim were collected from police documents and careful questioning of victim’s relatives, friends, neighbour, eyewitness and police personal accompanying dead bodies. Information regarding time and place of hanging, manner of suspension, type of ligature material used etc had been sought from them.

Thorough and meticulous postmortem examination was conducted on every case. Standard autopsy protocol was adopted with proper external examination and followed by internal examination. After palpation, the hyoid was very carefully removed from underlying structure to examine it thoroughly regarding the fracture number, site, type etc. Utmost care had been taken during removal of the bone to avoid doing post mortem fracture.

OBSERVATION AND RESULTS

A total of 1241 cases were brought to the department during the study period for medicolegal autopsy and out of those hanging accounted for 70 cases i.e. 5.64%. All those hanging cases under study were suicidal in nature. Male victims predominated over females by 71.43% and 28.57% respectively and male: female ratio was 2.5:1. Majority of hanging cases belonged to the age group 21-30 years (32.86%) followed by 11-20 years (21.43%) etc. Age groups of upto 10 years, 61-70 years and 81-90 years had least number of cases with 1.43% each.

Regarding fracture of neck structures, it has been found that hyoid was fractured in 4.29% cases. The thyroid cartilage was fractured in 2.86% cases. Isolated hyoid fracture was found in 1.43% cases. Combined hyoid and thyroid cartilage fracture was found in 2.86% cases. No case was found with fracture cricoid cartilage or cervical spine. All hyoid fractures were of abduction type and involved the greater horn only.

All the cases of hyoid fracture were above 40 years of age. Male hanging victims with fracture comprised of 6% of cases. No female case with hyoid fracture was found in the study. Fracture was seen in 4.76% cases of typical hanging as compared to 4.08% cases of atypical hanging. The incidence of fracture among the group of complete suspension was 6%. No case of hyoid fracture was found with partial hanging.

It was observed that out of total 38 cases who used soft ligature material, 1 case (2.63%) had hyoid fracture. On the other hand 2 cases (6.25%) showed fracture in the group of victim who used hard ligature material. Considering the relation of hyoid fracture with level of ligature mark on neck, it has been observed that hyoid fracture was found in 6% cases of hanging with ligature mark above the laryngeal prominence (ALP). No case of hyoid fracture was found in the group of hanging with ligature mark at or below the level of larynx.

In the study, diagnosis of fracture of hyoid bone was solely made by palpatory method and gross examination with naked eye. No pre autopsy X-ray or help of microscopy was taken to diagnose fracture.

DISCUSSION

In the present study, out of 70 hanging cases, only 3 (4.28%) cases showed evidence of hyoid fracture. All fractures were of abduction type and the greater horn of hyoid was exclusively involved (2 cases right greater horn and 1 case left greater horn). All the cases had single fracture site without the involvement of body or lesser horn.

Various previous forensic literature have mentioned that factors like age, sex, weight, type of suspension, position of ligature around the neck, ligature material etc may influence in causation of fracture. However, maximum importance has been given to the age of the victim. It has been repetitively demonstrated that the incidence of fracture increases with age. This is because as the age advances there is increase calcification and brittleness of the bone. Bony fusion of the greater horn and body of the hyoid bone is rare in an individual under 20 years and increases with advancing age. Various previous studies by different workers have mentioned that likelihood
of hyoid fracture increases after 40 years of age.\[x] In the present study also, all the cases of hyoid fracture were found to be above 40 years of age. However, increasing incidence of hyoid fracture after the age of 40 years can be concluded only after taking large numbers of such cases, which need further continuous study in this regard.

Regarding the effect of gender on the incidence of hyoid fracture, several studies have reached contradictive results. Some found a male predominance of fractures whereas others observed a female predominance or no significant difference between genders.\[x] However, most of those studies did not take age into consideration while evaluating the effect of gender on hyoid fracture. The present study also revealed male predominance of fracture. Increase incidence in male victims can be demonstrated by ossification pattern of hyoid in male and female.

Weight of the body of the victim is an important contributing factor in hyoid and other neck structure fracture. In complete hanging, the constricting force is the weight of the whole body. Hence the weight of the whole body is thrown upon the ligature material which may increase the likelihood of fracture of hyoid bone. According to Khokhlov VD, the so called vulnerability coefficient of fracture of hyoid bone/thyroid cartilage shows the highest index in complete hanging of the body.\[x] The present study revealed increase incidence of hyoid fracture among complete hanging cases. Many previous studies also pointed in favour of complete hanging being an important variable of hyoid fracture. However, this is not always true. Manner of suspension in hanging was not found to be a contributing variable in the development of neck structure fractures in some previous studies.\[x,10]

As hanging is commonly presumed to be mostly suicidal, an impulse for suicide may direct the victim to choose whatever material available on the particular time. However, soft materials such as saree, scarf, gamocha etc are used more frequently than hard ligature material. The present study also showed majority of cases using soft ligature materials. The reason may be easy availability of the material and less pain exerting to the neck. In relation to fracture of hyoid, role of nature of ligature material has no distinctive value. Few previous studies got findings of hyoid fracture more in cases of hard ligature material.\[x11] The same is also observed in the present study.

In majority cases of hanging, point of suspension lies on the side of the neck followed by back and then front. In the present study, fracture incidence is found to be more in atypical hanging cases. The position of the knot suggests the area of the neck where maximum pressure is being exerted and that will be on the side opposite to the position of the knot. When the knot is neither posterior nor anterior, a medium-large effect according to Cohen’s criteria is observed with the fracture tending to be on the opposite side of the knot.\[x12]

Several previous studies showed contradictive results & found no significance between position of knot and incidence of neck structure fracture.\[x13]

In the present study fracture is found with increased incidence in cases where hard ligature material was used. However, the role of ligature material in hyoid fracture is controversial. Various previous studies in this regard could not establish any strong and coherent relationship between hyoid fracture and specific composition, width and multiplicity of ligature material.\[x9,14]

**CONCLUSION**

Observation of hyoid bone is one of the most important parts of internal examination during autopsy of hanging cases. The incidence of hyoid fracture in hanging varies from one study to the next, from 0 to 60%.\[x15] In the present study the percentage of hyoid fracture is found to be 4.29%. This suggests that the fracture of hyoid bone may be present in hanging cases and it is not necessarily a common feature of hanging.

Several factors may play a role in the development of hyoid fracture in hanging. However, age is the most important variable for neck structure fracture and the rest are merely contributing factors. Various previous studies in this context showed contradictive results. This suggests the need of further study in this regard with large sample size.

Whenever the hyoid bone is found to be fractured, it should be mentioned. Discrepancy between the frequencies of hyoid fracture reported by different authors could probably be ascribed to
the lack of common autopsy protocol. Sometime false palpatory diagnostics may result from abnormal joint mobility between body and greater cornu of hyoid or artefacts produced due to postmortem fracture. However recent techniques like stereomicroscopy and stereomicroscopy with toludine blue stain have come up for diagnosis of antemortem hyoid fracture with microscopic haemorrhage. Beside this, pre autopsy X ray of hyoid bone may also minimize the chances of error.

The fracture itself is not a life threatening one but it indicates the amount of constricting force inflicted to the neck. The present study confirms the view of few previous prospective studies that fracture of hyoid in hanging is not so common. Retrospective studies in this regard are not helpful as we cannot interpret the fracture pattern and can only go through the records.

Acknowledgement: I want to express my greatful acknowledgement to my teacher and thesis guide, Prof. Dr.H.K.Mahanta, for his valuable suggestions, supervision and wise guidance throughout this research work and also to all those who have extended their best suggestions, help and co-operation in completing this small piece of work.

Conflict of Interest: Nil

Source of Support: Nil

Ethical Clearance: The study was conducted after obtaining ethical clearance from the college ethical committee.

REFERENCES

Pattern of Medico-legal Cases at KLES’S Dr. Prabhakar Kore Hospital and MRC, Belgaum – a Cross Sectional Study

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ABSTRACT

Background and objectives: In the recent times, medico-legal cases are on the rise. This pattern is of importance for those who are concerned with their documentation. Hence the present study is undertaken to know the pattern of medico-legal cases.

Methods: One year cross-sectional study was conducted at KLES’S DR. Prabhakar Kore Hospital & MRC, Belgaum from 1st January 2009 to 31st December 2009.

Results: Out of 2120 cases, RTA constituted the maximum of 68.8%. Maximum number of victims (33.5%) was between 21-30 years and 75.2 % of victims were males. More than 50% of incidents occurred in urban areas and the mortality rate was 9%. Occupants of motor cycle (59.8%) cases were the highest number of victims involved in RTA. The agriculturists were the highest (43.1%) in number among the victims and agrochemicals (67.0%) were the commonest type of poison. Maximum (69.5%) cases of burns were due to dry heat and the most common cause of burns was flame (45.2%). Majority of assault cases (71.0%) were by hard blunt weapon. Most common animal species involved in bites were snakes (53.3%). Maximum number of mechanical asphyxia cases was due to hanging (52.4%).

Conclusion and interpretation: The results could be useful in interpreting the types and strategic planning can be made accordingly for the benefit of the community.

Keyword: Medico-legal case; Road traffic accident; Burns; Poisoning; Assault; Bites and stings; Mechanical asphyxia.

INTRODUCTION

Medico-legal case is a medical case with legal implications or a legal case requiring medical expertise.¹

In recent days, medico-legal cases are on the rise. This may be due to increased vehicular traffic density, un-employment, high income disparities, substance abuse, meager infrastructure facilities, insurance/compensations, etc.²

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Pattern of Medico-legal cases is of importance for those, who are directly or indirectly related with Law and Order, who treat them and also who are concerned with the etiology, manner of causation and their documentation.² If pattern of cases that present to an emergency or elective setup is known, one can get better acquainted with more types of medico-legal cases and have better understanding for them. As a result of which, a medical practitioner shall be more comfortable in dealing with such cases.

METHODOLOGY

This cross-sectional study was carried out at KLES’S Dr. Prabhakar Kore Hospital and MRC, Belgaum from 1st January 2009 to 31st December 2009.
comprising all cases which were registered at the medico-legal register.

In this study, the information regarding the biodata of the victim like age, sex, domicile, time and place of incident were gathered by interviewing the patient or patient’s attendants either in casualty or in the wards of the hospital. The medico-legal records were also referred for additional information.

The data obtained was recorded in the pre-designed and pre-tested proforma, which comprised relevant data and analyzed.

RESULTS

It was observed that RTA constituted the maximum of 1459 (68.8%) cases followed by Poisoning 167 (07.9%) cases. The maximum 711 (33.5%) victims were in the age group of 21-30 years and 1596 (75.2 %) males outnumbered the females of 524 cases (24.8%). (Table 1 & 2)

Of total 2120 cases, 610 (28.8%) occurred between 4.01 pm – 08 pm. The majority of cases 1219 (57.5%) were from urban areas when compared to 901 (42.5%) cases of rural areas. Out of 192 cases that expired, RTA constituted the maximum of 110 cases (57.3%). (Table 3, 4 & 5)

Table 1. Distribution of Medico-legal cases according to type

<table>
<thead>
<tr>
<th>Medico-legal cases</th>
<th>Male</th>
<th>Female</th>
<th>Total (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTA</td>
<td>1164</td>
<td>295</td>
<td>1459 (68.8%)</td>
</tr>
<tr>
<td>Poisoning</td>
<td>85</td>
<td>82</td>
<td>167 (07.9%)</td>
</tr>
<tr>
<td>Burns</td>
<td>52</td>
<td>43</td>
<td>95 (04.5%)</td>
</tr>
<tr>
<td>Assault</td>
<td>68</td>
<td>11</td>
<td>79 (03.7%)</td>
</tr>
<tr>
<td>Bites and Stings</td>
<td>39</td>
<td>21</td>
<td>60 (02.8%)</td>
</tr>
<tr>
<td>Mechanical Asphyxia</td>
<td>14</td>
<td>07</td>
<td>21 (01.0%)</td>
</tr>
<tr>
<td>*Others</td>
<td>174</td>
<td>65</td>
<td>239 (11.30%)</td>
</tr>
<tr>
<td>Total</td>
<td>1596 (75.2%)</td>
<td>524 (24.8%)</td>
<td>2120 (100%)</td>
</tr>
</tbody>
</table>

* The fall from height, fall of weight, bull gore injury, suspected self-inflicted injuries, unusual occurrences in a factory, criminal abortions were included in others category.

Table 2. Distribution of Medico-legal cases according to age and sex

<table>
<thead>
<tr>
<th>Age (in years)</th>
<th>Male</th>
<th>Female</th>
<th>Total (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 10</td>
<td>67</td>
<td>48</td>
<td>115 (5.4%)</td>
</tr>
<tr>
<td>11-20</td>
<td>172</td>
<td>87</td>
<td>259 (12.2%)</td>
</tr>
<tr>
<td>21-30</td>
<td>548</td>
<td>163</td>
<td>711 (33.5%)</td>
</tr>
<tr>
<td>31-40</td>
<td>416</td>
<td>114</td>
<td>530 (25%)</td>
</tr>
<tr>
<td>41-50</td>
<td>209</td>
<td>69</td>
<td>278 (13.1%)</td>
</tr>
<tr>
<td>51-60</td>
<td>143</td>
<td>28</td>
<td>171 (8.1%)</td>
</tr>
<tr>
<td>&gt;60</td>
<td>41</td>
<td>15</td>
<td>56 (2.7%)</td>
</tr>
</tbody>
</table>

Table 3. Distribution of Medico-legal cases according to time of occurrence

<table>
<thead>
<tr>
<th>Time of occurrence</th>
<th>RTA</th>
<th>Poisoning</th>
<th>Burns</th>
<th>Assault</th>
<th>Bites and Stings</th>
<th>Mechanical Asphyxia</th>
<th>Others</th>
<th>Total (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.01 am-12 pm</td>
<td>291</td>
<td>42</td>
<td>46</td>
<td>21</td>
<td>22</td>
<td>10</td>
<td>81</td>
<td>513 (24.2%)</td>
</tr>
<tr>
<td>12.01 pm-4pm</td>
<td>305</td>
<td>43</td>
<td>21</td>
<td>13</td>
<td>07</td>
<td>03</td>
<td>94</td>
<td>486 (22.9%)</td>
</tr>
<tr>
<td>4.01 pm- 8 pm</td>
<td>458</td>
<td>37</td>
<td>21</td>
<td>22</td>
<td>22</td>
<td>04</td>
<td>46</td>
<td>610 (28.8%)</td>
</tr>
<tr>
<td>8.01 pm-6 am</td>
<td>405</td>
<td>45</td>
<td>07</td>
<td>23</td>
<td>09</td>
<td>04</td>
<td>18</td>
<td>511 (24.1%)</td>
</tr>
</tbody>
</table>
Table 4. Distribution of Medico-legal cases according to the Domicile pattern

<table>
<thead>
<tr>
<th>Domicile Status</th>
<th>RTA</th>
<th>Poisoning</th>
<th>Burns</th>
<th>Assault</th>
<th>Bites and Stings</th>
<th>Mechanical Asphyxia</th>
<th>Others</th>
<th>Total n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban</td>
<td>934</td>
<td>55</td>
<td>42</td>
<td>21</td>
<td>22</td>
<td>14</td>
<td>131</td>
<td>1219 (57.5%)</td>
</tr>
<tr>
<td>Rural</td>
<td>525</td>
<td>112</td>
<td>53</td>
<td>58</td>
<td>38</td>
<td>07</td>
<td>108</td>
<td>901 (42.5%)</td>
</tr>
</tbody>
</table>

Table 5. Distribution of Medico-legal cases according to the outcome

<table>
<thead>
<tr>
<th>Outcome</th>
<th>RTA</th>
<th>Poisoning</th>
<th>Burns</th>
<th>Assault</th>
<th>Bites and Stings</th>
<th>Mechanical Asphyxia</th>
<th>Others</th>
<th>Total n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recovered</td>
<td>1349</td>
<td>149</td>
<td>71</td>
<td>75</td>
<td>57</td>
<td>08</td>
<td>219</td>
<td>1928 (91.0%)</td>
</tr>
<tr>
<td>Expired</td>
<td>110</td>
<td>18</td>
<td>24</td>
<td>04</td>
<td>03</td>
<td>13</td>
<td>20</td>
<td>192 (09.0%)</td>
</tr>
</tbody>
</table>

Table 6. Distribution of RTA cases according to Age and Sex

<table>
<thead>
<tr>
<th>Age</th>
<th>Male</th>
<th>Female</th>
<th>Total n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 10</td>
<td>32</td>
<td>23</td>
<td>55 (03.8%)</td>
</tr>
<tr>
<td>11-20</td>
<td>118</td>
<td>35</td>
<td>153 (10.5%)</td>
</tr>
<tr>
<td>21-30</td>
<td>426</td>
<td>87</td>
<td>513 (35.2%)</td>
</tr>
<tr>
<td>31-40</td>
<td>297</td>
<td>65</td>
<td>362 (24.8%)</td>
</tr>
<tr>
<td>41-50</td>
<td>153</td>
<td>51</td>
<td>204 (14.0%)</td>
</tr>
<tr>
<td>51-60</td>
<td>109</td>
<td>25</td>
<td>134 (09.1%)</td>
</tr>
<tr>
<td>61-70</td>
<td>21</td>
<td>05</td>
<td>26 (01.8%)</td>
</tr>
<tr>
<td>71-80</td>
<td>08</td>
<td>04</td>
<td>12 (0.8%)</td>
</tr>
</tbody>
</table>

Table 7. Distribution of RTA cases according to educational status of the victims

<table>
<thead>
<tr>
<th>Educational status</th>
<th>Number</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Illiterate</td>
<td>265</td>
<td>18.2</td>
</tr>
<tr>
<td>Education upto 5th class</td>
<td>374</td>
<td>25.6</td>
</tr>
<tr>
<td>Education upto 8th class</td>
<td>312</td>
<td>21.4</td>
</tr>
<tr>
<td>Education upto 10th class</td>
<td>270</td>
<td>18.5</td>
</tr>
<tr>
<td>Intermediate</td>
<td>105</td>
<td>7.2</td>
</tr>
<tr>
<td>Graduate and above</td>
<td>118</td>
<td>8.1</td>
</tr>
<tr>
<td>Not applicable (&lt;5 years)</td>
<td>15</td>
<td>01</td>
</tr>
<tr>
<td>Total</td>
<td>1459</td>
<td>100</td>
</tr>
</tbody>
</table>
Table 8. Distribution of RTA cases according to type of the victims:

<table>
<thead>
<tr>
<th>Sex</th>
<th>Pedestrian</th>
<th>Pedal cyclist</th>
<th>Rider</th>
<th>Pillion rider</th>
<th>Driver</th>
<th>Front Seater</th>
<th>Back Seater</th>
<th>Driver</th>
<th>Front Seater</th>
<th>Back Seater</th>
<th>Animal Driven Vehicle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>143</td>
<td>56</td>
<td>594</td>
<td>117</td>
<td>85</td>
<td>23</td>
<td>50</td>
<td>10</td>
<td>06</td>
<td>15</td>
<td>05</td>
</tr>
<tr>
<td>Female</td>
<td>40</td>
<td>03</td>
<td>54</td>
<td>107</td>
<td>01</td>
<td>22</td>
<td>55</td>
<td>00</td>
<td>00</td>
<td>04</td>
<td>00</td>
</tr>
<tr>
<td>Total</td>
<td>183</td>
<td>59</td>
<td>872</td>
<td>236</td>
<td>35</td>
<td>62</td>
<td>12</td>
<td>12</td>
<td>06</td>
<td>15</td>
<td>05</td>
</tr>
</tbody>
</table>

Table 9. Distribution of poisoning cases according to occupation of the victims:

<table>
<thead>
<tr>
<th>Occupation of Victims</th>
<th>Total Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculturist</td>
<td>72</td>
<td>43.1</td>
</tr>
<tr>
<td>Laborer</td>
<td>39</td>
<td>23.3</td>
</tr>
<tr>
<td>Student</td>
<td>28</td>
<td>16.8</td>
</tr>
<tr>
<td>Employee in Service</td>
<td>14</td>
<td>8.4</td>
</tr>
<tr>
<td>Un-employed</td>
<td>08</td>
<td>4.8</td>
</tr>
<tr>
<td>Not applicable (&lt;5 years)</td>
<td>06</td>
<td>3.6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>167</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Table 10. Distribution of poisoning cases according to type of poison consumed:

<table>
<thead>
<tr>
<th>Poison Type</th>
<th>Total Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agro chemicals</td>
<td>112</td>
<td>67.0</td>
</tr>
<tr>
<td>Bromodialone</td>
<td>08</td>
<td>04.8</td>
</tr>
<tr>
<td>Medicinal drugs</td>
<td>30</td>
<td>18.0</td>
</tr>
<tr>
<td>Phenolic compounds</td>
<td>06</td>
<td>03.6</td>
</tr>
<tr>
<td>Vegetable irritants</td>
<td>04</td>
<td>02.4</td>
</tr>
<tr>
<td>Kerosene</td>
<td>03</td>
<td>01.8</td>
</tr>
<tr>
<td>Heavy metal</td>
<td>02</td>
<td>01.2</td>
</tr>
<tr>
<td>Alcohol</td>
<td>02</td>
<td>01.2</td>
</tr>
</tbody>
</table>

Fig 1. Distribution of RTA cases according to cause of death

Fig 2. Distribution of poisoning cases according to the Socio-economic status: (Based on modified B.G. Prasad Classification)

Fig 3. Distribution of cases according to Degree of Burns

**Total – 95 Cases**
Table -11 Distribution of Burn cases according to causative agent:

<table>
<thead>
<tr>
<th>Causative agent</th>
<th>Total Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flame</td>
<td>43</td>
<td>45.2</td>
</tr>
<tr>
<td>Electricity</td>
<td>12</td>
<td>12.75</td>
</tr>
<tr>
<td>Chemicals</td>
<td>08</td>
<td>8.4</td>
</tr>
<tr>
<td>Hot objects</td>
<td>01</td>
<td>1.1</td>
</tr>
<tr>
<td>Lightning</td>
<td>03</td>
<td>3.1</td>
</tr>
<tr>
<td>Steam</td>
<td>01</td>
<td>1.1</td>
</tr>
<tr>
<td>Hot water</td>
<td>17</td>
<td>17.9</td>
</tr>
<tr>
<td>Hot milk</td>
<td>05</td>
<td>5.3</td>
</tr>
<tr>
<td>Hot oil</td>
<td>03</td>
<td>3.1</td>
</tr>
<tr>
<td>Molten metal</td>
<td>02</td>
<td>2.1</td>
</tr>
</tbody>
</table>

Table -12 Distribution of Assault cases according to type of Weapon:

<table>
<thead>
<tr>
<th>Type of Weapon</th>
<th>Total Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blunt</td>
<td>62</td>
<td>78.6</td>
</tr>
<tr>
<td>Sharp cutting</td>
<td>16</td>
<td>20.2</td>
</tr>
<tr>
<td>Firearms</td>
<td>01</td>
<td>1.2</td>
</tr>
</tbody>
</table>

Table -13 Distribution of Bites and Sting cases according to Species:

<table>
<thead>
<tr>
<th>Species</th>
<th>Total Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dog</td>
<td>09</td>
<td>15.0</td>
</tr>
<tr>
<td>Cat</td>
<td>02</td>
<td>3.3</td>
</tr>
<tr>
<td>Monkey</td>
<td>03</td>
<td>5.0</td>
</tr>
<tr>
<td>Bear</td>
<td>01</td>
<td>1.7</td>
</tr>
<tr>
<td>Snake</td>
<td>32</td>
<td>53.3</td>
</tr>
<tr>
<td>Scorpion</td>
<td>07</td>
<td>11.7</td>
</tr>
<tr>
<td>Honey Bee</td>
<td>03</td>
<td>5.0</td>
</tr>
<tr>
<td>Unknown</td>
<td>03</td>
<td>5.0</td>
</tr>
</tbody>
</table>

Out of total 1459 (100%) RTA cases, 1164 (79.8%) were males and 295 (20.2%) were females. Maximum number of victims 513 (35.2%) were seen in the age group of 21-30 years and more than 2/3rd of victims were between 21-50 years. The maximum 374 (25.6%) victims had education up to 5th class. The occupants of motor cycle with 872 (59.8%) cases were involved in RTA and the commonest cause of death was head injury comprising 65 (59.1%) cases. (Table 6, 7, 8 & Fig 1)

It was observed in 167 (100%) poisoning cases, 85 (50.9%) were males and 82 (49.1%) were females. The maximum 71 (42.6%) cases belonged to Class V socio economic status and the agriculturist 72 (43.1%) were the highest in number among the victims and commonly consumed was agrochemicals with 112 (67.0%) cases. (Table 9, 10 & Fig 2)

Out of 95 (100%) burn cases, 52 (54.7%) were males. 81 (85.2%) victims had only superficial burns and the common cause was due to flame with 43 (45.2%) cases. (Table 11 & Fig 3)

Among the 79 (100%) assault cases, 86.1% (68 cases) were males. The maximum 56 (71.0%) cases were caused by hard blunt weapon and Head and face, neck was the most commonly injured region with 30 (38.0%) cases. (Table 12 & Fig 4)

In 60 (100%) bites and stings cases, 39 (65%) were males and 21 (35%) were females. The snakes were
the commonly involved species in 32 (53.3%) cases and the lower limb were the most common body part affected with 35 (58.2%) cases. (Table 13 & Fig 5)

Out of 21 asphyxial death cases, 14 (66.7%) were males and 07 (33.3%) were females. The hanging 11 (52.4%) cases was the most common type of asphyxia. (Table 14)

DISCUSSION

In the present study, RTA constituted the maximum of 1459 (68.8%) cases. The maximum number of victims 711 (33.5%) was in the age group of 21-30 years. The males 1596 cases (75.2%) outnumbered the females of 524 cases (24.8%). Our result is consistent with the study conducted at Mangalore.2

The male dominance may be due to the paternalistic nature of our society where males keep themselves most of the time outdoors and lead a more active life.

In a study conducted at Mangalore,2 the maximum numbers 125 (26.8%) occurred between 6 am- 12 pm, which is contrary to our study where the maximum cases 610 (28.8%) occurred between 4.01pm – 08 pm.

The majority of victims 1219 (57.5%) were from urban area and this could be due to the larger section of population concentrated in urban areas due to modernization and industrialization. This result is supported by the study conducted in Nagpur.3

In this study, the overall mortality rate was 9%. This less mortality rate could be due to the study which was conducted at a tertiary referral center.

It was observed in our study that people with lower levels of education (up to 5th class) were involved more in RTA with 374 (25.6%) cases. Similar results were reported by others also.2 4 However, this relationship between education and road traffic accidents may not be casual.

In our study, the occupants of motor cycle 872 (59.8%) cases were the highest number of victims involved in RTA and our result is similar to the study conducted at Nagpur3. The reason could be due to higher speed, which can be achieved over short distance and less stability of vehicle. However, the studies conducted in Delhi5 and Pondicherry4 showed maximum numbers of victims were pedestrians.

Out of 110 fatal cases of RTA, the commonest cause of death was head injury comprising 65 (59.1%) cases followed by hemorrhagic shock 26 (23.6%). This result is similar to the study conducted in Pondicherry4, while a study conducted in Delhi5 showed hemorrhagic shock as the most common cause of death.

The present study along with many other studies, gives the picture that it’s the youth between the ages of 20-30 years with 50 (30%) cases who are more prone for poisoning. In most of these youths, it is suicidal intent rather than accidental.

Among the victims of poisoning, maximum number 71 (42.6%) belonged to Class V status and least numbers 02 (01.2%) cases in Class I. Similar results were reported by Gupta et al8 and Prakash et al.9 The victims of low socioeconomic class are more vulnerable as they may be under continuous financial and stress during life.

In the present study, the agriculturist 72 (43.1%) were the highest in number among the poisoning victims. Similar views are shared by Bharadwaj et al7 and Gupta et al.8 However, the study conducted in Bangalore,6 revealed maximum numbers of victims were laborers.

The poisoning by agrochemicals 112 (67.0%) were seen in maximum numbers of victims and this result is similar to study conducted in Gujurat8 where as in Harayana7 it was found that aluminum phosphhide was most common type of poisoning.

The maximum victims 75 (67%) were due to poisoning by Organophosphorus compounds, which is also reported by Vanaja et al6 and Prakash et al9.

Out of 95 cases of burns, the most common cause was due to flame with 43 (45.2%) cases and this could be due to traditional household practice, lack of safety system and the prevailing socio-cultural determinant. Similar result have been reported from the study conducted in Indore.10

Among 79 assault cases, 68 (86.1%) were males and it is the fact that by nature male indulge in more violent activities. The majority of 56 (71.0%) assault cases were caused by hard blunt weapon and head, face and neck was the most commonly injured region in 30 (38.0%) cases. The head is the target of choice involving blunt trauma when the intention is to kill.
These results are supported by the study conducted in Mangalore.2

With respect to bites and stings of 60 (100%) cases, the snake bites 32 (53.3%) cases were the most common. However, in the study conducted at CHC, Himachal Pradesh,11 wasp and bee bites were common followed by snake bite. The most common body part affected was the lower limb with 35 (58.2%) cases. In this part of the study, the area being malnad and agriculture is the main occupation, the laborers and farmers are commonly exposed to the common species, being snake.

In a study conducted at KMC, Manipal12 hanging was the most common type of asphyxia and is similar to our study with 11 (52.4%) cases.

CONCLUSION

This study helps to interpret the types of medico-legal cases. The medico-legal cases are on the rise and this cost a lot not only to the individuals affected and their families but also to the nation. The incidence of medico-legal cases must be reduced as it is involving the most productive age group leading to substantial socio-economic impact on the society.

The various preventive measures can be employed to minimize the medico-legal cases like creating awareness among public about safety measures, first aid education and timely treatment.

This study will provide an insight to the policy makers, law custodians and the community to look into the specific aspects of the cases and to take measures accordingly for the benefit of the community and people at large.

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Ethical Clearance: Institutional ethical clearance has been obtained.

REFERENCES

Study of Stature by Per-cutaneous Ulnar Length in Madhya Pradesh Population of India

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ABSTRACT

Background: Stature of a person is one of the vital parts of identification. Assessment of height from different parts of the body by anthropometric study of skeleton is an area of interest to anatomist, anthropologist and forensic experts.

Objective: An attempt was made to formulate a linear regression equation for the estimation of the stature of Medical Students of Madhya Pradesh and others from the lengths of their ulna.

Study Design: Cross sectional study.

Place of Study: Department of Forensic Medicine at R. D. Gardi Medical College, Ujjain, M.P.

Methods: The present study was carried out to establish the regression equation and correlation coefficient between individual’s height and per-cutaneous ulnar length. It was conducted on the Medical students of second year, 147 subjects were selected irrespective of their caste, religion, dietary habits & socio-economic status.

Observations: Regression equation for estimation of stature from Per-cutaneous ulnar length for both sex Y= 64.36+ 3.82 x PC ulnar Length, for individual male sex Y= 130.10 + 1.57 x PC ulnar Length and for Female sex Y= 75.94 + 3.21 x PC ulnar Length. The correlation coefficient between height & Per-cutaneous ulnar length is highly significant.

Conclusions: The present study revealed that Per-cutaneous ulnar length dimensions are strongly correlated with stature & can be used for predicting the stature in the Forensic Examination.

Keywords: Per-cutaneous ulnar length, Forensic Anthropology, Stature, Regression analysis.

INTRODUCTION

The use of anthropometry in the field of forensic science and medicine dates back to 1882 when Alphonse Bertillon, a French police expert invented a system of criminal identification based on anthropometric measurements. Since then, anthropometry has continuously been used in forensic examinations of unknown dismembered human remains. Anthropometry helps in reconstruction of the biological profile of the deceased such as age, sex, ethnicity and stature¹,².

Time is a critical factor when a crime has been committed and the investigation begins. The crime scene investigator needs to make rapid and accurate assessments in the field such as identifying possible
suspects, especially when the crime is a violent one such as homicide. When processing a crime scene, many variables are usually not known about the suspect.

Anthropometry is being widely used in Forensic investigations for identification of an individual which is an important step in crime investigation. Various parameters used for identification are determination of age, sex, and race etc.\(^3, 4, 5\)

There may be few (if any) witnesses and the perpetrator seldom leaves behind specific identifying information (e.g., driver’s license). Information about the perpetrator’s identity is therefore deduced from the evidence left at the scene. Sometimes we get dismembered forearm for identification\(^6, 7\). With the help of length of this we can calculate suspected individuals’ height. A person’s height (i.e., stature) is one identifying characteristic that is often used. Stature is the height of the person in the upright posture. Stature estimation of an individual from the length of an ulna has obvious significance in the forensic identification analysis\(^8, 9, 10\). Accurate measurement of the height under field survey, by staff can be possible with minimum training of technique. This study is such attempt to estimate stature in Madhya Pradesh Population.

**OBJECTIVE**

An attempt was made to formulate a linear regression equation for the estimation of the stature of Medical Students of Madhya Pradesh and others from the lengths of their ulna.

**MATERIAL & METHOD**

In the present study, stature and per cutaneous ulnar length measurements of 147 college students (68 male & 79 female) of ages 18- 25 years were done. Amongst them 102 belonged to Madhya Pradesh and 45 from rest of the India. As there were no subjects available from North East region, we could not include them in study. As such subjects were selected irrespective of their caste, religion, dietary habits and socio-economic status. The study was a predominantly descriptive cross sectional study with analytical and comparative components. Sufficient permissions and consents are procured before the measurements of the students are taken and clearance from the Institutional Ethical committee is obtained in advance. Stature; using the stadio-meter, the subject was made to stand barefoot in the standard standing position on its baseboard. Both feet are in close contact with each other and head oriented in Frankfurt’s plane. The height was then recorded in centimeter from the standing surface to the vertex in the weight bearing position of foot.

Ulna length was obtained in the sitting position with the left forearm resting comfortably on a table. The palm faced downwards and the fingers were extended but together. The elbow was bent at 90 to 110°. The proximal end of the ulna was found by palpating along its length. The tip of the styloid process was felt at the wrist by palpating down the length of the bone distally, until its end was felt. All measurements were recorded to the nearest millimeter. Right ulna is used for the purpose of universal and equal standards\(^3\).

**EXCLUSION CRITERION**

Students morphologically showing the congenital malformations, Dwarfism/ Achondroplasia, features of nutritional deficiencies and injuries to extremities, using medication thought to alter growth, neuromuscular weakness or abnormal tone or with any other major medical illnesses or growth disturbance were excluded from the study.

**DATA ANALYSIS**

In vernier caliper, Length = reading of the main scale + vernier coincidence x vernier constant + mechanical error. (Here vernier constant = 0.01 and mechanical error = 0) Calculation of stature using regression equation: Stature = value of constant + regression coefficient x Per-cutaneous Ulnar Length. Value of the constant and regression coefficient was calculated using SPSS Version 19 program.

The regression equation thus calculated, to find significant difference between estimated and predictive value. Regression Equations of other studies selected for comparison with our data. The statistical data so obtained i.e. Mean SD, p value and t test were compared to see validity of equations. For this we have selected only right foot length from these selected studies to minimize variation.
RESULT AND OBSERVATIONS

Table No 1 Mean Height and Per-cutaneous ulnar Length Gender wise.

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Per-cutaneous ulnar Length Right Male</td>
<td>172.6</td>
<td>± 6.40</td>
<td>67</td>
</tr>
<tr>
<td>Per-cutaneous ulnar Length Right Female</td>
<td>158.5</td>
<td>± 6.00</td>
<td>80</td>
</tr>
</tbody>
</table>

Table No 2. Mean Height and Per-cutaneous ulnar Length State wise

<table>
<thead>
<tr>
<th>State</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>MP</td>
<td>164.2</td>
<td>± 9.51</td>
<td>102</td>
</tr>
<tr>
<td>NON MP</td>
<td>166.3</td>
<td>± 8.95</td>
<td>45</td>
</tr>
</tbody>
</table>

Graph 1: Linear Graph Showing Body height of total subjects with respect to Per-cutaneous ulnar length observed.

In present study, the formula i.e. Regression equation for estimation of stature from Per-cutaneous ulnar length for both sex Y= 64.36+ 3.82 x PC ulnar Length, for individual male sex Y= 130.10 + 1.57 x PC ulnar Length and for Female sex Y= 75.94 + 3.21 x PC ulnar Length. The correlation coefficient between height & Per-cutaneous ulnar Length is highly significant. From the above facts, it is clear that if either of the measurement (Per-cutaneous ulnar length or total height) is known the other can be calculated & this fact may be of practical use in Medico-legal investigations.

Table No 3: Showing comparison of Stature between MP and Rest of the India population

<table>
<thead>
<tr>
<th>State</th>
<th>Mean</th>
<th>SD</th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>MP</td>
<td>164.29</td>
<td>± 9.51</td>
<td>1.24</td>
<td>&gt; 0.05</td>
</tr>
<tr>
<td>Non MP</td>
<td>166.38</td>
<td>± 8.95</td>
<td>1.27</td>
<td>&gt; 0.05</td>
</tr>
</tbody>
</table>

Table No 4: Showing comparison of Observed heights between Male and Female Subjects.

<table>
<thead>
<tr>
<th>Sex</th>
<th>Mean</th>
<th>SD</th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>172.6</td>
<td>± 6.40</td>
<td>13.76</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Female</td>
<td>158.5</td>
<td>± 6.01</td>
<td>13.68</td>
<td>&lt; 0.01</td>
</tr>
</tbody>
</table>

It is observed in above graph that there is not much difference between Madhya Pradesh and Non MP subjects. Hence we can apply single formula for stature estimation for Overall Indian Population. In another graph it is seen that stature cannot be differentiated from male to that of female. Although if the gender is identified then one of the regression equation mentioned before can be utilized separately.

DISCUSSION

Our study was conducted on a population group where students studying in the Medical College belonging to various religious and regions were studied. We devised the linear regression equations as well as multiplication factors for estimation of stature from Per-cutaneous ulnar Length in both the genders. In this study Per-cutaneous ulnar Length is found to be good parameter for predicting stature in both the genders. The linear regression equation derived from Per-cutaneous ulnar length for estimation of stature showed a statistically significant relationship in both
the genders.

Athawale MC\textsuperscript{18} studied one hundred Maharashtra males of age ranging from 25 to 30 years, with the help of various graphs; he showed that there is definite correlation between stature of an individual, length of forearm bones, as well as length of upper limb. The regression formula derived for estimation of stature from length of long bones was stature = 59.2923 cm + 4.1442 X average length of right and left radius (cm) + 3.66 cm. Stature = 56.9709 cm + 3.9613 X average length of right and left ulna (cm) + 3.64 cm.

Nishat Ahmed Sheikh et al studied 170 school going children of Telangana region the regression equations for estimation of stature from right foot length (RFL) and left foot length (LFL) were 144.01 + 0.126 x RFL and 145.07 + 0.176 x LFL respectively\textsuperscript{16}.

Nishat Ahmed Sheikh et al. (2014) estimated stature from forearm length, the ratio fall between 3.49 and 3.88 for boys with a mean of 3.67 and SD + 0.090; and between 3.45 and 3.88 for girls with a mean of 3.68 and SD 0.093\textsuperscript{17}.

Trotter M et al. \textsuperscript{19} estimated the stature of American whites and Negroes from the ulna with linear regression equations. A study which was done by Lundy JK et al. (1985) \textsuperscript{20} discussed the regression equation and the mathematical and the anatomical method of estimating the living stature from the long limb bones in the South African population. The reports of Agnihotri AK et al. (2009)\textsuperscript{21} from Mauritius and those of Barbaosa VM et al. (2012)\textsuperscript{22} from Portugal also found the linear regression model to depict an individual’s stature from the percutaneous ulnar length.

Devi S et al. (2006)\textsuperscript{23} computed the correlation coefficient (r = 0.619 for males and 0.584 for females) and the regression equation formula for the estimation of stature by using the upper arm length among the living population of the Maring tribes of the Pallel area in the Chandel district, Manipur.

Inference could be drawn that the stature of an individual can be estimated from the Percutaneous ulnar length in both sexes. This method of stature estimation can be used by law enforcement agencies and forensic scientists. The only precaution which must be taken into consideration is that these formulae are applicable to the population from which the data have been collected due to inherent population variations in these dimensions, which may be attributed to genetic and environmental factors like climate, nutrition etc. The results obtained in our study correlates with the previous studies\textsuperscript{13, 14, 15}.

**CONCLUSION**

The present study revealed that Per-cutaneous ulnar length dimensions are strongly correlated with stature & can be used for predicting the stature in the Forensic Examination. We have found that, there is not much difference between statures of subjects from Madhya Pradesh & Non- Madhya Pradesh. It has been found similar as far as male & females are concerned. By above study, it can be concluded that, with difference of ±3 any equation from above study can give approximate height of an individual with the help of Per-cutaneous length. Also that formula can be standardized with inclusion of other parameter like age along with Per-cutaneous ulnar length. It is highlighted here that the findings of the present research apply to a very specific population and hence, should not be generalized. We further would like to continue to work on estimating stature by unique formula which can be utilized irrespective of gender and region, at least for India.

**Acknowledgement:** We would like to sincerely thank to Students of 2011 and 2012 batch MBBS students of RDGMC, Ujjain for their cooperation.

**Ethical Approval:** Ethical approval taken from the Institutional ethics committee.

**Source of Funding:** Nil

**Conflicts of Interest:** Nil

**Author Disclosures**

Authors have no conflict of interest. This study was a part of departmental research activities of Forensic Medicine at R. D. Gardi Medical College, Ujjain, M.P.

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2. Iscan MY. Rise of forensic anthropology.


Pattern of Acute Poisoning in Karad

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ABSTRACT

Introduction: Poison is defined as any substance which when administered in living body through any route (inhalation, ingestion, surface or absorption) will produce ill-health or death by its action which is due to its physical chemical or physiological properties. Poisoning is prevalent in all parts of the India but pattern of poisoning varies from place to place. In India agrochemicals dominate the death due to poisoning. Karad being the part of western Maharashtra, where agriculture is main occupation, people attempt to commit suicide by poisoning mainly by agrochemicals.

Material and methods: A cross sectional study of a total of 356 cases of acute poisoning admitted in Krishna hospital, Karad was conducted over a period of 12 months from November 2012 to October 2013.

Results: The most common age group of acute poisoning was 20-29years (36.23%) followed by 10-19 years (16.85%). The incidence of acute poisoning was more in males (58.42%) as compared to females (41.58%). Suicide (43.8%) was most common manner of acute poisoning followed by accidental poisoning (39.8%). The hospital stay ranged from 1 to 21 days.

Conclusion: Young adults males of age group 20-29 years were common victims of poisoning with majority showing improvement.

Keywords: Poisoning, Morbidity, Suicide.

INTRODUCTION

Poisoning is prevalent in all parts of the India but trend of poisoning varies from place to place. In advanced countries it has been observed that poisoning deaths are mainly due to the cleansing agents, detergents and other cosmetics. Paracetamol, CO, etc are frequently used as agents of poisoning. In India agrochemicals dominate the death due to poisoning.

Organophosphate (OP) poisoning is common in our country and occurs mostly by voluntary ingestion, inhalation, or by absorption through the skin. The clinical presentations and outcome of OP poisoning depend not only on the pesticide but also on the dose, the route of administration, and delay in treatment.

The incidence of poisoning in India is among the highest in the world. It is estimated that more than 50,000 people die every year from toxic exposure.

MATERIALS & METHOD

A cross sectional study of a total of 356 cases of acute poisoning admitted in Krishna hospital, Karad was conducted over a period of 12 months from November 2012 to October 2013. The data regarding age, sex, type of poison, manner of poisoning and outcome, was collected from the information furnished by patients and their close relatives. All the patients coming to casualty with the history of acute poisoning during the study period were considered for study. Data was collected and analysed with Microsoft excel and presented as descriptive statistics.
RESULTS

Table 1. Age and sex wise distribution of cases

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Gender</th>
<th>Total (n=356)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>0-9</td>
<td>10(2.80%)</td>
<td>7(1.96%)</td>
</tr>
<tr>
<td>10-19</td>
<td>28(7.86%)</td>
<td>32(8.98%)</td>
</tr>
<tr>
<td>20-29</td>
<td>77(21.62%)</td>
<td>52(14.60%)</td>
</tr>
<tr>
<td>30-39</td>
<td>31(8.70%)</td>
<td>24(6.74%)</td>
</tr>
<tr>
<td>40-49</td>
<td>28(7.86%)</td>
<td>13(3.65%)</td>
</tr>
<tr>
<td>50-59</td>
<td>15(4.21%)</td>
<td>10(2.80%)</td>
</tr>
<tr>
<td>60 &amp;above</td>
<td>19(5.33%)</td>
<td>10(2.80%)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>208(58.42%)</strong></td>
<td><strong>148(41.57%)</strong></td>
</tr>
</tbody>
</table>

A total of 356 cases of acute poisoning were admitted in the study period. The most common age group of acute poisoning was 20-29 years (36.23%) followed by 10-19 years (16.85%) as shown in Table 1. Least age group involved was 0-9 years (4.77%). The incidence of acute poisoning was more in males 58.42% (208 cases) as compared to females 41.58% (148 cases).

Table 2. Type of Poison

<table>
<thead>
<tr>
<th>Type of poison</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unknown</td>
<td>198</td>
<td>55.6</td>
</tr>
<tr>
<td>Organophosphorus</td>
<td>19</td>
<td>5.3</td>
</tr>
<tr>
<td>Unknown &amp; alcohol</td>
<td>12</td>
<td>3.4</td>
</tr>
<tr>
<td>Drug</td>
<td>9</td>
<td>2.5</td>
</tr>
<tr>
<td>Kerosene</td>
<td>5</td>
<td>1.4</td>
</tr>
<tr>
<td>Poisonous snake</td>
<td>85</td>
<td>23.9</td>
</tr>
<tr>
<td>Non poisonous snake</td>
<td>21</td>
<td>5.9</td>
</tr>
<tr>
<td>Others</td>
<td>7</td>
<td>2</td>
</tr>
</tbody>
</table>

In 356 cases of acute poisoning, the poison was unknown in 55.6% cases (n=198) followed by poisonous snake bite in 23.9% cases (n=85) as shown in Table 2.

Table 3. Hospital stay.

<table>
<thead>
<tr>
<th>Hospital stay</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-2 days</td>
<td>45</td>
<td>12.6</td>
</tr>
<tr>
<td>3-5 days</td>
<td>128</td>
<td>49.9</td>
</tr>
<tr>
<td>6-10 days</td>
<td>76</td>
<td>21.3</td>
</tr>
<tr>
<td>11-15 days</td>
<td>32</td>
<td>9</td>
</tr>
<tr>
<td>16-20 days</td>
<td>15</td>
<td>4.2</td>
</tr>
<tr>
<td>&gt;20 days</td>
<td>10</td>
<td>2.8</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>356</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

The most common duration of hospital stay of acute poisoning in the study period was 3-5 days (49.9%, n=128) followed by 6-10 days (21.3%, n=76) and 0-2 days (12.6%, n=45) as shown in Table 3. Longest hospital stay was more than 20 days in 2.8% (n=10).

Suicide (43.8%, n=156) was most common manner of acute poisoning followed by accidental poisoning (39.8%, n=142) as shown in Figure 1. In 16% (n=57) cases, the manner of poisoning was undetermined. No case of homicidal poisoning was reported.

Figure 1. Manner of poisoning.

Figure 2. Outcome of poisoning.
In majority of cases of acute poisoning in the study period were improved (77%, n=274) where as death occurred in 1.1% (n=4) cases as shown in figure 2.

**DISCUSSION**

A total of 356 cases of acute poisoning were admitted in the study period. The most common age group of acute poisoning was 20-29 years (36.23%) followed by 10-19 years (16.85%). The higher incidence of poisoning in younger age of 20-29 years could be due to stress, financial issues, family problem, occupational issues. This finding is similar to studies Gargi J et al, Vani Axita et al and Sanjeev K et al.

The incidence of acute poisoning was more in males 58.42% as compared to females 41.58% with male to female ratio 1.4:1. The could be due to males were exposed mental stress and financial problems. This finding is similar to observations made by Gargi J et al, Vani Axita et al and Vinay et al.

In 356 cases of acute poisoning, the poison was unknown in 55.6% followed by poisonous snake bite in 23.9% cases. This could be due to nature of poison was not known by patients. Karad being western part of Maharashtra, Snake bites are common. In contrast to this, studies have shown different poisons in different area like Gargi J et al (aluminium phosphide), Axita Vani et al (organophosphorus), Zaheer et al (aluminium phosphide),

Suicide was most common manner of acute poisoning followed by accidental poisoning. This could be due easy availability of poisons. This finding is similar to studies by Axita Vani et al, Thomas et al and Tufekci et al.

The most common duration of hospital stay of acute poisoning in the study period was 3-5 days followed by 6-10 days and 0-2 days. In majority of cases of acute poisoning in the study period were improved where as death occurred in 1.1% cases.

**Conclusion:** Young adult males of age group 20-29 years were common victims of poisoning with majority showing improvement. There should be strict implementation of law regarding sale of poisons.

**Acknowledgement:** Author acknowledges the great help received from all the faculty of Department of Forensic Medicine, Krishna Institute of Medical Sciences Karad, Maharashtra.

**Conflict of Interest:** No.

**Source of Funding:** Nil.

**Ethical Clearance:** The study was approved by Institutional Ethical Committee of Krishna Institute of Medical Sciences Karad, Maharashtra.

**REFERENCES**

Pattern of Homicidal Deaths among Autopsied Cases at
BIMS, Belagavi - a Two Year Retrospective Study

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Toxicology Belagavi Institute of Medical Sciences, Belagavi

ABSTRACT

A retrospective study was conducted at the Department of Forensic Medicine & Toxicology, BIMS,
Belagavi to determine the pattern of Homicidal deaths among cases autopsied at BIMS-Hospital
mortuary for period of 2 years from Jan 1st 2011 to Dec. 31st 2012. During the above said period of 2 years
a total number of 1541 cases were autopsied out of which 55 cases were homicidal in nature (3.56%).
Majority of victims fall in the age group of 20-29 yrs, 22 cases (40%). Sex wise distribution showed male
preponderance with 32 cases (58.18%). In the present study number of Homicidal deaths in rural areas
were more, 36 (65.41%). Among pattern of injuries observed death being caused by sharp weapon
inflicts were maximum, 19 cases (34.5%). As per information obtained from Police records property
dispute seemed to be main motive, 16 cases, (29%) followed closely by illicit relationship, 12(21.8%).

Keywords: Homicide, property dispute, sharp cutting weapon, Sec.300 IPC.

INTRODUCTION

Man by nature is a fighting animal. Hence to
imagine a society without crime will be a myth.
Sec. 300 IPC defines murder as the act by which
the death is caused, is done with intention of causing
death or with intention of causing such bodily injury
which offender knows to be likely to cause death or
such injury is sufficient in ordinary course at nature
to cause death.¹

NCRB Statistics notes an increase in number of
murders from 9082 cases (1953) to 34,434 cases (2012)
as increase by 251.3 %. Average number of cases
from 2007 to 2011 is 33,019. It is definitely alarming.
If attempt to murder cases are also to be considered
which alone is 35,138 in 2012, than in toto number of
cases in which a human being has tried to kill or
killed his fellow being amounts to 67,572- which is
extremely shocking.²

As the nation has progressed and is progressing
in terms of science, technology, information, GDP
growth, industrialization and in many more such
nation building fields, at the same time it is shocking
to note the increase in crime rate too, particularly
homicides.

But if we observe the homicidal rate, per lakh
population from 1995 (4.37)³ to 2011 (3.46) it shows
decreasing trend,⁴ some ray of hope.

Conviction rates in murder cases has been
disheartening too. Out of 1.27 lakh murders between
2005 to 2009, 44,601 have been convicted 36.2% .⁵
Conviction rates for crimes under IPC has dropped
from 62.7% in 1972 to 38.5% in 2012 .⁶

It is evident from above figures that statistics
play vital role in judging many factors like crime
rates efficient control measures, effectiveness of
investigation etc.

Hence this study was taken up to provide that
vital statistics from the region of Belagavi, which is
considered as 2nd capital of Karnataka state.

MATERIALS & METHOD

All the homicidal deaths registered U/S 302 IPC
autopsied at BIMS hospital mortuary from Jan1st
2011 to Dec 31st 2012 were included. Data regarding
age, sex, & area of distribution were obtained from
police records. Nature of Injuries and weapons of
offence noted from autopsy findings. Information
as to the motive for homicide was obtained from
police inquest, case dairy of police and even from interviewing deceased attenders.

**OBSERVATION AND RESULT**

- During the study period of 2 years a total number of 1541 cases were autopsied, out of which 55 cases (3.56%) were homicidal in nature.
- Age wise distribution showed maximum cases in the age group of 20-29 yrs (22 cases-40%) followed by age group of 30-39 yrs, 16 cases(29%), least number of cases were seen after age of 50 yrs (3.63%).[table-1]
  - Male preponderance was seen in sex wise distribution with 32 cases (58.18%).[table -2]
  - Cases from rural area were almost double than urban area, rural being 36 (65.4%) and urban 19(34.5%).[table-3]
  - Weapon of offence were sharp cutting weapons in 19 cases (34.5%) inflicting stab, chop and incised wound. Hard and blunt weapons were used in 11 cases (20%).
  - Asphyxia was Chosen as mode of causing death by offenders strangulation, smothering , throttling and drowning in 11 cases (20%).
  - Inflammable agents like petrol, kerosene were used to cause death in 11 cases(22%).
  - In only 2 cases weapon / agent of offence could not be traced.[table-4]
  - Property dispute has been the main motive for murder in 16 cases (29%) followed closely by illicit relationship in 12 cases (21.8%).[table-5]

**DISCUSSION**

According to study conducted by A.K. Shetty in Belagavi cases where sharp weapon is used as weapon of offence is maximum- 53.5%. Most of victim are in age group of 21 to 40 yrs (57%) and cases from rural areas (57%) are more than urban area. These are consistent with present study. Main motive for homicide is property dispute (29%)in present study which is in contrast to above study by A.K. Shetty where quarrel and provocation is main motive (36%).

In present study nature of Injuries being caused by sharp weapon is maximum which is consistent with the study conducted by Kohli and Aggarwal in north East Delhi,[7] Murthy O.P and Agnihotri A.K. in South Delhi (Ref). (8) But it is in contract to the study conducted by S.K. Pandey and Tripathi in Varanasi[9] and Murphy G. K. (10) in united states where firearms was most commonly used weapon.

Study conducted by Rastogi A. K, Singh B. K, Dadu S. K. et al[11] showed male preponderance among victims which is consistent with present study and blunt weapons as weapon of offence in maximum cases which is in contract to present study.

In a study conducted by Bashir M.Z, Saeed A. Khan D. et al[12] at Faisalabad, firearms was the most common weapon of offences (50%) which is in contract to present study. Male preponderance and age group of 3rd decade being more in above study is consistent with present study.

In a study conducted by Bhupendar S. Lenmar T. K, Syed A. M, (13) Blunt force was used in maximum cases for causing death which is in contrast to present study, where as male preponderance and victims age group in maximum cases is 20-39 yrs, are consistent with present study.

A study conducted by Buchade D, Mohite S. (14) in greater Mumbai shows that main motive for murder is property dispute, most victims were male and in age group of 21-30 yrs, all of which are consistent with present study. Whereas most common weapon of offence in above study is hard blunt object which is in contrast to present study where sharp weapons were predominated.
RESULTS

Table- I: Distribution of Victims Based on age.

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Age Group (Years)</th>
<th>No. of cases 2011</th>
<th>2012</th>
<th>Total</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Less than 09</td>
<td>1</td>
<td>4</td>
<td>5</td>
<td>9%</td>
</tr>
<tr>
<td>2</td>
<td>10-19</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>5.45%</td>
</tr>
<tr>
<td>3</td>
<td>20-29</td>
<td>13</td>
<td>9</td>
<td>22</td>
<td>40%</td>
</tr>
<tr>
<td>4</td>
<td>30-39</td>
<td>09</td>
<td>7</td>
<td>16</td>
<td>29%</td>
</tr>
<tr>
<td>5</td>
<td>40-49</td>
<td>04</td>
<td>01</td>
<td>05</td>
<td>9%</td>
</tr>
<tr>
<td>6</td>
<td>50-59</td>
<td>01</td>
<td>01</td>
<td>02</td>
<td>3.63%</td>
</tr>
<tr>
<td>7</td>
<td>60 and above</td>
<td>00</td>
<td>02</td>
<td>02</td>
<td>3.63%</td>
</tr>
</tbody>
</table>

Table-II: Distribution of Victims Based on Sex.

<table>
<thead>
<tr>
<th>Year</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>14</td>
<td>16</td>
</tr>
<tr>
<td>2012</td>
<td>18</td>
<td>07</td>
</tr>
<tr>
<td>Total</td>
<td>32</td>
<td>23</td>
</tr>
<tr>
<td>Percentage</td>
<td>58.18%</td>
<td>41.81%</td>
</tr>
</tbody>
</table>

Table-III: Area wise distribution of Victims.

<table>
<thead>
<tr>
<th>Year</th>
<th>Rural</th>
<th>Urban</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>19</td>
<td>11</td>
</tr>
<tr>
<td>2012</td>
<td>17</td>
<td>08</td>
</tr>
<tr>
<td>Total</td>
<td>36</td>
<td>19</td>
</tr>
<tr>
<td>Percentage</td>
<td>65.4%</td>
<td>34.5%</td>
</tr>
</tbody>
</table>

Table IV: Distribution of homicidal cases according to pattern of injuries.

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Pattern of Weapon</th>
<th>Pattern injuries</th>
<th>Year 2011</th>
<th>2012</th>
<th>Total</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sharp cutting weapon</td>
<td>Stab wound</td>
<td>04</td>
<td>05</td>
<td>19</td>
<td>34.5%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Chop wound</td>
<td>01</td>
<td>02</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Incised wound</td>
<td>03</td>
<td>04</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Hard and Blunt weapon</td>
<td>Head injuries (Cranio Cerebral Injuries)</td>
<td>05</td>
<td>06</td>
<td>11</td>
<td>20%</td>
</tr>
<tr>
<td>3</td>
<td>Asphyxia by</td>
<td>Strangulation Smothering Drowning Throttling</td>
<td>03</td>
<td>01</td>
<td>01</td>
<td>00</td>
</tr>
<tr>
<td>4</td>
<td>Inflammable</td>
<td>Burns</td>
<td>08</td>
<td>03</td>
<td>11</td>
<td>20%</td>
</tr>
<tr>
<td>5</td>
<td>Poison</td>
<td>Poisoning</td>
<td>01</td>
<td>00</td>
<td>01</td>
<td>1.8%</td>
</tr>
<tr>
<td>6</td>
<td>Not Known</td>
<td>Not Known</td>
<td>02</td>
<td>01</td>
<td>02</td>
<td>3.6%</td>
</tr>
</tbody>
</table>

Table V: Distribution of homicide cases based upon motive.

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Motive</th>
<th>No. of Cases in 2011</th>
<th>2012</th>
<th>Total</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Property dispute</td>
<td>08</td>
<td>08</td>
<td>16</td>
<td>29%</td>
</tr>
<tr>
<td>2</td>
<td>Illicit Relationship</td>
<td>05</td>
<td>07</td>
<td>12</td>
<td>21.8%</td>
</tr>
<tr>
<td>3</td>
<td>Dowry</td>
<td>04</td>
<td>05</td>
<td>09</td>
<td>16%</td>
</tr>
<tr>
<td>4</td>
<td>Political rivalry</td>
<td>00</td>
<td>02</td>
<td>02</td>
<td>3.6%</td>
</tr>
<tr>
<td>5</td>
<td>Quarrel and provocation</td>
<td>01</td>
<td>02</td>
<td>03</td>
<td>5.45%</td>
</tr>
<tr>
<td>6</td>
<td>Rape</td>
<td>02</td>
<td>00</td>
<td>02</td>
<td>3.6%</td>
</tr>
<tr>
<td>7</td>
<td>Murder for gain</td>
<td>02</td>
<td>03</td>
<td>05</td>
<td>09%</td>
</tr>
<tr>
<td>8</td>
<td>Not Known</td>
<td>03</td>
<td>03</td>
<td>06</td>
<td>10%</td>
</tr>
</tbody>
</table>
CONCLUSION

The very basic mind set of people where in they feel something can be/will be achieved by killing others is dangerous but the most dreaded mind set is where in they feel it is not that difficult to kill someone and go unpunished. Reasons for dispute or quarrel are manifold and invariably exist in every society. There are numerous peaceful and logical ways of settling them. As the most victims fall in the age group of 20-39 (69%) it is evident that the youth (be it accused or victim) are unable to control their rage and in that fit of anger they make the most worst decision of their lives.

If that moment of extreme anger, clouding one’s logical thoughts, can be controlled for few minutes by intervention of an elderly person most murders can be prevented.

Illiteracy, ignorance, trivial fights for property seems to be the main reason for increasing murders in rural areas.

Easy availability of weapons commonly used for agricultural purposes like sickle, axe etc is reason behind pattern injuries noted being caused by sharp weapons.

Conviction rate is getting down day by day and time period for a conviction to happen is in years. Witnesses over such long periods of trials are subjected to various pressures (be in fear, money threats Emotions etc) and finally many turn hostile. These factors have to greater extent reduced the fear of police and judiciary. Thus the dreaded mindset that one can escape from clutches of law even after committing such heinous crime. Unless and until that phobia is not created in minds of people that law can be harshest to those who break it any heinous crime, cannot be brought down significantly.

Acknowledgement – Nil

Ethical Clearance – Not applicable, as its a statistical analysis, wherein identity of autopsied has not been revealed.

Source of Funding – Self

Conflict of Interest - Nil

REFERENCES

5. Time of India 14th of Jan 2014.
Profile of Acute Poisoning Fatalities at Puducherry, Southern India

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ABSTRACT

Background: Acute poisoning cases are significant contributors of medical emergencies and unnatural deaths worldwide, and more so in developing countries like India. Critical analysis of factors related to these fatalities are pivotal to implement preventive steps. Aims: This study was aimed to assess the pattern & socio-demographic factors in victims of fatal poisoning. Materials & Methods: The present study is a cross sectional, descriptive study of 186 poisoning deaths autopsied at the IGGGH & PGI in Puducherry during the calendar year 2012. Victim’s data were gathered from interviews, autopsy procedure and results were analyzed. Results; Fatal poisoning cases were accounted for 11.92% of autopsies. Most victims were males (68.3%), between third and fifth decade of life (66%). Remarkably victims were from rural background (72%), Hindus (91%), Agricultural workers (45%), Married (67%), Illiterate (48%) and Lower income (54%) group. The predominant poison consumed was organophosphorus insecticides, followed by snake bites, alcohol and drug overdoses. The commonest manner was suicidal intent, and the most common reasons for poisoning were personal issues and family disputes. Conclusions: Legislation of sale and distribution of agricultural poisons & Education among vulnerable population alleviates the frequency of poisoning deaths.

Keywords: Acute Poisoning, Fatalities, Insecticides, Autopsy, Suicide.

INTRODUCTION

Acute poisoning is a medical emergency condition and it is associated with high morbidity and mortality. According to world health organisation (WHO), Poisoning is a major public health problem worldwide and highest fatalities are reported among agricultural workers of developing countries. It is estimated that 0.3 million people die each year due to various poisoning agents such as agrochemicals, medications and environmental agents. Acute poisoning is one of the commonest cause of mortality in India, but the exact number is unrealistic, since all poisoning deaths are not reported. Studies have revealed that intentional poisoning is commonest among adults and accidental poisoning is commonest in children. In India, medico-legal autopsy is mandatory in all fatal poisoning cases as death unnatural.

Presently, organophosphorus insecticides are the common poisoning agents used in rural India and Agricultural workers are a vulnerable group for intentional poisoning due to easy availability and stressful situations. Chronic diseases, failure in love and examination, loss of a loved one, emotional disturbances and accidental consumption are the common reasons for poisoning.

Hence this study is aimed at the analysis
and interpreting epidemiological factors related to poisoning deaths in the rural Pondicherry population.

**MATERIALS & METHOD**

The present descriptive research study was undertaken at the Indira Gandhi Government General Hospital and Postgraduate Institute, Puducherry (Union territory in South India) from 1st January to 31st December 2012. All poisoning related deaths, including snake bites, drug overdose cases autopsied at the study center were included in this study. Victim’s sociodemographic and epidemiological data like age, gender, residence, occupation, seasonal variations, poisonous agent, hospitalization details, the manner of death were recorded.

Data was collected by personal interview with the relatives of the deceased, eye witnesses and concerned police authorities. Further details of the victims were collected from the hospital case reports and dead body findings were personally examined at autopsy.

The collected data were analyzed manually as well as using the Microsoft excel package (2010). Statistical analysis was done for frequencies, percentages, proportions & ratios and results were interpreted.

**RESULTS**

A total of 1560 medico-legal autopsies were performed at the study centre, among them 186 deaths were related to acute poisoning and accounted for 11.9% of autopsies. Fatalities in males (68.3%) were more than two third of total fatalities compared with females (31.7%). The majority of the victims were in the age group of 21 to 50 years (66%), but individuals below 10 years and above 60 years of age were least affected. (Table 1)

The highest number of fatalities were reported among the rural population (72%), belonged to Hindu religion (91%), Illiterates (46.7%), Married (72.6%), Employed & Students (48%) and from lower socioeconomic status (54.3%) Agricultural workers (44.6%) including labourers were maximum affected occupants, followed by Unemployed (19.9%) and Housewives (11.3%). (Table 2)

It is evident that the bulk of poisoning incidents happened at daytimes (59%) between 6 AM and 6 PM, and also during evening hours between 6PM and 9PM. Nearly half of poisoning events were took place during rainy season (41.4%) and at home (53.2%). Over 80% of cases were hospitalised within 3 hours of poisoning and too many victims (64%) succumbed within first 2days. Illness (28.5%) and financial issues (24.7%) were revealed as the prominent reasons for intentional poisoning. The commonest manner of poisoning was suicide (79.6%), and followed by accidental poisoning (12.9%). The least manner of poisoning was noticed to be homicidal and in nine cases manner was undetermined. (Table 3)

The commonest poisoning agents used for acute poisoning were pesticides. Organophosphorus insecticides were associated with maximum fatalities compared to drugs, snakebites and environmental agents. Alcohol and snake bites related deaths were relatively significant in number. The exact poison was not determined in 11 cases. (Table 4)

**DISCUSSIONS**

In the present study poisoning cases contributed to 11.9% of medico-legal deaths, so the frequency was at a lower level than various studies conducted in India.\(^7\) The mortality in acute poisoning depends upon the nature of the poison, dose, immediate hospitalization, availability of medical facilities and standard care.

Males were affected twice more than that of females and this preponderance of males may be attributed to frequent exposure to stressful conditions, occupational exposure, hatred at home & workplace.\(^8,9\) Individuals aged between 21 and 50 years were regularly tangled in fatal poisoning, and more so by the married middle aged adults. But many other studies have reported that young adults between 16 & 25 years and persons aged between 30 and 39 years are mostly affected in poisoning deaths.\(^10,11\) These people are more likely exposed to greater financial burden, stress, family and marital disputes.

Rural population was worst affected with fatal poisoning than urban and semi-urban inhabitants, this finding is in concordance with many earlier studies because rural people are more geographically distributed, abundant availability of pesticides, venomous organisms and exposed to financial burdens.\(^12\) Greater proportion of fatalities were noticed
in illiterates, married and lower socioeconomic status and it is correlated with poor knowledge, financial status and stressful life.\textsuperscript{7,13} In India agricultural workers and labourers are critically prone to suicidal poisoning deaths from earlier times due to poverty, less problem solving abilities.\textsuperscript{14} Unemployed & housewives are other common group of people commit suicide by consuming poisons.

Seasonal variations with higher incidence in the summer season are reported in many poisoning studies, but in the present study, we noticed maximum cases in rainy seasons, the probable reasons could not damage to crops, loss of earnings. Fatal poisoning occurs more during daytime and at evening hours and in house are closely related to isolation, multifarious work, stress and strain.\textsuperscript{15} Multiple factors such as type & amount of poison consumed, availability of transportation, medical emergency services, and quality of medical care determines the prognosis of poisoned victim. Hence the timely availability of quality emergency medical services to the poisoned will play a crucial role in preventing mortalities.

The reasons for high incidence of suicidal poisoning in vulnerable population due to easily availability of household and agricultural poisons, frustration in life, too many problems, no strict enforcement of drug distribution and selling. The main reasons for intentional poisoning are physical and mental illness, financial issues and family issues.

Poisoning agents used varies with different countries, similar to the results of many other Indian studies, the commonest poison used in our study is organophosphorus compounds.\textsuperscript{16} Alcohol and drug overdoses are responsible for a significant number of fatalities in western countries, but in our study, they are next to organophosphorus compounds in acute poisoning fatalities.\textsuperscript{17}

\textbf{TABLES}

\textbf{Table 1: Age and gender-wise distribution of fatal poisoning cases}

<table>
<thead>
<tr>
<th>Age group</th>
<th>Male gender</th>
<th>Female gender</th>
<th>Total cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 10 years</td>
<td>05 (2.7%)</td>
<td>02 (1.1%)</td>
<td>07 (3.7%)</td>
</tr>
<tr>
<td>11 -20 years</td>
<td>10 (5.4%)</td>
<td>05 (2.7%)</td>
<td>15 (8.1%)</td>
</tr>
<tr>
<td>21 -30 years</td>
<td>26 (14%)</td>
<td>13 (7%)</td>
<td>39 (21%)</td>
</tr>
<tr>
<td>31 -40 years</td>
<td>27 (14.5%)</td>
<td>16 (8.6%)</td>
<td>43 (23.1%)</td>
</tr>
<tr>
<td>41 -50 years</td>
<td>28 (15.1%)</td>
<td>13 (7%)</td>
<td>41 (22%)</td>
</tr>
<tr>
<td>51 -60 years</td>
<td>19 (10.2%)</td>
<td>05 (2.7%)</td>
<td>24 (12.9%)</td>
</tr>
<tr>
<td>61 -70 years</td>
<td>08 (4.3%)</td>
<td>04 (2.1%)</td>
<td>12 (6.4%)</td>
</tr>
<tr>
<td>&gt; 70 years</td>
<td>04 (2.1%)</td>
<td>01 (0.5%)</td>
<td>05 (2.7%)</td>
</tr>
<tr>
<td>Total</td>
<td>127 (68.3%)</td>
<td>59 (31.7%)</td>
<td>186 (100%)</td>
</tr>
</tbody>
</table>

\textbf{Table 2: Sociodemographic characteristics in fatal poisoning cases.}

<table>
<thead>
<tr>
<th>Demographic characteristics</th>
<th>Categories</th>
<th>Number &amp; Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residence</td>
<td>Rural</td>
<td>134 (72%)</td>
</tr>
<tr>
<td></td>
<td>Semi-urban</td>
<td>28 (15%)</td>
</tr>
<tr>
<td></td>
<td>Urban</td>
<td>19 (10.2%)</td>
</tr>
<tr>
<td></td>
<td>Unknown</td>
<td>05 (2.7%)</td>
</tr>
<tr>
<td>Religion</td>
<td>Hindu</td>
<td>169 (90.8%)</td>
</tr>
<tr>
<td></td>
<td>Christian</td>
<td>09 (4.8%)</td>
</tr>
<tr>
<td></td>
<td>Muslim</td>
<td>05 (2.7%)</td>
</tr>
<tr>
<td></td>
<td>Unknown</td>
<td>03 (1.6%)</td>
</tr>
<tr>
<td>Educational status</td>
<td>Categories</td>
<td>Number &amp; Percentage</td>
</tr>
<tr>
<td>---------------------------------</td>
<td>-----------------------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td></td>
<td>Illiterate</td>
<td>87 (46.7%)</td>
</tr>
<tr>
<td></td>
<td>Education up to 12th standard</td>
<td>60 (32.2%)</td>
</tr>
<tr>
<td></td>
<td>Graduation &amp; above</td>
<td>33 (17.7%)</td>
</tr>
<tr>
<td></td>
<td>Unknown</td>
<td>06 (3.2%)</td>
</tr>
<tr>
<td>Socioeconomic status</td>
<td>Lower</td>
<td>101 (54.3%)</td>
</tr>
<tr>
<td></td>
<td>Middle</td>
<td>64 (34.4%)</td>
</tr>
<tr>
<td></td>
<td>Upper</td>
<td>15 (8.1%)</td>
</tr>
<tr>
<td></td>
<td>Unknown</td>
<td>06 (3.2%)</td>
</tr>
<tr>
<td>Marital status</td>
<td>Unmarried</td>
<td>52 (27.9%)</td>
</tr>
<tr>
<td></td>
<td>Married</td>
<td>125 (67.2%)</td>
</tr>
<tr>
<td></td>
<td>Divorced / widow</td>
<td>05 (2.7%)</td>
</tr>
<tr>
<td></td>
<td>Unknown</td>
<td>04 (2.2%)</td>
</tr>
<tr>
<td>Occupation</td>
<td>Student</td>
<td>13 (7%)</td>
</tr>
<tr>
<td></td>
<td>Housewives</td>
<td>21 (11.3%)</td>
</tr>
<tr>
<td></td>
<td>Agricultural workers</td>
<td>83 (44.6%)</td>
</tr>
<tr>
<td></td>
<td>Unemployed</td>
<td>37 (19.9%)</td>
</tr>
<tr>
<td></td>
<td>Employed &amp; businessman</td>
<td>23 (12.3%)</td>
</tr>
<tr>
<td></td>
<td>Others</td>
<td>09 (4.8%)</td>
</tr>
</tbody>
</table>

Table 3: Epidemiological factors in fatal poisoning cases.

<table>
<thead>
<tr>
<th>Epidemiological factors</th>
<th>Categories</th>
<th>Number &amp; Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Season</td>
<td>Summer (Feb to May)</td>
<td>58 (31.2%)</td>
</tr>
<tr>
<td></td>
<td>Winter (Oct to Jan)</td>
<td>51 (27.4%)</td>
</tr>
<tr>
<td></td>
<td>Rainy season (June to Sep)</td>
<td>77 (41.4%)</td>
</tr>
<tr>
<td>Time of poisoning</td>
<td>12pm - 6am</td>
<td>17 (9.1%)</td>
</tr>
<tr>
<td></td>
<td>6am - 12am</td>
<td>39 (20.1%)</td>
</tr>
<tr>
<td></td>
<td>12am - 6pm</td>
<td>72 (38.7%)</td>
</tr>
<tr>
<td></td>
<td>6pm – 12pm</td>
<td>58 (31.1%)</td>
</tr>
<tr>
<td>Place of incident</td>
<td>Home</td>
<td>99 (53.2%)</td>
</tr>
<tr>
<td></td>
<td>Agricultural field</td>
<td>26 (13.9%)</td>
</tr>
<tr>
<td></td>
<td>Roadside</td>
<td>21 (11.3%)</td>
</tr>
<tr>
<td></td>
<td>Working place</td>
<td>11 (5.9%)</td>
</tr>
<tr>
<td></td>
<td>Beach &amp; sea</td>
<td>19 (10.2%)</td>
</tr>
<tr>
<td></td>
<td>Hostel</td>
<td>04 (2.1%)</td>
</tr>
<tr>
<td></td>
<td>Unknown</td>
<td>06 (3.2%)</td>
</tr>
<tr>
<td>Survival period</td>
<td>&lt;2hours</td>
<td>10 (5.4%)</td>
</tr>
<tr>
<td></td>
<td>3-12hours</td>
<td>53 (28.5%)</td>
</tr>
<tr>
<td></td>
<td>13-24hours</td>
<td>56 (30.1%)</td>
</tr>
<tr>
<td></td>
<td>2-7days</td>
<td>48 (25.8%)</td>
</tr>
<tr>
<td></td>
<td>Above 1week</td>
<td>19 (10.2%)</td>
</tr>
<tr>
<td>Manner of poisoning</td>
<td>Suicidal</td>
<td>148 (79.6%)</td>
</tr>
<tr>
<td></td>
<td>Accidental</td>
<td>24 (12.9%)</td>
</tr>
<tr>
<td></td>
<td>Homicidal</td>
<td>05 (2.7%)</td>
</tr>
<tr>
<td></td>
<td>Undetermined</td>
<td>09 (4.8%)</td>
</tr>
<tr>
<td>Reason for poisoning</td>
<td>Illness</td>
<td>53 (28.5%)</td>
</tr>
<tr>
<td></td>
<td>Unemployment</td>
<td>16 (8.6%)</td>
</tr>
<tr>
<td></td>
<td>Financial issues</td>
<td>46 (24.7%)</td>
</tr>
<tr>
<td></td>
<td>Quarrel</td>
<td>22 (11.8%)</td>
</tr>
<tr>
<td></td>
<td>Examinations</td>
<td>08 (4.3%)</td>
</tr>
<tr>
<td></td>
<td>Love failure</td>
<td>14 (7.5%)</td>
</tr>
<tr>
<td></td>
<td>Loss of loved ones</td>
<td>05 (2.7%)</td>
</tr>
<tr>
<td></td>
<td>Business issues</td>
<td>07 (3.7%)</td>
</tr>
<tr>
<td></td>
<td>Unknown</td>
<td>15 (8.1%)</td>
</tr>
</tbody>
</table>
Table 4: Type of poison consumed in fatal poisoning cases

<table>
<thead>
<tr>
<th>Poisons</th>
<th>Number &amp; Percentage of cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organophosphates</td>
<td>74</td>
</tr>
<tr>
<td>Organochlorides</td>
<td>05</td>
</tr>
<tr>
<td>Rat poisons</td>
<td>08</td>
</tr>
<tr>
<td>Aluminium Phosphide</td>
<td>02</td>
</tr>
<tr>
<td>Hair dye</td>
<td>04</td>
</tr>
<tr>
<td>Alcohols</td>
<td>21</td>
</tr>
<tr>
<td>Phenol</td>
<td>03</td>
</tr>
<tr>
<td>Corrosives</td>
<td>02</td>
</tr>
<tr>
<td>Cyanide</td>
<td>01</td>
</tr>
<tr>
<td>Neurotics</td>
<td>09</td>
</tr>
<tr>
<td>Yellow oleander</td>
<td>05</td>
</tr>
<tr>
<td>Datura</td>
<td>02</td>
</tr>
<tr>
<td>Snake bite</td>
<td>15</td>
</tr>
<tr>
<td>Kerosene</td>
<td>03</td>
</tr>
<tr>
<td>Drug overdose</td>
<td>19</td>
</tr>
<tr>
<td>Crane poison</td>
<td>02</td>
</tr>
<tr>
<td>Unknown</td>
<td>11</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>186</strong></td>
</tr>
</tbody>
</table>

CONCLUSIONS

Fatalities due to acute poisoning are remarkably high in agricultural workers of rural population, and most of them are adult males. Suicidal intent is the commonest manner of death and homicide with poison is least. Organophosphorus compounds are the most common poisonous agent. Availability of medical emergency care centres & ambulance services during the early hours of poisoning in rural India will dramatically reduce mortalities and morbidities.

Acknowledgement: We express deep sense of gratitude to all the faculty members of Forensic Medicine Departments, Indira Gandhi Government General Hospital and Post-Graduate Institute (IGGGH & PGI) and Sri Manakula Vinayagar Medical College & Hospital, Puducherry for their support, help and guidance.

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Ethical Clearance: Obtained from Institutional ethical committee.

REFERENCES


Sex Determination Using Finger Print Ridge Density among the Medical Students of NIMS Medical College, Jaipur

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¹PG 2nd Year Forensic Medicine & Toxicology, NIMS Medical College, Shobha Nagar Jaipur, ²1st Year MA Applied Economics, Christ University, Bangalore, ³PG 3rd Year, ⁴Professor & HOD Forensic Medicine & Toxicology, NIMS Medical College, Shobha Nagar Jaipur

ABSTRACT

To determine the sex of an individual plays an important role among forensic pathologists and scientists particularly when the fingerprints recovered from the crime scene does not match any of the criminal record so in that case fingerprint ridge density plays an important role in determining the sex of an individual. The present study was done among the 100 medical students of NIMS Medical college (50 males and 50 females) shobha nagar, Jaipur. Finger ridge density was counted on the radial border of each print. Result of the study shows that females have higher number of fingerprint ridge density count as compared to males. Application of Baye’s theorem suggests that fingerprint ridge density count <14ridges/25mm² is more likely to be male while fingerprint ridge density count >14ridges/25mm² is more likely to be female.

Keywords: Finger print, Ridge density, Sex determination and Baye’s theorem.

INTRODUCTION

Determination of the absolute identity of an individual is known as identification. Nowadays newer techniques came into practice i.e. DNA fingerprinting for establishing the identity of an individual, but still the technique carries multiple short comings like the DNA profile of monozygotic twins is same so can’t be identified separately and this technique require good amount of nucleated sample . The technique is too costly to be afforded by the common man of India. But the fingerprints of an individual are unique, not even the monozygotic twins have the same prints. Study of the fingerprint is known as Dactylography or Dactyloscopy or Dermatoglyphics and at present also known as Henry-Galton system of identification¹. Finger print study is done by taking the impression of the patterns formed by the papillary ridges on the bulbs of the fingers and thumbs on unglazed paper with the help of printer’s ink²,3,4.

It is used in both civil and criminal cases because of their unique properties of absolute identity⁵. Even the portion of the palm which is bulged between the glove worn by a safe breaker has left sufficient details for the proof of identity⁶.

Many studies have been carried out on the determination of the most common type of pattern of fingerprint which has been conducted region wise. But very minute number of studies has been carried out to determine the sex of an individual by getting the chance prints at the scene of crime. It has been observed by the previous studies so by mine that the finger ridge density tend to be coarse and little in number in males as compared to females who have fine ridges and more in number. By the help of the fingerprint ridge count, we are able to detect the sex of the criminal whose chance finger prints are left at the scene of crime.
MATERIAL & METHOD

The study was conducted amongst the medical students of NIMS medical college, Jaipur. 100 students were selected randomly by taking verbal consent from them. Amongst the 100 students, 50 boys and 50 girls were selected in the age group of 18-24 years.

Students with any physical deformity or any allergy or skin disease are excluded from the study. They are fully explained about the procedure and the aim of the study.

Materials used in the study are:

1. Stamp pad
2. Magnifying glass
3. Transparent film strip
4. Pointer
5. Proforma.

Before taking the prints, subjects were asked to wash the hands properly. Dry the hands and then the prints were taken. Each finger is stained first on the blue colored stamp pad and pressed with moderate pressure over the space provided on the proforma. Impression of all the ten fingers is taken in the similar fashion. In this way, for every subject impression of ten fingers is taken. After taking the fingerprints, the upper portion of the radial border of each finger was chosen as an area of study because the entire fingerprint pattern showed a similar ridge flow in this area. Once the fingerprints are obtained the finger print ridges of the selected area 5X5 mm are counted which is drawn on a transparent fixed on the magnifying lens, by using a pointer. Counting is done from one corner to another.

Some important criteria’s were taken into account while carrying out the study- At the time of counting the ridges, we excluded the dots if present and forks if present are considered as two ridges. Thus the ridges are counted per 25mm² which would show the ridge density. Mean value of all the ten fingers of each individual and mean of individual fingers of all the subjects is calculated which gives the approximate number of ridges. Calculation of the study was done using SPSS software on computer. The likelihood ratio was calculated to obtain the probability inferences of males and females, based on ridge density. Likelihood ratio (LR) is based on Baye’s theorem,

\[ LR = \frac{Probability \ of \ a \ given \ fingerprint \ originating \ from \ male (c)}{Probability \ of \ a \ given \ fingerprint \ originating \ from \ female (c_1)} \]

RESULT: Ridge density in males falls from 10 to 16 while in females ridge density varies from 11 to 21 (Table 1).

<table>
<thead>
<tr>
<th>Ridge density</th>
<th>Total</th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>80</td>
<td>80</td>
<td>0</td>
</tr>
<tr>
<td>11</td>
<td>132</td>
<td>118</td>
<td>14</td>
</tr>
<tr>
<td>12</td>
<td>134</td>
<td>108</td>
<td>26</td>
</tr>
<tr>
<td>13</td>
<td>164</td>
<td>96</td>
<td>68</td>
</tr>
<tr>
<td>14</td>
<td>109</td>
<td>43</td>
<td>66</td>
</tr>
<tr>
<td>15</td>
<td>162</td>
<td>44</td>
<td>118</td>
</tr>
<tr>
<td>16</td>
<td>106</td>
<td>11</td>
<td>95</td>
</tr>
<tr>
<td>17</td>
<td>59</td>
<td>0</td>
<td>59</td>
</tr>
<tr>
<td>18</td>
<td>41</td>
<td>0</td>
<td>41</td>
</tr>
<tr>
<td>19</td>
<td>5</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>20</td>
<td>5</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>21</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>1000</td>
<td>500</td>
<td>500</td>
</tr>
</tbody>
</table>

Fingerprint density of 10 belonged to males only while ridge density of 17,18,19,20 & 21 belong to females only (Table 2). Ridge density of 11 is 89.39% for males and 10.60% for females while ridge density of 16 is 89.62% for females and 10.37% for males. (Table 2)
Table no. 2: Distribution of ridge density values between males and females

<table>
<thead>
<tr>
<th>Ridge Density</th>
<th>Total No.</th>
<th>Males</th>
<th></th>
<th></th>
<th></th>
<th>Females</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>% Within Group</td>
<td>No.</td>
<td>% Within Group</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>80</td>
<td>100</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>132</td>
<td>89.39</td>
<td>14</td>
<td>10.60</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>134</td>
<td>80.59</td>
<td>26</td>
<td>19.40</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>164</td>
<td>58.53</td>
<td>68</td>
<td>41.46</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>14</td>
<td>109</td>
<td>39.44</td>
<td>66</td>
<td>60.55</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>162</td>
<td>27.16</td>
<td>118</td>
<td>72.83</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>106</td>
<td>10.37</td>
<td>95</td>
<td>89.62</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>59</td>
<td>0</td>
<td>59</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>41</td>
<td>0</td>
<td>41</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>5</td>
<td>0</td>
<td>5</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>3</td>
<td>0</td>
<td>3</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table no. 3: Group statistics for males

<table>
<thead>
<tr>
<th>INDIVIDUAL FINGERS</th>
<th>STANDARD(Ω) DEVIATION</th>
<th>MEAN</th>
<th>STANDARD ERROR</th>
</tr>
</thead>
<tbody>
<tr>
<td>RT THUMB</td>
<td>1.35</td>
<td>11.7</td>
<td>.19</td>
</tr>
<tr>
<td>RT INDEX</td>
<td>1.60</td>
<td>11.9</td>
<td>.23</td>
</tr>
<tr>
<td>RT MIDDLE</td>
<td>1.60</td>
<td>12.5</td>
<td>.23</td>
</tr>
<tr>
<td>RT RING</td>
<td>2.7</td>
<td>13.1</td>
<td>.20</td>
</tr>
<tr>
<td>RT LITTLE</td>
<td>1.5</td>
<td>12.7</td>
<td>.22</td>
</tr>
<tr>
<td>LT THUMB</td>
<td>1.4</td>
<td>11.6</td>
<td>.20</td>
</tr>
<tr>
<td>LT INDEX</td>
<td>1.2</td>
<td>12.0</td>
<td>.17</td>
</tr>
<tr>
<td>LT MIDDLE</td>
<td>1.5</td>
<td>12.1</td>
<td>.22</td>
</tr>
<tr>
<td>LT RING</td>
<td>1.5</td>
<td>12.3</td>
<td>.22</td>
</tr>
<tr>
<td>LT LITTLE</td>
<td>1.6</td>
<td>12.0</td>
<td>.22</td>
</tr>
</tbody>
</table>

Table no. 4: Group statistics for females

<table>
<thead>
<tr>
<th>INDIVIDUAL FINGERS</th>
<th>STD. DEVIATION</th>
<th>MEAN</th>
<th>STD. ERROR</th>
</tr>
</thead>
<tbody>
<tr>
<td>RT THUMB</td>
<td>2</td>
<td>13.9</td>
<td>.28</td>
</tr>
<tr>
<td>RT INDEX</td>
<td>2.4</td>
<td>14.8</td>
<td>.34</td>
</tr>
<tr>
<td>RT MIDDLE</td>
<td>2.8</td>
<td>15.2</td>
<td>.30</td>
</tr>
<tr>
<td>RT RING</td>
<td>2.4</td>
<td>16.1</td>
<td>.30</td>
</tr>
<tr>
<td>RT LITTLE</td>
<td>2.1</td>
<td>15.5</td>
<td>.29</td>
</tr>
<tr>
<td>LT THUMB</td>
<td>1.6</td>
<td>14.3</td>
<td>.24</td>
</tr>
<tr>
<td>LT INDEX</td>
<td>1.8</td>
<td>15.2</td>
<td>.26</td>
</tr>
<tr>
<td>LT MIDDLE</td>
<td>2.1</td>
<td>15.6</td>
<td>.30</td>
</tr>
<tr>
<td>LT RING</td>
<td>1.9</td>
<td>15.6</td>
<td>.28</td>
</tr>
<tr>
<td>LT LITTLE</td>
<td>1.4</td>
<td>15.3</td>
<td>.20</td>
</tr>
</tbody>
</table>
Table no. 5: Showing Maximum, Minimum, Median and Mean ridge densities of both Males and Females.

<table>
<thead>
<tr>
<th>Total Sample</th>
<th>Maximum</th>
<th>Minimum</th>
<th>Median</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>16</td>
<td>10</td>
<td>13</td>
<td>12.2</td>
</tr>
<tr>
<td>Female</td>
<td>20.6</td>
<td>11</td>
<td>16.5</td>
<td>15.15</td>
</tr>
</tbody>
</table>

The analysis of present study shows that males have significantly lesser density of fingerprint ridge count than females (p<0.001).

Table no. 6: Probability densities & likelihood ratios derived from observed ridge densities.

<table>
<thead>
<tr>
<th>Ridge Density</th>
<th>Probability density</th>
<th>Likelihood Ratio</th>
<th>Favored Odds</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male (c)</td>
<td>Females (c₁)</td>
<td>Males (c/c₁)</td>
</tr>
<tr>
<td>10</td>
<td>0.16</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td>11</td>
<td>0.236</td>
<td>0.028</td>
<td>8.42</td>
</tr>
<tr>
<td>12</td>
<td>0.216</td>
<td>0.052</td>
<td>4.15</td>
</tr>
<tr>
<td>13</td>
<td>0.192</td>
<td>0.136</td>
<td>1.41</td>
</tr>
<tr>
<td>14</td>
<td>0.086</td>
<td>0.132</td>
<td>0.65</td>
</tr>
<tr>
<td>15</td>
<td>0.088</td>
<td>0.236</td>
<td>0.372</td>
</tr>
<tr>
<td>16</td>
<td>0.022</td>
<td>0.19</td>
<td>0.11</td>
</tr>
<tr>
<td>17</td>
<td>0</td>
<td>0.188</td>
<td>0</td>
</tr>
<tr>
<td>18</td>
<td>0</td>
<td>0.082</td>
<td>0</td>
</tr>
<tr>
<td>19</td>
<td>0</td>
<td>0.01</td>
<td>0</td>
</tr>
<tr>
<td>20</td>
<td>0</td>
<td>0.01</td>
<td>0</td>
</tr>
<tr>
<td>21</td>
<td>0</td>
<td>0.006</td>
<td>0</td>
</tr>
</tbody>
</table>

**DISCUSSION**

This study has been conducted on the medical students of NIMS Medical College to prove the hypothesis that females have more fingerprint ridge count density than males. Many studies have been carried out, but mainly on race determination and genetic inheritance. But this study gives us the differentiation of sex by counting the fingerprint density.

This study shows that males of NIMS Medical college have lesser number of fingerprint ridge count than females which corresponds with the study done by Gungadin and Nithin ⁷,⁸ who had done study on the south Indian population. The mean of Gungadin study in case of males is 12.80 while in case of females mean is 14.60 and the mean for males in Nithin study is 12.57 and for females is 14.15. These values are nearly same as that of my study showing mean for males 12.20 while that for females is 15.15.

On the other hand Acree carried out the study on Caucasian and African Americans and the values for the mean of fingerprint density count for males and females is:

<table>
<thead>
<tr>
<th>Groups</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caucasian</td>
<td>11.14</td>
<td>13.32</td>
</tr>
<tr>
<td>African Americans</td>
<td>10.90</td>
<td>12.61</td>
</tr>
</tbody>
</table>

According to the Gungadin and Nithin study ⁷,⁸ a ridge density of < 13 ridges/25mm² is more likely to be male and >14 ridges/25mm² is likely to be female. Acree ⁹ got a lesser value, who concluded that fingerprint possessing a ridge density of <11 ridges/25mm² is most likely to be male and fingerprint ridge density of >12 ridges/25mm² is more likely to be female.

The conclusions derived from my study are as follows:

1. Fingerprint ridge density of 10 ridges/25mm²
has 100% sensitivity and positive predictive value for males, only observed in males.

2. Fingerprint ridge density of 17-21 ridges/25mm² have 100% sensitivity for females as they are observed only in females.

3. Fingerprint ridge density of 13 & 14 ridges/25mm² are inconclusive in differentiating between males and females.

**CONCLUSION**

The result of the study helps us to differentiate sex of an individual. It can be of practical value to forensic pathologists and scientists in situations where there is retrieval of severed arm/hand/fingers or a chance/latent print at the crime scene.

**Acknowledgement:** I would like to appreciate and thank all the medical students who showed full cooperation and dedication throughout my study.

**Conflict of Interest:** Nil

**Source of Funding:** Self

**Ethical Clearance:** Not Required.

**REFERENCES**

2. Karmakar RN. J B Mukherjee’s Forensic Medicine and Toxicology. 3rd ed.; 2007: 166-173
Firearm Fatalities: A Postmortem Study in a Northeastern State of India

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ABSTRACT

Background: Firearm injuries are one of the most common causes of death all across the world, and different places have different incidence and pattern of firearm injuries. Methods: The materials for this study comprised all firearm fatalities, presented to the mortuaries of the two medical colleges in Manipur, a small northeastern state of India, during the period of April 2010 to March 2014. A thorough analysis of the history and post-mortem findings of the firearm victims was carried out to find out the pattern of fatal firearm injuries and the findings were statistically analyzed. Results: Out of the total 2046 cases brought for autopsy, 12.95% were cases of firearm fatalities. Male victims outnumbered the female victims; the mean age being 34.05 years. The highest number of deaths occurred during late evening and night hours, and the nature of death was homicidal in 92.45% of cases. Single entry wound was observed in 30.94%, double entry wounds in 16.98% and multiple entry wounds in 52.08 % of the cases. Most of the suicide cases had a contact or close or near range of fire. Conclusion: It may be concluded that the state has a relatively higher number of firearm fatalities compared to other parts of the country and homicidal motive was common. The majority of the victims were males in the age group of 20 to 40 years, and multiple entrance wounds were common in the homicidal firearm deaths.

Keywords: Manipur, firearm fatalities, homicide, suicide, range of fire.

INTRODUCTION

All across the world, firearm fatality is a global health problem destroying many lives every day. The prevention of firearm fatality needs identification of the risk factors. According to the World Health Organization, firearms are used in two thirds of all homicide cases and one fifth of suicide cases.¹ In the USA, there are 30,000 firearm-related deaths every year.² Moreover, the incidence of gunshot wounds in civilian trauma has increased in many parts of the world, sometimes approaching epidemic level e.g. Brazil, Columbia and United States of America.³ In our country also firearm injury is one of the important causes of morbidity and mortality. There has been a continuous increase in the incidence of firearm injuries in recent years because of an increase in interpersonal violence, dacoity, robberies, caste feuds, terrorism, easy availability of illegal country made guns and refinement in ballistics - automatic & semi-automatic firearms.⁴

Manipur is a small state in the northeastern part of India with an incidence of 6.11 firearm deaths per 1,00,000 population in the year 2008, and most of these deaths were attributed to separatist violence.⁵ This retrospective study has been undertaken in the two medical colleges of Manipur to find out the pattern of fatal firearm injuries as regards the types of the victims, nature of the injuries and other factors associated with such injuries.

MATERIALS & METHOD

The materials for this descriptive study comprised
all firearm fatalities, presented to the mortuaries of the two medical colleges in Manipur viz. Jawaharlal Nehru Institute of Medical Sciences and Regional Institute of Medical Sciences, Imphal during the period of April 2010 to March 2014. After obtaining the institutional ethical committee approval, a thorough analysis of the history and post-mortem findings of the firearm victims was carried out to find out the pattern of fatal firearm injuries as regards the sex, age, caste of the victims. Diurnal variations, number of the shots and range of fire, motive/intent of firearm injury, nature of injuries, etc. were also studied and the findings were statistically analyzed. The results are expressed in mean and percentages, and chi-square and p-value were calculated wherever applicable; p-value of <0.05 was considered significant.

RESULTS

Out of the total number of 2046 autopsies, 265 cases were firearm deaths (12.95%). It is evident from Table 1 that males outnumbered the females and the maximum number of victims was observed in the age group of 20 to 40 years (64.15%), the mean age being 34.05 years. Meiteis (an ethnic group in valley area) were the common victims (54%) followed by Manipuri tribals (27%) as shown in Fig 1. The highest number of deaths occurred during the late evening and night hours (Fig 2). The manner of death was determined in all the cases with 92.45% of cases identified as homicide, 6.04% as suicide and 1.51% as accident. Single entry wound was observed in 30.94%, double entry wound in 16.98% and multiple entry wounds in 52.08% of cases. In suicides, 62.50% of the cases had single entrance wounds and 37.50% had multiple entrance wounds. In homicides, 16.33% had double entry wounds, while 55.92% had multiple entry wounds (Fig 3). Interestingly, a victim in the present study sustained forty eight shots. As shown in Fig 4, in homicide, 86.12% of the cases were shot from a distant range and only 4.08% were shot from contact and 9.80% from close or near ranges. In suicides, shots fired from a contact range in 62.5% and from a close or near range in 37.5% of the cases. It is evident from Table 2 that significant association between nature of death and number of entrance wounds ($\chi^2 = 7.935$, p-value = 0.0048) was observed in the study, and the range also showed significant association with nature of death ($\chi^2 = 68.113$, p-value = 0.000).

DISCUSSION

Different places have different incidence and pattern of firearm injuries. In a study by Myint et al.[6] in Bangkok, it was observed that, out of 7,126 unnatural deaths, 2.1% (n=149) were due to firearm injuries whereas in a study by Kohli et al.[7] in Delhi, out of the total of 7,034 autopsies, 1.5 % were cases of firearm fatalities. Similarly, in another study by Hugar et al.[8] in Bangalore, the incidence of firearm deaths was only 1.75%, while in Surat, Prajapati et al.[9] observed that it was 4.22% of the total number of cases. In contrast to these findings, firearm fatalities constituted 12.95% of the autopsy cases in this study. This difference could be explained by the insurgency problem in this part of the country. Interestingly, Manipur is home to the highest firearm murder rate in the country and Imphal, the capital of Manipur, exhibits the highest rate of autopsies on gunshot victims.[5] On the other hand, in a study in Karachi, Pakistan by Mirza et al.,[10] it was observed that out of the 2006 autopsies performed, 47.05% (n=944) medico legal deaths were due to firearms, and the workers attributed this higher incidence to the deteriorating law and order situation in their country.

In the present study, it was observed that 97.74% of the victims were males and the commonest age group was 20 to 40 years (64.15%), the mean age being 34.05 years. Meiteis (an ethnic group in valley area) were the common victims (54%) followed by Manipuri tribals (27%) as shown in Fig 1. The highest number of deaths occurred during the late evening and night hours (Fig 2). The manner of death was determined in all the cases with 92.45% of cases identified as homicide, 6.04% as suicide and 1.51% as accident. Single entry wound was observed in 30.94%, double entry wound in 16.98% and multiple entry wounds in 52.08% of cases. In suicides, 62.50% of the cases had single entrance wounds and 37.50% had multiple entrance wounds. In homicides, 16.33% had double entry wounds, while 55.92% had multiple entry wounds (Fig 3). Interestingly, a victim in the present study sustained forty eight shots. As shown in Fig 4, in homicide, 86.12% of the cases were shot from a distant range and only 4.08% were shot from contact and 9.80% from close or near ranges. In suicides, shots fired from a contact range in 62.5% and from a close or near range in 37.5% of the cases. It is evident from Table 2 that significant association between nature of death and number of entrance wounds ($\chi^2 = 7.935$, p-value = 0.0048) was observed in the study, and the range also showed significant association with nature of death ($\chi^2 = 68.113$, p-value = 0.000).
crimes was in the morning (114, 42.54%). However, Kumari et al.\cite{4} observed that the maximum numbers of firearm injury cases were reported during night hours (>50%). Hagras and Kharoshah,\cite{13} and Mohanty et al.\cite{14} also observed that most of the crimes occur during night time. In our study also late evening time and night showed higher rate of firearm injuries, and this may be due to the fact that generally most violent crimes occur during late hours.

Sachan et al.\cite{15} in a study in Kanpur, observed that the nature of firearm deaths were homicidal in 92%, while suicidal and accidental cases were 2% each. Similarly in our study, 92.45% of cases were homicides and 6.04% were suicides. Similar findings were observed by Mirza et al.\cite{10} This is in contrast to the observation of Wintemute\cite{16} in the United States where most deaths from firearm violence are suicides (60.5%).

In a study in Saudi Arabia by Magdy et al.\cite{17}, it was observed that in the majority of cases (56.3%), a single shot was fired while in 15.6% of cases, there were two shots. In a study by Kumari et al.\cite{4}, single entry wound was observed in 74.6%, double entry wound were in 6.8% and multiple entry wound in 18.6% of cases. On the contrary, in our study, multiple shots were fired in 52.08% and single shots were fired in 30.9% while 16.98% sustained double shots. However, an interesting finding in these studies is that multiple entrance wounds are common in homicidal firearm deaths. In a study by Myint et al.\cite{6}, most of the cases of suicide had single entrance wound and only 4 had multiple entrance wounds \cite{6}. In our study also, 6 cases (37.50%) of the suicides sustained 2 or more entry wounds. Various workers have also reported about suicides with multiple entrance wounds \cite{18-20}.

Distant range fire was observed in 65.6% of cases in a study Magdy et al.\cite{17} in Saudi Arabia. A close or distant shot has been the range of fire determined in the majority of homicide cases,\cite{21,22} while a contact/near contact shot is the range of fire in the majority of suicide cases.\cite{21,23,24} Similarly in the present study, 86.12% of the homicide cases, the shots were fired from a distant range; however, 4.08% of these cases were shot from a contact range and all the suicide cases had shots fired from contact/close range.

Myint et al.\cite{6} observed that the range of fire showed significant association with manner of death (χ² = 112.306, p-value = 0.000) and there was significant association between manner of death and number of entrance wound (χ² = 25.942, p-value = 0.000). The findings of the present study also showed significant association between the nature of death and number of entrance wounds (χ² = 7.935, p-value = 0.0048), and the range also showed significant association with nature of death (χ² = 68.113, p-value = 0.000).

### Firearm fatalities: a postmortem study in a northeastern state of India

#### TABLES & FIGURES

**Table No. 1. Showing the age and sex distribution of the victims**

<table>
<thead>
<tr>
<th>Age in years</th>
<th>Male</th>
<th></th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>%</td>
<td>No.</td>
</tr>
<tr>
<td>0 to 10</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>&gt;10 to 20</td>
<td>17</td>
<td>6.41</td>
<td>1</td>
</tr>
<tr>
<td>&gt;20 to 30</td>
<td>108</td>
<td>40.75</td>
<td>0</td>
</tr>
<tr>
<td>&gt;30 to 40</td>
<td>61</td>
<td>23.02</td>
<td>1</td>
</tr>
<tr>
<td>&gt;40 to 50</td>
<td>47</td>
<td>17.74</td>
<td>2</td>
</tr>
<tr>
<td>&gt;50 to 60</td>
<td>24</td>
<td>9.06</td>
<td>0</td>
</tr>
<tr>
<td>&gt;60 &amp; above</td>
<td>2</td>
<td>0.75</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>259</td>
<td>97.74</td>
<td>6</td>
</tr>
</tbody>
</table>

---
Table 2. Showing the relation between the nature of deaths and the range of fire and the no. of entrance wounds

<table>
<thead>
<tr>
<th>Findings</th>
<th>Non-suicide (Homicide + Accident)</th>
<th>Suicide</th>
<th>Total</th>
<th>Chi-square</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of entrance wounds</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Single</td>
<td>72</td>
<td>10</td>
<td>82</td>
<td>7.935</td>
<td>0.0048</td>
</tr>
<tr>
<td>• Double/Multiple</td>
<td>177</td>
<td>6</td>
<td>183</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Range of fire</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Contact/Close &amp; Near</td>
<td>37</td>
<td>16</td>
<td>53</td>
<td>68.112</td>
<td>0.0000</td>
</tr>
<tr>
<td>• Distant</td>
<td>212</td>
<td>0</td>
<td>212</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

CONCLUSION

Firearm fatalities destroy several lives everyday all across the world. From this study, it may be concluded that the state of Manipur has a relatively higher number of firearm fatalities compared to other parts of the country and homicidal motive was common in these cases. The majority of the victims were males in the age group of 20 to 40 years, and multiple entrance wounds were common in homicidal firearm deaths.

Acknowledgement: Nil

Source of Funding: Nil

Conflict of Interest: Nil
REFERENCE


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An Autopsy Based- Retrospective Study of Corrosive Poisoning Cases

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ABSTRACT

This study pertains to observe the extent of injuries due to ingestion of corrosive poisons. Post-mortem reports and clinical records of victim of poisoning autopsied during the period of January 2013 to December 2014 at Department of Forensic Medicine and Toxicology, NDMC Medical College and Hindu Rao Hospital, New Delhi, were analyzed retrospectively. Out of 376 medico-legal autopsies conducted during the study period, poisoning contributed to 83 cases of which Corrosive poisoning comprised 27 cases. Commonest age group was between 21 to 30 years Involving 9 (33.33%) cases. Males have outnumbered females with 63% cases. Manner of death was suicidal (81%) in most of the cases. Perforations observed in the stomach wall in 22% cases while internal lesions without perforations were seen in 78% of cases. Maximum number of mortality (56%) were observed with in first 24 hours of hospitalization after ingestion of corrosive poison.

Keywords: Corrosive poison, perforation, mortality, hospitalization.

INTRODUCTION

Corrosive ingestion is a common cause of upper gastrointestinal tract injury across the globe but the burden is more in developing countries¹. It is cheap, easily available and commonly used in the household for drain cleaning and cleaning toilets and basins². Both acids and alkalies when ingested act as corrosives and produce considerable and progressive injuries to the upper gastrointestinal tract. Magnitude of such injuries depend upon many factors such as nature, volume, concentration, duration of exposure, age of the patient and the manner with which the corrosive was consumed. Gastric perforations and peritonitis are present with acute life threatening emergencies.

Poisons are substances that cause disturbance to organisms when a sufficient quantity is absorbed usually by chemical reaction or other activity on the molecular scale³. Poisoning causes damage or injury to the body due to its exposure by means of ingestion, inhalation or contact⁴.

MATERIAL & METHOD

The present study was based on the retrospective analysis of the autopsy cases conducted in the Department of Forensic Medicine & Toxicology, NDMC Medical College and Hindu Rao hospital over a period of two years (Jan 2013 to Dec 2014). Total 376 cases of autopsy were conducted in this period, of which 83 cases were of poisoning of all types including corrosive poisoning seen in 27 cases. The key variables such as age, sex, manner, survival time etc. were analyzed from various sources such as post mortem reports, police inquest papers and hospital records.

The clinical data and cause of death were ascertained from the hospital records. Information and various other inputs relating to the time of incidence, manner of incidence etc of corrosive poisoning gathered from the police. All these observations were
later corroborated with the postmortem findings to facilitate the overall process of analysis.

**OBSERVATIONS**

A total number of 83 poisoning cases were autopsied in the department of Forensic Medicine over a period of 2 years (Jan 2013 to Dec 2014), among these 27 cases were of corrosive poisoning of which 6 cases were associated with gastric perforation.

**Table 1: Age distribution of cases:**

<table>
<thead>
<tr>
<th>Age</th>
<th>No of cases</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>00-10</td>
<td>3</td>
<td>11.11 %</td>
</tr>
<tr>
<td>11-20</td>
<td>5</td>
<td>18.52 %</td>
</tr>
<tr>
<td>21-30</td>
<td>9</td>
<td>33.33 %</td>
</tr>
<tr>
<td>31-40</td>
<td>7</td>
<td>25.93 %</td>
</tr>
<tr>
<td>&gt; 40</td>
<td>3</td>
<td>11.11 %</td>
</tr>
<tr>
<td>Total</td>
<td>27</td>
<td>100 %</td>
</tr>
</tbody>
</table>

In this study, age group showing highest incidence (33.33%) of corrosive poisoning was 21-30 years, followed by 31-40 years with 25.93% of cases.

**DISCUSSION**

In the present study the highest number of mortality is seen in the age group 21-30 years (table 1), while the male to female ratio was observed to be 1.7:1, indicating males outnumbered females (Fig. 1). According to the study Armani SC et al\(^5\) similar pattern has been showed with male to female ratio of 1.24:1. The study by Ramesha KN et al\(^6\) has also found results on the similar pattern. However, in the study of Dey S et al\(^2\) incidence of corrosive poisoning was higher in females than males.

While the suicidal incidences (Fig. 2) being the commonest amongst all age groups, significant mortality have been found in children due to accidental ingestion. The above finding show stark similarity with the findings observed in the pattern of manner of deaths by Dey S et al\(^2\).
In the nature of severity of injuries, the perforation in the stomach wall has been observed in 6 cases out of 27 cases (Fig. 3) while other cases have showed the moderate to severe type of internal injuries without perforation of stomach wall. This study showed similarity to the study performed by Zamir et al\(^7\) and study conducted by Chibeshev et al\(^8\).

Cases after ingestion of corrosive poison received as brought dead (37%) in the casualty and within first 24 hours of hospitalization (56%) (Fig. 4) sufficiently pointing towards the lethal nature of corrosives poisons.

**CONCLUSION**

This study shows that the incidence of deliberate self harm by using corrosives is increasing amongst the urban population in developing countries. The mortality as a result of corrosive poisons intake can be sufficiently reduced by adopting an aggressive multidisciplinary approach including an early medical management.

**Acknowledgement** : Nil

**Ethical Clearance** : Nil

**Source of Funding** : Self

**Conflict of Interest** : Nil

**REFERENCE**


2 Subrata Dey, Indira Dey, Bhaskar Das and Dipayan Ghosh; Epidemiology of oesophageal stricture and its outcome: a study among patients attending a tertiary hospital of Kolkata; Al Ameen J Med Sci 2013; 6(2):176-179


6 Ramesha KN, Krishnamurthy BHR, Ganesh SK; Pattern and outcome of acute poisoning cases in a tertiary care hospital in Karnataka, India. IJCCM. 2009; 13(3):152-155.


A Perforating Wound of Head: An Unusual Case

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ABSTRACT

Objective: To report the correlation of force and extent of perforating injury to head.

Material and Method: This case was brought to mortuary of Late Baliram Kashyap Memorial Government Medical College, Jagdalpur, Bastar, Chhattisgarh, for post-mortem examination, with history of injury by iron rod falling from a tree. Result: The extent of injury retrospectively explains the amount of force sufficient to cause perforating injury to head. Conclusion: Force of 1.0625 kg m/s (N) per square cm on skull is sufficient to perforate the bone.

Keywords: Head injury, perforating injury.

INTRODUCTION

Laceration over scalp and perforating fracture of skull with inward displacement of fractured fragment may indicate injury by a projectile. In scalp it is difficult to find the typical results of firearm entry wound, the surgical intervention may aggravate the problem. In unwitnessed or suspicious circumstances similar injury may raise doubts on the possibility of such an extensive injury by fall of small metallic rod.

In present case the witnessed incidence and the presented data were used to retrospectively explain the amount of force sufficient to cause fatal perforating injury to head.

CASE: 10 years old male was brought to mortuary of govt. medical college Jagdalpur. As per police requisition- boy was struck on head by the iron rod (Fig. 4) falling from tree (~ 22 ft), the incidence witnessed by many. The rod was pulled by the villagers. Boy started bleeding and gradually lost consciousness. He was admitted to this hospital on same day but expired in the night during treatment. Autopsy was conducted on next morning. Blood stained hospital bandage was present around head. Scalp around wound was shaved. A single laceration over scalp in frontal region was present 2.5 cm in diameter with two stitches in situ. Underlying bone had a round perforating fracture of 1.5 cm diameter (Fig. 1 and 2). There was bevelling at inner table of skull in oval shape. The fractured fragment was found in extradural space below the injury. Underscalp haematoma (Fig. 1), meningeal tear, extradural, subdural haematoma and subarachnoid haemorrhage were present. Sagittal sinus was perforated and had scanty clots. Medial surface of frontal lobe of brain was lacerated corresponding to external injury up to depth of 4 cm (Fig. 3) bilaterally more so on left side. Liquifactive necrosis was evident around the injury. The boy died due to shock and haemorrhage due to rupture of sagittal sinus associated with injury to brain.

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Fig. 1- Underscalp haematoma and skull fracture.
The iron rod (length- 60 cm, weight- 235 gm, diameter- 0.78 cm) was brought by police for examination, which had blood, rust and mud stains. 

The mass of the rod has potential energy \( P.E_r \) of \( m \cdot g \cdot L/2 \). Centre of mass of rod (Length of rod- \( L_\text{r} \)) = \( L_\text{r}/2 \), Mass of the rod = \( m \), acceleration due to gravity = \( g \). When it falls to the ground this \( P.E \) is converted to kinetic energy \( (K.E_r) = \frac{1}{2} \cdot m \cdot V_\text{r}^2 \) (\( V_\text{r} \) - velocity).

\[
P.E_r = K.E_r \\
m \cdot g \cdot L_\text{r}/2 = \frac{1}{2} \cdot m \cdot V_\text{r}^2
\]

Velocity \( (V_\text{r}) \) of the rod falling = 2.43 m/s.

Time \( (t) \) taken by the rod to hit surface from the height of 6.71 m = 1.13 sec (calculated by actual experiment).

\[
F_r = m \cdot a = m \cdot \Delta V / \Delta t = 0.235 \cdot 2.43/1.13 = 0.51 \text{ kg m/s (N)}
\]

Cross sectional area of iron rod \( (A_\text{r}) = \pi \cdot r^2 \) radius \( (r) = 0.0039 \)

\[
A_\text{r} = 3.14 \cdot (0.0039)^2 = 0.000048 \text{ m}^2
\]

The Force \((F_\text{r})\) of 0.51 kg m/s (N) acting on surface area \((A_\text{r})\) 0.000048 m\(^2\) (0.48 cm\(^2\)) = 1.0625 kg m/s (N) of force acting per square cm on skull bone (covered with hairs and scalp) is sufficient to perforate the bone.

**DISCUSSION**

Force required to fracture a cadaveric skull (400-600 pounds) or empty human skull (25 inch pound) are calculated in experimental conditions\(^2\). In present case force causing perforating fracture is calculated retrospectively. A case of penetration of metallic rod in head (penetrated approximately 3.5 cm into the brain parenchyma of the right fronto-parietal region) was reportedly saved after surgery\(^1\). In present case after trauma death was hastened primarily due to removal of rod as first aid. Cranial concentric fractures due to blunt force trauma are internally bevelled, against externally bevelled fractures resulting from ballistics trauma\(^3\), the finding was similar in this case.

During surgical removal of impacted object the path of trajectory is followed in reverse direction. The manipulation may change the appearance of defect. In low kinetic energy, projectile make oval holes on the outer table of the skull and round holes on the inner table with radial prominences on the walls of projectile channels, large bone fragments; in moderate kinetic energy--make round holes in the outer table and oval on the inner table with skew prominences on the walls of the outlet part of the channels, large and middle-sized flat bone fragments; in high kinetic energy injuries on both tables were round, prominences were cross, bone fragments were flat, small and middle-sized\(^7\). The round hole in outer table and oval one in the inner were found in the...
present case.

A perforative impact produces a hole defect the shape of which depends on bullet speed. A bursting impact of the bullet causes disruption of the bone tissue outside the bullet defect as a result of an additional radial effect of high pressure of the air wave reaching in the wounds inflicted by high-speed bullets the effect of the hydrodynamic shock in the spongy layer of the flat bone. Resultant morphological manifestations are aggravated by damage caused by hydrodynamic shock coming from the cranial cavity. The absence of such effects indicated lower velocity of the projectile.

Depending on the mass, velocity, direction and site of impact of the bullet, gunshot wounds to the skull vault usually show two patterns of fractures: radial fractures originating from the point of impact and concentric fractures cantered around the entrance or exit wound. In the present case absence of radiating or concentric fractures were observed with the low speed projectile. The displacement of fractured fragment in extradural space below fracture also indicated low velocity of projectile.

CONCLUSION

Force of 1.0625 kg m/s (N) per square cm on paediatric skull is sufficient to perforate the bone.

Conflict of Interest: There is no conflict of interest between the authors, investigating agency or institute in any form in this case.

Source of Funding: There is no issue of funding in this case.

Ethical Clearance: There is no issue of ethical clearance in this case, as no human or animal experiment was conducted and the procedure followed was a routine one.

Acknowledgement – Nil

REFERENCES

7. Dubrovin I.A.- Forensic-medical significance of the characteristics of gunshot perforating fractures of the skull bones [Article in Russian]. Sud Med Ekspert. 2006 May-Jun; 49 (3); 3-5.
Socio-demographic Profile of Cases of Hanging Autopsied in Bengaluru

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¹Assistant Professor, Department of Forensic Medicine, Krishna Institute of Medical Sciences Karad, Maharashtra, ²Associate Professor, Department of Forensic Medicine, ³Professor, Dean and Director, Bengaluru Medical College and Research Institute, Bengaluru

ABSTRACT

Background: Hanging is that form of asphyxia, which is caused by partial or complete suspension of the body by a ligature around the neck, the constricting force being the weight of the body. Aim of the study: The purpose of the study is to know the socio-demographic profile of cases of hanging. Materials and methods: A cross sectional study of a total of 105 cases of hanging was conducted in the Department of Forensic Medicine, Victoria Hospital over a period of 20 months from November 2009 to June 2011. The data was collected from the information furnished by deceased relatives and police and post mortem examination and analysed with Microsoft excel and presented as descriptive statistics. Results: Age group of 20-29 years (53.33%) were most vulnerable to commit suicide by hanging followed by 30-39 years (20.95%) with male: female ratio 3:2. Majority of the people (89%) committed suicide at their residence. Conclusion: - Young male of age group 20-29 years who belonged to Hindu religion committed suicide by hanging commonly at their residence.

Keywords: Hanging, suicide, autopsy

INTRODUCTION

Hanging is that form of asphyxia, which is caused by partial or complete suspension of the body by a ligature around the neck, the constricting force being the weight of the body.¹ It is one of the most commonly used methods for suicide as it is a simple but effective way². In India, it is among the top five methods of choice for committing suicide. According to the NCRB (National crime reports bureau) report 2009, the incidence of suicide by hanging in India is 31.7% in 2007, 32.2% in 2008 and 31.5% in 2009³.

Hanging is a common means of suicide among younger people belonging to the lower socio-economic group of the society, and is usually committed in familiar surroundings with ligature materials easily available to the victim⁴. Hanging, as the method of suicide, was found to be more prevalent among males in comparison to females with maximum number of cases in 21- 30 year’s age groups⁵.

The reasons for suicide attempts are multiple either single or combination. Family problems, illness, divorce, dowry, love affairs, cancellation or the inability to get married (according to the system of arranged marriages in India), illegitimate pregnancy, extra-marital affairs, and such conflicts relating to the issue of marriage, play a crucial role, particularly in the suicide of women in India⁶.

Virtually all hangings are suicides until unless otherwise proved contrary⁷. The purpose of the study is to know the socio-demographic profile of cases of hanging autopsied at Victoria Hospital, Bengaluru.

MATERIALS & METHOD

A cross sectional study of a total of 105 cases of hanging and was conducted in the Department of Forensic Medicine, Victoria Hospital over a period of 20 months from November 2009 to June 2011. The data was collected from the information furnished by deceased relatives and police and post mortem examination and analysed with Microsoft excel and
The above figure clearly depicts that deceased having PUC educational statuses were succumbed to hanging followed by high school and degree.

Table 1. Distribution of cases of hanging according to religion.

<table>
<thead>
<tr>
<th>Religion</th>
<th>Number(n=105)</th>
<th>Percentage</th>
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<tr>
<td>Hindu</td>
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<tr>
<td>Christian</td>
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<td>01</td>
<td>0.95</td>
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</table>

In the present study, majority were Hindus (90.47%) followed by Christians (4.76%).

The above figure clearly shows that age group of 20-29 years (53.33%) were most vulnerable to commit suicide by hanging followed by 30-39 years (20.95%). 74.28% of the cases belong to the age group 20-39 years involving the most productive age group of any population.

Males (58%) were commonly committed suicide by hanging than females (42%), indicating a male: female ratio of nearly 3:2 in the study.

In the present study, it is observed that 64 cases (61%) were complete hanging as compared to 41 cases (39%) of partial hanging.
The above figure shows atypical hanging (93%) was more common in comparison with typical hanging (7%).

**DISCUSSION**

In the present study it was observed that age group of 20-29 years (53.33%) were the most vulnerable to commit suicide by hanging followed by 30-39 years (20.95%) with a mean age at death of 30.3 + 11.23 as shown in figure 1. Similar findings were found in studies conducted by Sharija, Momin and Vijay Kumar. 74.28% of the cases belong to the age group 20-39 years with a mean age at death of 30.3 + 11.23 years involving the most productive age group of any population. This could be explained that younger individuals of age group 20-39 years were facing stress due to poverty, unemployment, family problems etc.

Among 105 cases of deaths due to hanging, 58.09% (n=61) were male and 41.90% (n=44) were female with males to female ratio 1.4:1 as shown in figure 2. Males committed suicide by hanging commonly than females. Similar findings were observed in studies conducted by Sharija, Pranav, Singh, Davidson and Baishya. The influencing factors for the above distribution could have been unemployment, love failure, marital disharmony, financial problems, etc.

Education plays important role in unnatural deaths like hanging. In the present study, deceased having PUC(31.4%) as educational statuses were succumbed to hanging followed by high school (24.8%) and degree(23.8%) as shown in figure 3. Similar findings were observed in studies conducted by Baishya and Chavan. This could be explained by the fact that the higher incidence of suicide among the school and college groups was mostly due to the mental disharmony resulting from failure in examination and failure in love affairs.

In the present study, majority of deceased were Hindus (90.47%) followed by Christians (4.76%) and Muslims (3.8%) as shown in table1. Similar observations found in studies conducted by Chaurasia, Sharija and Baishya and. In this study there is strong evidence which shows that Hindus victims were more common, because of Hindu dominated population in Bengaluru.

In the present study, majority of the people (89%) committed suicide at their residence and a very few committed suicide at their workplace (1%) as shown in figure 4. Similar observations were documented in the studies reported by Baishya, Derya Azmak and Olive Bennewith. This could be due to easy availability of ligature material at their residence.

In the present study, it is observed that 64 cases (61%) were complete hanging as compared to 41 cases (39%) of partial hanging as shown in figure 5. The above observations were similar to the findings observed by Meera, Bowen DA and Simonson J. This may be explained by the fact that most of the victims in the present study committed suicide by hanging at their residence and when a victim attempts to commit suicide in a room, they usually use a chair or a stool for standing to reach the point of suspension which may be ceiling fans, beams, etc. and later on push them away by feet and hence most had complete suspension. This opinion is in concurrence with the explanation of Meera.

In the present study, atypical hanging (93%) was more common in comparison with typical hanging (7%) as shown figure 6. The above observations were similar to the findings observed by Meera, Bowen DA and Simonson J. This could be explained by the fact that type of hanging depends upon the circumstances in which victim uses ligature material, where he/she ties the knot in relation to occiput, type of knot and slippage of knot after suspension.

**CONCLUSION**

It is evident from the present study that young male of age group 20-29 years who belonged to Hindu religion committed suicide by hanging
commonly at their residence. In majority of cases the type of hanging was complete hanging. Hence, the findings of the present study will help in highlighting the socio-demographic profile of hanging deaths in Bengaluru. Proper education to promote healthy coping mechanism, stress management and good job opportunities to the younger generation will help to reduce suicide rates in order to save the most active generation of society. The policy makers should take necessary steps to reduce as well to prevent suicides in India.

Acknowledgement: Authors acknowledge the great help received from Dr Shashidhar Basgoudar, Assistant Professor, Department of Community Medicine, Raichur Institute of Medical Sciences Raichur, Karnataka and all the faculty of Department of Forensic Medicine, Bangalore Medical College and Research Institute Bangalore.

Conflict of Interest: No.
Source of Funding: Self
Ethical Clearance: The study was approved by Bangalore Medical College and Research Institute Ethical Committee.

REFERENCES

Middle Finger is an Estimate of Stature

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ABSTRACT

Unknown bodies pose a big challenge and demand an extra effort from the Forensic Expert. The task of a Forensic Expert in the Mortuary in an Unknown body is to note down all the data available to fix the identity. Numerous equations and formulae are available to deduce the stature from various big bones[1]. This study has been taken up to corroborate the findings of those few studies which were already done, with the same methodology[3]. Since stature varies with race, sex and geographical locations, the present study was done to see the relationship of middle finger length with stature in Mahbubnagar District. The present study was carried out in the department of Forensic Medicine and Toxicology at SVS Medical College, Mahbubnagar, Telangana State. A total of 200 subjects were included in the study, out of which 100 were males and 100 were females within the age group of 18 to 23 years. Middle finger lengths of both sides were recorded along with stature of the person. The data collected was subjected to statistical analysis using statistical package for social sciences (SPSS) to know the correlation of the stature with the middle finger length. The reliability of estimation of stature from the lengths of middle finger was determined with the help of ‘p’ value, SEE, r, r Square and regression equations. A moderate correlation was observed between middle finger length and height of a person which is statistically highly significant.

Keywords: Finger Length, Stature, Regression equations.

INTRODUCTION

Unknown bodies pose a big challenge and demand an extra effort from the Forensic Expert. The task of a Forensic Expert in the Mortuary in an Unknown body is to note down all the data available to fix the identity. In cases of mass disaster it is difficult to match the body parts unless such estimates are available. Also in cases of putrefied, mutilated, extensively charred or skeletonised bodies, estimating the stature from the available bones should be done. Numerous equations and formulae are available to deduce the stature from various big bones[1]. Forensic Anthropologist have established the fact beyond doubt that every body part bears a more or less constant relationship with stature[2]. But not much of study exists on the relation of small bones with stature.

Hence, this study has been taken up to corroborate the findings of those few studies which were already done, with the same methodology[3]. This study will be helpful when only hand or part of hand is available for identification of a person. Formulae had been derived to calculate stature with good results, even when only parts of the bone are available[4]. Different hand dimensions to predict the stature of an individual in different populations[5][8]. Since stature varies with race, sex, and geographical locations the present study was done to see the relationship of middle finger length with stature in Mahbubnagar District. It is shown in earlier studies that various hand measurements tend to differ in various ethnic groups[9]. It is very interesting to state that the formulae designed to estimate stature from various anatomical dimensions in one population do not apply to another[7][8].

DOI Number: 10.5958/0974-1283.2016.00047.5
MATERIAL & METHOD

The present study was carried out in the department of Forensic Medicine and Toxicology at SVS Medical College, Mahbubnagar, Telangana State, between 01-11-15 and 30-11-15. A total of 200 subjects were included in the study, out of which 100 males and 100 females within age group of 18 to 23 years. Anthropometric measurements of the middle fingers were taken independently on left and right side of each individual. Besides the above measurements, stature of each subject was also recorded. All measurements were taken in day light in the department. The measurements were taken by using standard anthropometric instruments in centimeters to the nearest millimeter. Subjects with any skeletal deformities, absent fingers, contractures etc., were excluded in the present study.

The distance from the tip of middle finger to the proximal crease of the middle finger was taken as the middle finger length for all cases and the measurement was done by the same researcher. A Vernier Caliper was used to measure the middle finger lengths. The caliper was horizontally placed along the ventral surface of the left hand. The fixed part of the outer jaw of the caliper was applied to the proximal crease of middle finger and the mobile part of the caliper was approximated to the tip of the middle finger and measurement was taken. In the same way measurement of the middle finger of the right hand were taken.

Stature is the vertical distance between the vertex and the heel touching the ground surface \(^3\). The subject was made to stand in erect posture against the wall with the feet axis parallel or slightly divergent and the head balance on neck and the measurement was taken. The data was collected, analyzed and subjected to statistical analysis using statistical package for social sciences (SPSS) to know the correlation of the stature with the middle finger length. The reliability of estimation of stature from the lengths of middle finger was determined with the help of ‘p’ value, SEE, r, r Square and regression equations.

FINDINGS

The present study focused on estimation of stature from the length of the middle finger.

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<th>SD</th>
<th>P* Value, sig</th>
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</thead>
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<td>0.39</td>
<td>P&lt;0.001 HS</td>
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<tr>
<td>LMFL</td>
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<td>0.43</td>
<td>P&lt;0.001 HS</td>
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<tr>
<td>Height</td>
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<td></td>
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RMFL = Right middle finger length, LMFL = Left middle finger length.

<table>
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<th>P* Value, sig</th>
</tr>
</thead>
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<td>0.43</td>
<td>P&lt;0.001 HS</td>
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<td>LMFL</td>
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<td>Height</td>
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<td>5.56</td>
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Table 3 : Showing Correlation Coefficient and Standard Error of estimation of right and left middle finger in Males

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Table 4 : Showing Correlation Coefficient and Standard Error of estimation of right and left middle finger in females

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<tr>
<td>LMFL</td>
<td>4.9</td>
<td>0.46</td>
<td>0.21</td>
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</tbody>
</table>

RMFL = Right middle finger length, LMFL = Left middle finger length.

Table 5: Regression Equation in both males and females from right and left middle finger

<table>
<thead>
<tr>
<th>Parameter</th>
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</thead>
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<tr>
<td>RMFL</td>
<td>Height=111.52+7.49 (RMFL)</td>
</tr>
<tr>
<td>LMFL</td>
<td>Height=138.44+4.17 (LMFL)</td>
</tr>
<tr>
<td></td>
<td>Height=107.80+6.86 (RMFL)</td>
</tr>
<tr>
<td></td>
<td>Height = 117.5+5.54 (LMFL)</td>
</tr>
</tbody>
</table>
RMFL = Right middle finger length, LMFL = Left middle finger length.

Regression equation: stature= value of constant (a) + regression coefficient (b) x middle finger length.

Males: Y1 = 111.52+7.49 (RMFL)
Y2 = 138.44+4.17(LMFL)

Females: X1 = 107.80+6.86 (RMFL)
X 2 = 117.5+5.54 (LMFL)

Regression equation with range of height
Males: Y3 = 129.84 + 5.81(RMFL) +11.6
Y4 = 131.60 + 5.60(LMFL) + 12.4

Females: X3 = 111.32 + 7.10(RMFL) + 9.4
X 4 = 116.90 + 6.22(LMFL) + 9.8

Where Y1 & Y2 = Height in males, Y3 & Y4 = Average height in males, X1 & X2 = Height in females, X3 & X4 = Average height in females.

The present study showed that the estimation of stature from middle finger length is highly significant (p<0.001) in both males and females so it can be used for estimation of stature. And the above results completely matched with the study of Nagesh Kuppast et al[3]. A study done by Rastogi et al on 500 subjects from Manipal North and South Indian population, showed higher significance in males as compared to females[9]. A study was done by Krishan et al on stature from IFL and RFL which shows larger significance in males than females, with higher significance for IFL than RFL which is contradictory to our study showing higher significance in females[10]. The values of ‘r’ Square in males and females with r Square = 0.20 RMF, 0.09 of LMF in males being the lowest and r Square = 0.21 LMF, 0.28 for RMF in females being the highest value, depicts that estimation of height from the RMF in females is more significant than in males where LMFL gives better prediction of height estimation, over all in both males and females it is right middle finger length in case of females which is a better predictor of stature estimation. Standard error of estimation SEE = 5.8 for RMF, SEE = 6.2 for LMF in males, SEE= 4.7 RMF & SEE = 4.9 LMF in case of females. This indicates RMF in case both males & females is better predictor of height estimation as compared to LMF and is highly significant. Considering all parameter it is females, which shows better prediction of height estimation from middle finger length as compared to males.

**CONCLUSION**

Stature is an important parameter to arrive at the partial identification of an Unknown body or dismembered remains. The results of the present study indicate that the middle finger length can be efficiently used for estimation of stature. Most authors have underlined the need for population-specific stature estimation formulae. This study was an effort to derive a regression equation to estimate stature from middle finger length in the people of Mahbubnagar District. This study revealed that the MFL can be used with high significant values for estimation of stature, even if only an amputated hand is found and other body parts are unavailable. The results of this study are however, applicable only when an intact middle finger is examined. Such studies can help in narrowing down the pool of possible victim matches in cases of identification from dismembered remains.

**Acknowledgement:** Nil

**Conflict of Interest:** Nil

**Source of Funding:** Self

**Ethical Clearance:** The Ethics Committee of SVS Medical College, Mahbubnagar has given clearance on this study on 1st of November,2015.

**REFERENCES**


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