

# Medico-Legal Update

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# MEDICO-LEGAL UPDATE

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# Iranian Statutes: For or Against Child Victims with Mental Disability?

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## Abstract

## Purpose

The purpose of this study is to determine the extent Iranian Acts provided criminal protection for mentally disabled children and to specify legal gaps in these Acts.

## Method

Literature was mainly taken from scientifically valid and peer-reviewed journals. The prevalence of murder, physical and sexual abuse, and violence against the mentally disabled children are reviewed. Regarding the municipal Acts, Islamic Penal Act 1991 (articles 206, 222, & 596); Comprehensive Protection for the Disabled Individuals Act 2004 (articles 3), and Criminal Procedure Act 1992 (articles 204) have been analyzed.

## Results

Iranian criminal justice system didn't pay enough attention to this group of victims and sometimes treated them with discrimination. Iranian legislator didn't consider mental disability as a cause of victimization of mentally disabled children.

## Conclusions

Incohesive and unsystematized criminal protections and provisions dealing with mentally disabled children would lead to discrimination which, in turn, would result in breaching their rights. Enacting a special Act which covers rights and legal needs of mentally disabled children can be considered as a pressing need in Iranian legal system.

## Key Words

Child victims with mental disability; Iranian Acts; homicide; violence; abuse.

## Introduction

A woman with intellectual disabilities was raped by her father and brother as a child. In addition, she was repeatedly raped during her 33 years in an institution. She has been free of sexual assault only for the last few years of living in the community. No arrests were made<sup>1</sup>.

This story is not the first, nor will it be the last one which illustrates the types of victimization experienced by some people with developmental disabilities. One of Canadian scholars, who studied about developmental disabilities, included disorders such as mental retardation, autism, cerebral palsy, epilepsy, and severe learning disabilities in this category of disabilities<sup>2</sup>. Reiter and Lapidot-Lefler<sup>3</sup> showed that these children experienced verbal vulgar epithets, ridicule, threats, physical beatings, being forced to do things against their will and being sexually touched without their consent. Another study<sup>4</sup> reported very high estimate of violence against persons with disabilities. Brownridge<sup>5</sup> defines vulnerable populations as groups of individuals who share some common characteristics not held by the rest of the population and who are uniquely vulnerable with respect to risk and/or experiences

surrounding violence. Accordingly, we can categorize them as a vulnerable population in criminological studies. The ultimate aim of this article is to shed light on the dark sides of negligence and discrimination in order to pave the way to enact legal provisions which can fully cover legal needs of child victims with mental disability.

## Method

The method is based on the literature review. The literature was mainly taken from scientifically valid and peer-reviewed journals which are indexed in different databases such as PubMed and ISI web of knowledge. Research and review articles which deal with murder, physical and sexual abuse, and violence against the mentally disabled children are reviewed. Moreover, some specific articles of the following Iranian Acts are chosen and analyzed because they dealt with disabled victims, their rights and needs, and criminal protection for them: Islamic Penal Act 1991<sup>6</sup> (articles 206, 222, & 596); Comprehensive Protection for the Disabled Individuals Act 2004<sup>7</sup> (articles 3), and Criminal Procedure Act 1992<sup>8</sup> (articles 204).

### A. Abuse of individuals under legal age, their personal needs or their weakness of character

Article 596 of Islamic Penal Act 1991<sup>6</sup> maintains: Every person who abuses individuals under legal age with weakness of character, aspirations or desires and takes any manuscripts or documents; whether commercial or non-commercial such as bill of exchange, promissory note, check, draft, receipt, instrument on settlement of debts or any manuscript which binds him/her or acquittal of debt of receiver of document or any other person, the perpetrator will be convicted from six months to two years imprisonment or from one million to ten million rials fine in addition to the compensation, and if the offender is that person's guardianship, executorship or mandate, he/she will be convicted from three to seven years imprisonment in addition to compensation.

This provision with a little change can be observed in article 117 of Iranian Ta'zirat Act 1982<sup>9</sup>. Based on article 596 of Islamic Penal Act 1991<sup>6</sup>, taking a manuscript or a document from an individual under legal age has been recognized as crime. This article maintains that there is no need to impose actual loss on the children under legal age directly but mere performing such a wrongful behavior is considered as crime. This kind of protection was not systematic; it is rare and is only used in a diversified manner in Islamic Penal Act 1991<sup>6</sup>. Also in case of being guardianship, executorships and mandate, the severity of the punishment increases.

Article three of the Comprehensive Protection for the Disabled Individuals Act 2004<sup>7</sup> maintains: "In judicial courts, Welfare Organization is bound to determine a barrister and to introduce him/her to the court to defend the rights of the disabled". Accordingly, Iranian legislator emphasizes on one of the characteristics of fair trial (i.e., right to access to a barrister) and bounds the Welfare Organization to determine a barrister for the disabled individual and to introduce him/her to the competent court. Regarding guardianless individuals (i.e., mainly minors), clause two of article three of the above Act holds: "Welfare Organization is permitted to bring an action and to litigate on behalf of the guardianless individuals who have a disability". Although the article legally "permits" the Welfare Organization to bring an action to litigate in court to prevent violating the rights of the guardianless victims, this social body is suggested to be "bound" to do that. Also,

the Iranian legislator transferred the authority of bringing an action on behalf of the disabled victims to the Welfare Organization. This kind of transformation of authority paves the way to use a discriminatory and discretionary treatment with the guardianless individuals who have a disability and finally, may result in breaching their rights.

Article 204 of Criminal Procedure Act 1992<sup>8</sup> holds: "If a civil claimant, an accused or an informed individual is deaf or dumb, the court will take the necessary measures to investigate them by medical specialists". The victim's disability necessitates the professional investigation be conducted by employing experts and based on the training which they received. Iranian legislator limited the above article's legal scope to the deaf and the dumb. It is clear that employing medical specialists is necessary to investigate the other disabled victims to assist the court to recognize the pre-criminal investigations and the seriousness and weakness of injurious symptoms of crimes committed against them. Mentally disabled especially minors have not been considered enough neither in criminal nor in medical protection in Iranian legal system.

### **B. Victim's insanity, disorders and abolition of offender's punishment**

Victimization of individuals with severe mental illness has been reported nearly 12 times that of the general population<sup>10</sup>. Interviewing 336 individuals with intellectual disabilities, Pan<sup>11</sup> reported that the prevalence of sex abuse for this population was 5.4%. A research revealed that children with mental retardation have higher rates of certain forms of maltreatment and longer duration of it<sup>12</sup>. One of the most common diagnoses given to children is attention deficit hyperactivity disorder<sup>13,14</sup>. Reid and Sullivan<sup>15</sup> believe that previously victimized youth should benefit from information concerning the psychological effects of victimization such as anxiety and depression and these effects may place them at elevated risk for further victimization. The results of a study<sup>16</sup> support an association between victimization and psychiatric diagnosis.

According to research, sexual assault prevalence for persons with chronic psychosis increased from 2.47 to 13.90 in 2002 -2007 in Taiwan<sup>17</sup>. Some researchers found higher rates of a variety of diagnoses in victims of abuse such as posttraumatic stress disorders (PTSD), depression and substance abuse<sup>18,19</sup>. In this line of research, Cuevas, Finkelhor, Ormrod, and Turner<sup>20</sup> have emphasized on three kinds of victimization: physical abuse, neglect and sexual abuse. Others proved the association between victimization and psychopathology<sup>21,22</sup> and also, between maltreatment and cognitive delays or low intelligence<sup>23</sup>.

#### **Article 222 of Islamic Penal Act 1999<sup>6</sup> states:**

If a murderer kills an insane individual, he/she will not be convicted to retaliation [1] (i.e., capital punishment). If his/her conduct results in public disorder, fear or causes the increasing tendency of offender and/or that of others to repeat the commission of the crime, the punishment will be considered from three to ten years imprisonment.

Hence when the victim is insane and the murderer is not, retaliation (i.e., capital punishment) will be abolished. The above article indicates that if an insane individual attacks a healthy individual and the latter intends to defend himself/herself and results in homicide of the insane individual, there will be no retaliation and the blood money [2] will be paid from the Muslim Treasury [3] on behalf of the murderer.

One of the conditions for retaliation should be the equality of wisdom rather an insane victim should not be discriminated in favor of a sane offender. Abolition of punishment including retaliation (i.e., capital punishment) in the case of murdering an insane victim by a sane offender will increase the tendency of offenders to commit homicide against the individuals with mental disability. Enacting such a provision in article 222 of Islamic Penal Act 1991<sup>6</sup> implicitly permits the offender to kill the insane individuals. Actually, Iranian legislator exposed the insane individuals to the risk of victimization of homicide more than the individuals without such a disability while from a criminological viewpoint, the former group deserves more criminal protection and the latter group is more capable to defend themselves.

When describing the occasions of murder, Article 206 (III) of

Islamic Penal Act 1991<sup>6</sup> holds:

The occasions in which the murderer doesn't have the intent of killing or his/her conduct is not typically fatal but with respect to the other individual, because of "illness", adult age, "disability or minority" and something like this, is typically fatal and the murderer knows these characteristics of the victim.

Here, Iranian legislator considered the conduct as murder and mentioned "illness, disability, and minority" as symptoms of vulnerability. Accordingly, Iranian legislator considered two terms and conditions for murder: (a) fatality of the murderer's conduct regarding vulnerability, (b) murderer's knowledge of the victim's vulnerability. Accordingly, the murderer can not acquit himself/herself of the charge of murder with mere proving that his/her conduct is not fatal to the individuals without a disability, but he/she will be convicted regarding conditions mentioned in the article. Accordingly, "illness, disability, and minority" are taken into consideration in homicide to provide criminal protection for victims.

## **Conclusions**

Enacting discriminatory provisions regarding disabled victims shows that Iranian legislator is far away from criminological instructions and this makes Iranian criminal statutes not adaptive to the guidelines of criminology. The abolition of retaliation (i.e., capital punishment) as punishment of murderer when the victim is insane can be considered as a clear example. Accordingly, lack of comprehensive and regular protection for victims with mental disability indicates the long way Iranian legislator has to go in future. Specific and diversified treatment of such cases shows that the legislator basically had neither a supportive approach nor a clear position based on principles of victimology [4]. Also, Iranian statutes and provisions concerning the criminal protection for the disabled victims are not cohesive and this indicates unknowingly attention of Iranian legislator to "the victimization of the disabled specially the mentally disabled individuals".

A glance at the Iranian criminal statutes shows two points: (a) the municipal provisions have a lot of legal gaps from the viewpoint of supportive provisions for the disabled victims, (b) enacting diversified and unsystematic provisions, Iranian legislator made it difficult for the subjects of criminal law to understand Iranian criminal policy about the disabled victims. These victims really deserve double protections especially in the process of criminal procedures. If Iranian legislator were aware that these victims deserved specific criminal protection, he/she would apply a comprehensive and criminal protection for them and would criminalize certain behaviors committed against them. Also, special new Acts and provisions are recommended in this respect.

Following issues are suggested for procedural criminal law in Iranian legal system: (a) taking some measures to accelerate and facilitate the victim's reports about the crimes committed against them; (b) binding all people to report such crimes; (c) considering a duty for prosecutors to prosecute the perpetrators even without the complain posed by complainants; (e) employing the professionals to investigate the disabled victims depending on the kinds of their disabilities; (f) informing law enforcements about the needs of vulnerable groups. Unfortunately, like the substantive criminal law, there are some gaps in respect of enacting protective provisions for the people with a disability in the area of procedural criminal law. Hopefully, this writing will be the first and a small step to introduce Iranian Acts regarding the disabled victims both to fill the legal gaps and to compensate the loss and hurt sometimes inflicted on "silent victims" who are looking forward to our efforts.

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## Endnotes

1. A punishment which Islamic law determines regarding the offender. It should be enforced exactly similar to the offense committed. For example, if murder was committed through burning the victim, the offender should also be burnt.
2. A sum of money which Islamic law determined and the offender is obliged to pay to the blood-wits as blood money. Blood-wits are the descendants of the killed person who have a lawful right to demand retaliation or to forgive the offender. The offenders of unintentional murder and manslaughter should pay the blood money.
3. Muslim treasury is a fund which Islamic government establishes to pay blood money in special occasions on behalf of those who can not afford it or have incapacity to pay or deceased and are not alive to pay it.
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# Peripheral Ossifying Fibroma-A Case Report

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## Abstract

The gingiva is often the site of localized growths that are considered to be reactive rather than neoplastic in nature. Many of these lesions are difficult to be identified clinically and can be identified as specific entity only on the basis of typical and consistent histomorphology. Peripheral ossifying fibroma (POF) is one such reactive lesion. It has been described with various synonyms and it is believed to arise from the periodontal ligament. It comprises of about 9% of all gingival growths. The size of the lesion is usually small, located mainly in the anterior maxilla with a higher predilection for females, and it is more common in the second decade of life.

## Key Words

Peripheral ossifying fibroma (POF), Peripheral Odontogenic Fibroma (POFD), Ossifying Fibroma (OF)

## Introduction

POF is one of the most common inflammatory hyperplasia in response to injuries affecting mouth cavity. In 1872, Menzel first described ossifying fibroma, but only in 1927 Montgomery assigned its terminology<sup>3</sup>.

The literature reports a higher incidence in infants and in young adults, mainly occurring in the age range from 10 to 19 years; with a female sex predilection.

Ossifying fibroma epulis; ossifying fibroma with calcification; peripheral cemento-ossifying fibroma and calcifying fibroma are the terms which might refer to peripheral ossifying fibroma<sup>5,7</sup>

It's most common clinical aspect is the growth of well delimited tissue, of a smooth surface, usually with normal colored mucosa, sessile or pedunculated base, of hard consistency<sup>1</sup>, and smaller than 1.5cm in its largest diameter, although there have been reports of sizes upto 4cm<sup>2</sup>. Majority of them are placed in the anterior maxilla and more precisely in the interdental papilla<sup>5,7</sup>

POF is easily mistaken with a pyogenic granuloma at its beginning or when already developed. Calcification, which is its most expressive histopathological feature, will differentiate it from other fibrous proliferation.<sup>5,7,1</sup>

This study reports a case of pyogenic granuloma, later diagnosed as peripheral ossifying fibroma.

## Case Report

A 35 years old woman, has reported to the Department of Oral Medicine and Radiology in the Institute of Dental Sciences, Bareilly with the chief complaint of swelling in upper front tooth region since 10 years. Patient gave the history of removal of swelling more than 3 years back. The swelling reappeared since 3 years. Swelling was associated with moderate to severe pain, intermittent in nature. Pain aggravated on touch and was relieved on its own.

The general health of the patient was excellent with no previous medical history. But there is history of use of tobacco containing tooth powder once a day since 7-8 months.

Clinical examination revealed interdental swelling in relation to (i.r.t) 11, 21. It was solitary, tender on palpation; measuring 1X1 cm (Fig.1&2). Overlying mucosa was erythematous. Occlusal caries was present i.r.t

46. Oral hygiene was poor with grade III calculus and stains. There is generalized inflammation of marginal and interdental gingival. Radiographic findings are normal.



Fig. 1: Labial view of lesion



Fig. 2: Occlusal view of lesion

## Histopathology

The epithelium lining showed normal appearing stratified squamous parakeratinised epithelium overlying connective tissue stroma. Connective tissue stroma comprised of loose to dense bundles of collagen fibers with plump fibroblasts. Many areas were showing hematoxyphillic round calcified bodies and osteoid tissue. Chronic inflammatory infiltrate predominantly comprised of lymphocytes. Endothelial lined blood vessels with RBCs were also present (Fig. 3). On the basis of histopathological finding final diagnosis is of *Peripheral Ossifying Fibroma* is given.

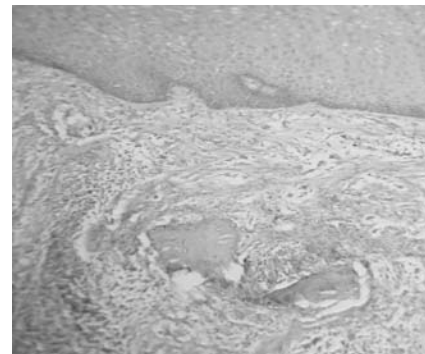


Fig. 3: Histological picture of lesion

## Discussion

POF has also been described by various synonyms such as peripheral cemento ossifying fibroma, peripheral odontogenic fibroma (POFD) with cementogenesis, peripheral fibroma with osteogenesis, peripheral fibroma with calcification, fibrous epulis, calcifying fibroblastic granuloma, etc<sup>2</sup>. Almost 60% of the lesions occur in the maxilla and mostly occur anterior to molars. The lesion is most common in the second decade of life affecting mainly females. The lesion though usually smaller than 1.5 cm in diameter can reach a much larger size and can cause separation of the adjacent teeth, resorption of the alveolar crest, destruction of the bony structure and cosmetic deformity<sup>9</sup>.

The term POF should not be confused with PODF, which is the rare peripheral counterpart of central odontogenic fibroma. In North America, it is still synonymously used by many for POF as the lesion is thought by them to be derived from the periodontal ligament and hence to be odontogenic. The evidence for its odontogenic origin is circumstantial, being based partly on the demonstration of oxytalan



fibers within its calcified structures and its exclusive occurrence on gingiva. However, oxytalan fibers have also been reported in the sites other than the periodontal ligament<sup>4</sup>.

Radiographically radiopaque foci within the soft tissue tumor mass are observed if the calcified element is significant, but in this case no radiopaque foci were seen.

Histologically, POF can exhibit either ulcerated or intact stratified squamous epithelium. In a typical ulcerated lesion, three zones could be identified:

**Zone I:** The superficial ulcerated zone covered with the fibrinous exudate and enmeshed with polymorphonuclear neutrophils and debris.

**Zone II:** The zone beneath the surface epithelium composed almost exclusively of proliferating fibroblasts with diffuse infiltration of chronic inflammatory cells mostly lymphocytes and plasma cells.

**Zone III:** More collagenized connective tissue with less vascularity and high cellularity; osteogenesis consisting of osteoid and bone formation is a prominent feature, which can even reach the ulcerated surface in some cases.

The calcified material can generally take one or more of the following four forms: (a) mature lamellated trabecular bone; (b) immature, highly cellular bone; (c) circumscribed amorphous, almost acellular, eosinophilic, or basophilic bodies, and (d) minute microscopic granular foci of calcification<sup>2</sup>.

Treatment requires proper surgical intervention that ensures deep excision of the lesion with periosteum and affected periodontal ligament. Thorough root scaling of adjacent teeth and/or removal of other sources of irritants should be accomplished. In children, reactive gingival lesions can exhibit an exuberant growth rate and reach significant size in a relatively short period of time. In addition, the POF can cause erosion of bone, can displace teeth, and can interfere or delay eruption of teeth. Early recognition and definitive surgical intervention result in less risk of tooth and bone loss<sup>6</sup>.

It is suggested that there is no absolute histological distinction between bone and cementum, and as the so-called cementum-like globules of calcification are seen in fibro-osseous lesions in all membrane bones, it is unrealistic to separate the ossifying and cementifying lesions

and it is speculated that the fibro-osseous lesions might represent stages in the evolution of a single disease process passing through the stages of fibrous dysplasia to ossifying fibroma to cementoid lesions<sup>8</sup>.

In conclusion, clinically it is difficult to differentiate between most of the reactive gingival lesions particularly in the initial stages. Regardless of the surgical technique employed, it is important to eliminate the etiological factors and the tissue has to be histologically examined for confirmation.

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# Morphometric Study of Tibia in Vidarbha Region

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## Abstract

The present study is undertaken on the samples of vidarbha region of Maharashtra with the object to assess the value of different selected measurements of the human tibia in the determination of sex in an individual. The material consists of fully ossified tibia belonging to 68 dissection hall cadavers, out of which 48 were males and 20 females of known sex and stature from Govt. medical College Nagpur, Indira Gandhi medical college Nagpur and Lata Mangeshkar College Nagpur. Five parameters were applied to study the sexual dimorphism. The present study reveals that the maximum width of the upper end of tibia is the best for identification of female in which 40% right female and 40% left female tibia could be identified. The weight is the best discriminant factor for identification of males; in which 14.58% right male and 18.75% left male tibia could be identified. Midshaft circumference, lower end of tibia and length of tibia are also discriminant parameters in order of accuracy.

## Key Words

sex determination, tibia.

## Introduction

- Identification of an unknown dead body is one of the important work in the field of forensic medicine. Sex determination from skeletal remains of an individual from an examination of single bone, except the hip bone is considered to be difficult task.
- The tibia was chosen for this study as it is an ideal bone since, the portion of this bone often remains in good condition and it resists erosive forces and keeps its anatomical shape for a long time even after being buried (Kirici, Ozan H. 1999)<sup>1</sup>

The present study is undertaken on the samples of Vidarbha region of Maharashtra with the object to assess the value of different selected measurements of the human tibia in the determination of sex in an individual

## Material and Methods

- The material consists of fully ossified Tibia
- 68 dissection hall cadavers
- 48 were males and 20 females of known sex
- (Govt. medical college, I.G.G.M.C., L.M.M.C.Nagpur)

## Five parameters were applied to study the sexual dimorphism

1. Maximum width of upper end of tibia-with the help of sliding caliper
2. Maximum width of lower end
3. Length-Total length was measured on an osteometric board.
4. Mid-shaft circumference-It was measured by wrapping a thin strip of millimeter graph paper around the bone at the midpoint already marked on the bone while measuring length on an osteometric board.

5. Weight-Weight of tibia was measured on an ordinary balance. The data obtained for each parameter was analyzed statistically in both sexes for right and left tibia

## Observations

- As per the method of Jit and Singh (1966)<sup>2</sup> the D.Ps were obtained by calculated range which were worked out by adding and subtracting  $\pm 3S.D.$  to the mean value of each parameter. On the basis of this D.Ps, the % of bones in males and females were calculated.
- Standard deviation =  $\sqrt{(x-x)^2/n}$
- Range
- Mean
- Standard deviation (S.D)
- Identification point for males and females

**Table 1.** Showing Observations in Cms. on Maximum Width of Upper End of Tibia

Sr. No	Detail Measurements	Right male	Rt. Female	Left Male	Lf. Female
1	No of bones	48	20	48	20
2	Range	6.7-8.4	5.4-7.1	6.4-7.9	5.7-7.1
3	Mean	7.27	6.42	7.21	6.49
4	Stand. Devi. (S. .D.)	0.33	0.42	0.35	0.40
5	Identification points	>7.1	<6.7	>7.1	<6.4
6	%of identified bones	66.66%	65%	60.41%	45%
7	Calculated range	6.28-8.26	5.16-7.68	6.16-8.26	5.29-7.69
8	Demarking points	>7.68	<6.28	>7.69	<6.16
9	% beyond D.P	8.33%	40%	8.33%	40%

**Table 2.** Showing Observations in CMS. on Maximum Width of Lower End of Tibia

Sr. No	Detail Measurements	Right male	Rt. female	Left male	Lf. female
1	No of bones	48	20	48	20
2	Range	3.5-5.4	3-4.8	4-5.8	3.5-4.8
3	Mean	4.36	4.00	4.38	3.75
4	Stand. Devi. (S. .D.)	0.39	0.46	0.38	0.28
5	Identification points	>4.8	<3.5	>4.8	<4.0
6	%of identified bones	10.41%	15%	8.33%	95%
7	Calculated range	3.19-5.53	2.62-5.38	3.24-5.52	2.91-4.59
8	Demarking points	>5.38	<3.19	>4.59	<3.24
9	%beyond D.P	2.08%	5%	10.41%	0%

- % of identified bones
- Calculated range
- Demarking points(D.P)
- %beyond D.P

**Table 3.** Showing Observations in CMS.on Midshaft Circum.of Tibia

Sr. No	Detail Measurements	Right male	Rt. Female	Left male	Lf. Female
1	No of bones	48	20	48	20
2	Range	6.8-8.9	5.6-7.7	6.7-9.0	5.4-7.6
3	Mean	7.81	6.58	7.68	6.56
4	Stand. Devi. (S. .D.)	0.59	0.62	0.64	0.64
5	Identification points	>7.7	<6.8	>7.6	<6.7
6	%of identified bones	52.08%	60%	45.83%	55%
7	Calculated range	6.04-9.58	4.72-8.44	5.76-9.60	4.64-8.48
8	Demarking points	>8.44	<6.04	>8.48	<5.76
9	% beyond D.P	8.33%	30%	16.66%	10%

**Table 4.** Showing Observations in CMS.on Length of Tibia

Sr. No	Detail Measurements	Right male	Rt. female	Left Male	Lf. Female
1	No of bones	48	20	48	20
2	Range	34-42.5	31.5-40	33.4-43.0	32.5-40.6
3	Mean	37.64	35.05	37.53	35.29
4	Stand. Devi. (S. .D.)	1.92	1.91	2.04	2.01
5	Identification points	>40	<34	>40.6	<33.4
6	%of identified bones	10.4%	30%	4.2%	20%
7	Calculated range	31.88-43.4	29.32-40.78	31.41-43.65	29.26-41.32
8	Demarking points	>40.78	<31.88	>41.32	<31.41
9	%beyond D.P	4.16%	5%	2.08%	0%

**Table 5.** Showing Observations in Gms.of Weight of Tibia

Sr. No	Detail Measurements	Right male	Rt Female	Left male	Lt female
1	No of bones	48	20	48	20
2	Range	135-352	125-275	130-365	120-270
3	Mean	271.166	202.5	267.54	199.5
4	Stand. Devi. (S. .D.)	50.80	45.88	57.07	44.62
5	Identification points	>275	<135	>270	<130
6	%of identified bones	43.75%	10%	43.75%	10%
7	Calculated range	118.76-423.56	64.86-340.14	96.33-438.75	68.64-333.36
8	Demarking points	>340.14	<118.76	>333.36	<96.33
9	%beyond D.P	14.58%	0%	18.75%	0%

## Discussion

- The present study reveals that the maximum width of the upper end of tibia is the best criteria for identification of female in which 40% right female and 40% left female tibia could be identified.
- The weight is the best discriminant factor for identification of male bones, in which 14.58% rt. male and 18.75% left male tibia could be identified. Midshaft circumference, lower end of tibia and length

of tibia are also discriminant parameters in order of accuracy.

## Conclusion

- Demarking points (D.P) as per the method of Jit and Singh (1966)

**Table 6.** Showing the percentages of tibia identified by demarking points by various parameters

Parameters	Right Male	Rt. Female	Left Male	Lf. female
Maximum width of upper end of tibia	8.33%	40%	8.33%	40%
Maximum width of lower end of tibia	2.08%	5%	10.41%	NONE
Midshaft circumference	8.33%	30%	16.66%	10%
Length of tibia	4.16%	5%	2.08%	NONE
Weight of tibia	14.58%	NONE	18.75%	NONE

**Table 7.** Showing comparative study of percentages of tibia identified by demarking points

Measure-ments of tibia	Singh et al(1975)				Present study(2005)			
	Right		Left		Right		Left	
	Male	Female	Male	Female	Male	Female	Male	Female
Max. Width upp. end	9	32	19	44	8.33	40	8.33	40
Max. width low-end	7	3	16	None	2.08	5	10.41	None
Midshaft circum.	9	16	18	12	8.33	30	16.66	10
Length	4	12	5	3	4.16	5	2.08	None
Weight	14	None	23	None	14.58	None	18.75	None

<sup>2</sup> which identify the sex with 100% accuracy were obtained in the present study. The Demarking points are different for different races and zones and differ according to the side of the body.

- Maximum width of upper end of tibia is the best criteria for identification of females. By this parameters 40%right female and 40%left female tibia could be identified. Weight is the best criteria for males and by this parameter14.58% right male and 18.75% left male tibia could be identified. Similarly midshaft circumference, maximum width of lower end of tibia and length of tibia are also discriminant parameters in order of their accuracy.
- It is concluded that demarking points give high degree of accuracy for sexual dimorphism. Maximum width of upper end of tibia in females and weight in males and midshaft circumference are best discriminant parameters for sexual dimorphism.
- Thus this study will definitely be useful to the Anatomist and Forensic experts where a bone or a piece of bone is subjected to the medico legal examination.

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# An Insight to Forensic Odontology and its Medico-Legal Application

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## Abstract

Forensic-Odontology is a branch of forensic science that utilizes dental and oro-facial findings to serve the judicial system. In world-wide scenario; forensic dentists are playing an important role in human identification, bite-mark analysis, maxillofacial trauma and malpractices. A qualitative 'dental-record' of clinician is considered as promising tool for judicial purposes. Even in absence of dental records, a forensic dentist can contribute investigating team by dental 'profile match'. Detection, interpretation and the management of health problems are the soul ethics of medical profession. And when, it reaches to a purposeful reporting level, is the peak of a profession. As a part of health profession's worker, dentists should be aware of the legal implications of individual case-records and their responsibilities towards society. This article gives an insight to Forensic Odontology and outlines some of its medico-legal applications.

## Key Words

Forensic Odontology, Maxillo-Facial, Identification, Violence and Abuse.

## Introduction

Forensic Odontology (dentistry) is a new and growing section of forensic medicine. The historic journey of forensic dentistry starts from Agrippina, the mother of Roman emperor Nero, in 49 A.D. when she recognized her rival Lollia –Paulina's discolored front tooth after her assassination. Another famous foray into forensic dentistry was Paul Revere, a blacksmith and dentist; who recognized a revolutionary war dead buried on battle field, by his dental delivery made of silver wire and pieces of hippo tusks<sup>1</sup>. In 1897, Dr. Oscar Amoedo wrote his post-doctoral thesis entitled "L'Art Dentaire en Medicine Legale" describing the utility of dentistry in forensic medicine with particular emphasis on identification of victim<sup>2</sup>. The honor of being "father of forensic odontology" is often bestowed to him. But, the credit for the idea of using dental information to assist final identification actually belongs to Mr. Albert Haus<sup>3</sup>.

Forensic dentistry is the proper handling, examination and evaluation of dental evidences in the interest of justice. With other authority members, a forensic dentist can contribute in identification of found human remains, in mass fatalities, in assessment of bite mark injuries and cases of abuse (child, spousal, elder)<sup>4</sup>. Age estimation of children and civil cases involving malpractices are other important areas of contribution by forensic odontologist in medico-legal application<sup>1</sup>. In India, forensic dentistry is just stepping forward. Even at institutional levels, there is lack of undergraduate and post-graduate programs in this field. This article gives a brief overview of some of the roles undertaken by Forensic Odontologists

## Individual Identification

Identification is based on comparison between known characteristics of a missing individual (termed ante-mortem data) with recovered characteristics from an unknown body (termed post-mortem data). Identification of the deceased is most commonly achieved visually by a relative or a friend who knew the person during life. This is performed by looking at characteristics of the face, various body features and/or personal belongings. However, this method

becomes undesirable and unreliable when the body features are lost due to post- and peri-mortem changes (such as decomposition or incineration). Visual identification in those circumstances is subject to error.

Despite being similar, dental characters widely vary from individual to individual; making each dentition a unique<sup>5 (A,B)</sup>.

Dental enamel is the hardest substance in the body which remains long after the decay of other body parts. Victims of fire are often identified by their teeth which can withstand a temperature of more than 2000° F. Dental works (i.e. partial or metallic crowns, bridges and many restorations) distort by fire but can still aid in identification<sup>6</sup>.

Professional dental record, notes, prescriptions, clinical photographs, radiographs and 'study cast' are important tools which allow successful ante and post-mortem comparison of the victim. At many situations of multishooting incidents; mass-incinerations and multiple homicides, forensic odontologists play an important role in the retrieval of evidence and identification of the incinerated victims. Even in lack of ante-mortem records they use CT- Scan radiographs to match other remains and fire scene procedures<sup>7</sup>.

Dental examination are considered as powerful tool in identification of burn victims<sup>8</sup>. In Scandinavian "Star Ferry Fire(1990)" even long-lasting and fire-resistant tooth structures degraded but forensic odontologists preserved the dental remains with fixatives and established the identity in 68 percent cases using Interpol DVI-form, with other team member<sup>9</sup>.

Sometimes teeth may have particular characteristics, such as discoloration owing to antibiotics(tetracycline in growing age) or a Pink tooth(due to internal resorption), which provide relatively unique and important dental evidence that can solve the case<sup>10</sup>.

In cases where dental records are not available, the unusual oral habits, dietary patterns, socioeconomic strata and the age of deceased may be directive factors. Things such as biters life style can be determined by the teeth; a constant pipe-smoker or a bagpipe player has a distinctive 'wear pattern'. Dress-maker and tailors may have chipped teeth<sup>6</sup>.

The formation and eruption of teeth in mouth occurs in chronological order. Therefore, it helps in age determination of children up to 15- yrs of age. Above 15-yrs of age, dental aging is relied on attrition, cementum-formation and root-transparency level. Particularly, incremental lines in root cementum of human teeth is a reliable age-marker<sup>11,12</sup>.

In addition to dental records forensic dentists can retrieve DNA samples by extracting the dental pulp. Unlike enamel, dental pulp can be damaged by fire or another conditions, but it can also last for hundreds of years<sup>6</sup>.

## Mass Fatalities

Mass fatalities and large scale infrastructural damages are the signs of natural Disaster. It creates an all-round challenge to local authorities, and the only solution remain is all-round contribution.

FBI Report for Disaster Squad (1940) emphasizes Dental-chart as "valuable identification tool" in mass fatality incidents<sup>13</sup>. Forensic odontologists have contributed to the resolution of many mass disasters. The 2004, Indian Ocean tsunami is probably the most eminent example on the success of forensic odontologists in identifying a large number of victims in short time. Nearly half of the victims in Thailand were

identified by dental characteristics method alone, and forensic dentists contributed to the remaining half by assisting the finger-print, DNA and physical characteristics' team. Even the absence of dental records did not stop forensic odontologists from contribution. They identified the victims either by photographic superimposition or by narrowing down possible matches for the DNA and fingerprint teams through dental aging<sup>14</sup>.

### Bite-Mark Analysis

Biting is often a sign of perpetrator seeking to degrade the victim while achieving complete domination<sup>15</sup>. Bite marks can be formed anywhere in the body of suspect when a victim attempts to defend him/herself (cases of sexual assaults, murder, and child abuse). Usually it is noticed on soft, fleshy tissue such as the face, stomach and buttocks. Even, bite marks found on objects at the crime-scene can be a major factor in leading to a conviction.

There have been many cases in history which have made uses of bite marks as evidence. Even though, using bite mark as evidence began around 1870, the first published account involving a conviction based on bite mark analysis was Doyle V. State, Texas in 1954 (on a piece of cheese at the crime scene)<sup>16</sup>. This conviction set the stage for bite-marks found on skin or objects, for use as evidence in future cases.

Despite many successful contributions, several erroneous bite mark analysis, mainly from US- courts; rendered this type of evidence questionable. In most cases the chief cause of question mark was lack of scientific support for bite mark analysis to be employed in court<sup>17</sup>. At this juncture, DNA analysis from saliva surrounding the area of bite-mark proves to be more reliable form of identification<sup>16</sup>. New researches are underway to allow digital comparison of teeth and bite marks at a 3-dimensional level<sup>18,19</sup>. To avoid discrepancy and to increase validity of bite mark analysis, ABFO (American Board of Forensic Odontologists) has created a bite mark methodology guide line to collect and preserve the marks. This guideline is not a mandate but a list of generally accepted methods<sup>20</sup>.

Facial and dental injuries in civil or criminal trauma occur relatively frequently in family disputes, brawls and gang-fights. The Forensic Odontologists provide evidences that may show who is to blame for injury. So that victim may get the compensation from court and attacker be punished<sup>21</sup>.

### Domestic-violence and child-abuse

WHO declares that violence is a major and growing public health problem<sup>22</sup>. All forms of violence such as; physical, sexual, psychological and neglect, can manifest in the oro-facial region, and hence should be of concern to dentist.

None-accidental injuries have certain distinct character that helps in recognition<sup>23</sup>(table<sup>1</sup>). Particularly, fractured teeth, jaw and nasal bones; bruising, cuts and scarring of the face, lips and ears, and cigarette or ligature burns or bite-marks on face, neck or arms are clinical clue of physical abuse<sup>22</sup>. While there has not been a lot of research into implications of abuse for forensic dentists, some cases have been identified. A mismatching of injury observed and the reported history of injury, serves as a signal to dentist that something works. Such cases must be carefully reported to appropriate authority. The scientific documentation of cases with confidentiality, strengthen the evidence and provide redress to the victim.

Many countries have laws that govern reporting of violence. Even some laws penalize health workers by imprisonments or fines for not reporting the violence manifested patients<sup>24,25</sup>.

In India, currently Section 498A of Indian Penal Code which punishes the perpetrators for 3yrs imprisonment is the only law that victims of domestic violence can have recourse. Although an undated WHO report that has apparently said that the loopholes in 498A is one of the major reasons for growing "elder abuse in India"<sup>16</sup>.

Child-Abuse is one of the most heinous and inhuman crimes against humanity. Despite having one of the youngest populations in world, it is India's hidden shame that there is no specific law against child-abuse. The parliament of India has been long awaited to make a specific law even stricter against child-abuse.

**Table 1.** Characteristic features of Abusive injuries

The history of injury is vague and inconsistent with clinical findings In Injuries appear in places away from bony prominences
The injuries are inconsistent with the child's age-dependant activities i.e. walking, playing and crawling. Unexplainable delay in seeking health care.
The injury occurred in the absence of witnesses or a sibling is blamed F for causing injury.
Evidence of neglect, such as malnutrition, head-lice and poor hygiene
Presence of other injuries and/or repeated attendance to healthcare facilities with similar complaints

### Conclusion

Dental clinicians are at the forefront in detecting signs of violence and abuse on their patients. All forms of 'Dental records' are important for forensic application, and are beneficial to legal authorities during identification process. Therefore, dental practitioner must be aware of the forensic application of dentistry and the proper documentation of a case.

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# Epidemiological Study of Suicidal and Homicidal Burn Injuries Admitted in Tertiary Care Hospitals of Belgaum District, Karnataka State, India

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## Abstract

Burn injuries due to attempted suicide and homicide are one of the leading causes of death and disability globally. In view of the above, this study was done with the objectives to elucidate epidemiological and outcome characteristics of alleged suicidal and homicidal burn injuries admitted in two tertiary care hospitals in South India. The present cross sectional study of all suicidal and homicidal burn injuries admitted in two tertiary care hospitals of Belgaum city during the study period from April 2004 to March 2005 were included after informed consent from the patients themselves or from close family members. Out of the total cases, 35(60.34%) were suicidal and 23(39.66%) were homicidal. Females contributed to 21(60%) of the suicidal and 17(73.91%) of the homicidal cases. Sixty percent (60%) of attempted suicidal burn injuries and 34.78% of homicidal victims had TBSA more than 80% and was found to be statistically significant. In suicidal injuries, mortality was 81.80% and in homicidal cases it was 52.17%.

## Key Words

Suicidal burn injuries, Homicidal burn injuries

## Introduction

Burn injuries due to attempted suicide and homicide is one of the leading causes of death and disability globally (1)

Every year suicidal and homicidal burn injuries contribute to a significant number of hospitalizations, emergency care, amputations, disfigurement, pain, suffering and agony. Many children become orphans, women become destitutes and the elderly grieve in isolation. The extent of economic loss is yet to be recognized due to lack of systematic research.

As India moves towards its quest for growth, development and economic prosperity, the dark and ugly side of this progress is rapidly emerging due to the absence of accompanying safety regulations on the use of inflammable liquids.

Suicidal and homicidal burn injuries occur due to a complex interaction of man and environmental factors in a socio economic and political context.(2)

As the etiologic factors of burn injuries due to alleged suicide and alleged homicide vary considerably in different Indian communities, careful analysis is needed before a plan for prevention can be implemented. In view of the above, this study was done with the objectives to elucidate epidemiological and outcome characteristics of alleged suicidal and homicidal burn injuries admitted in two tertiary care hospitals in South India.

## Material and Methods

The present cross sectional study of all suicidal and homicidal burn injuries admitted in two tertiary care hospitals of Belgaum city during the study period from April 2004 to March 2005 were included after informed consent from the patients themselves or from close family members. Ethical clearance was obtained from Institutional Ethical Committee. Data was obtained by questionnaire interview using a pre designed and pre tested proforma and analysed by percentages and chi square test.

## Results

During the study period, 58 victims with alleged suicidal and homicidal burn injuries were admitted in the two hospitals. Out of the total cases, 35(60.34%) were suicidal and 23(39.66%) were homicidal.

Females contributed to 21(60%) of the suicidal and 17(73.91%) of the homicidal cases. The male to female ratio was 1:1.9

Majority of suicidal injuries in males (85.72%) was in the age group of 15-44 years and 7.14% were less than 14 years of age whereas 50% of homicidal burn injuries in males were less than 14 years of age.

Suicidal and homicidal burn injuries in females were maximum between 15-44 years of age contributing to 90.48% and 88.24% of the cases respectively. It was observed that 36(62.07%) of the suicidal and homicidal victims were from a rural background and 53(91.38%) were Hindus and 5(8.62%) were Muslims. Majority (56.90%) were from nuclear families. Almost one-third cases in each group belonged to lower economic status. The source of burn was kerosene in all the cases.

Almost 46% of the injuries occurred either in the evening or at night till midnight. It was seen that 43.64% of the suicidal and homicidal burn injuries were in housewives who contributed to 31.43% of suicidal and 65% of homicidal cases. Out of 24 housewives, 3(12.5%) were pregnant. Regarding education, it was observed that 16(45.71%) of suicidal cases had secondary level education and 9 (45%) of homicidal cases had primary education.

In the present study, 13(27.10%) males and 28(58.33%) females were married at the time of the alleged suicidal or homicidal burn injury. It was observed that 19(54.3%) attempted suicide was due to a marital or family dispute.

In 17 homicidal cases (73.9%), the circumstance was a marital or financial dispute.

Sixty percent (60%) of attempted suicidal burn injuries and 34.78% of homicidal victims had TBSA more than 80% and was found to be statistically significant

**Table 1.** Distribution of suicidal cases according to the circumstance for burn injury

Circumstance for suicidal burn injury	Male		Female		Total	
	No.	%	No.	%	No.	%
Torture for dowry	00	00.0%	01	04.8%	01	02.8%
Marital or family dispute	06	42.9%	13	61.8%	19	54.3%
Debt	05	35.7%	00	00.0%	05	14.3%
Failure in affair	00	00.0%	03	14.3%	03	08.6%
Verbal abuse by parents	02	14.3%	00	00.0%	02	05.7%
Attempt to rape	00	00.0%	01	04.8%	01	02.9%
Depression	01	07.1%	03	14.3%	04	11.4%
Total	14	100%	21	100%	35	100%

In suicidal injuries, mortality was 81.80% and in homicidal cases it was 52.17%. Residual disability in homicidal cases was 21.74%.

**Table 2.** Distribution of homicidal cases according to the circumstance for burn injury

Circumstance for homicidal burn injury	Male		Female		Total	
	No.	%	No.	%	No.	%
Dowry Marital or	00	00.0%	03	17.6%	03	13.0%
Financial dispute	05	83.3%	12	70.6%	17	73.9%
Property dispute	01	16.7%	02	11.8%	03	13.1%
Total	06	100%	17	100%	23	100%

**Table 3.** Distribution of Burn Injuries according to Mode of Burn and TBSA

TBSA	Suicidal Injury		Homicidal Injury	
<19%	00	0.00%	03	13.04%
20-39%	04	11.44%	07	30.43%
40-59%	05	14.28%	01	04.36%
60-79%	05	14.28%	04	17.39%
>80%	21	60.00%	08	34.78%
Total	35	100%	23	100%

X<sup>2</sup>=9.083      DF=3      p=0.028

## Discussion

Suicidal and homicidal burn injuries and their related morbidity, disability and mortality represent a public health problem of increasing importance in South East Asian countries(3)

In the present study, majority of the alleged suicidal and homicidal victims were females which reveals the alarming issue of domestic violence.

It was observed that 7.14% of the suicidal burn cases and 50% of the homicidal injuries were in boys less than 14 years of age. In a study conducted in Taiwan, suicide attempts were seen in 2.4% of all pediatric burn injuries (4). In another study conducted in Iran, 4.1% of the burn cases in 11-14 year old children were suicidal. (5) Our findings suggest sensitivity of attempted suicide cases and the necessity of counseling in children. They are also innocent victims of homicidal attacks.

In our study, it was observed that majority of the females who attempted suicide or were victims for homicide were between 15-44 years of age. This finding suggests that women in this age group, under stressful conditions are at a risk to take the extreme step to end their lives or cannot voice their opinions within their families. They are also targets for homicide due to male dominated society and they are also victims of dowry demands which is still prevailing as an evil practice in Indian society.

Majority were from rural areas, nuclear families and lower socioeconomic status. and suggest socio-cultural problems prevalent in rural areas and breakdown of family support and economic situation of the victims.

About half of the injuries occurred after 4.00 pm indicating the time when conflicts arise at home or when victims decide to attempt suicide.

Majority of the victims were housewives and similar findings have been observed in other Indian studies (6,7,8) and indicate that housewives are vulnerable and targeted within their own homes with the availability of kerosene in the households.

Most of the victims had lower levels of education. This is in contrast to a study done in Patiala, India where 91% of dowry deaths were observed in those who were educated and amongst them 30% were graduates and post graduates. 20% of them were working and contributing to the family income but could not escape dowry victimization. (8). These findings suggest greed of family members and women being the targets to bring in more money from their parental home.

Majority were married at the time of the incident indicating family disputes as the cause for attempted suicide or homicide. The root cause is again in the social, economic, cultural and psychological state of the victim's families. In many cases, the causes are multi-factorial, cumulative and progressive (2)

In the present study, it was noted that 60% of suicidal and 34.78% of homicidal injuries had TBSA more than 80%. A study conducted in USA, revealed that mean extent of suicidal burns was 34 to 29%(9). In another study in Tokyo, mean suicidal burn extent was 40.70%. (4).

These findings suggest that suicidal burns are deliberate and the victim makes no attempt to douse out the fire and it is usually committed behind closed doors so that no one can rescue the victim and injury is extensive. In homicidal burns, the victim tries to save his/her life by dousing out the fire.

Mortality was more than 80% in suicidal injuries and more than 50% in homicidal injuries due to increased total burn surface area.

Duration of hospital stay increased with increase in TBSA and almost similar findings were observed in another study conducted in India. (6) Severity of burns determines hospital stay and longer stay in survivors is due to multiple surgical procedures and frequent infections with increasing costs.

## Conclusion

Epidemiological study of suicidal and homicidal burn injuries in India has its limitations as the truth of the mode of burn will never be known in suspicious cases due to reluctance of the victims and their families to divulge the truth because of medico-legal issues. The truth dies with the victims and the survivors live to tell their tale of horror in homicidal case and repentance in Suicidal cases.

Housewives who are easy targets are to be educated to become independent in dire consequences and take decisions when a dowry issue arises. Legislation to ban kerosene use is the need of the hour. Safer equipment like solar cookers should be advocated by policy makers.

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# Estimation of Stature from Hand Length in Haryanavi Population of North India

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## Abstract

The present study was conducted in the Department of Forensic Medicine at Pt. B.D. Sharma PGIMS, Rohtak, Haryana State, India. A total number of 103 (52 males, 51 females) Haryanvi medical students were included in the study. The subjects were within the age limit of 21-32 years as stature attains its maximum limits at around 21 years of age and senility related changes of stature start appearing after 32 years. The subjects included in the study were healthy individuals free from any apparent skeletal deformity. Only right handed subjects were included in the study. Anthropometric measurements were taken by using standard anthropometric instruments in centimeters to the nearest millimeter. All the measurements were taken in a well lighted room. The data were collected, analyzed and subjected to statistical analyses using Statistical Package for the Social Sciences (SPSS) to know the correlation of the stature with the hand length, SEE and linear regression formulae (simple and multiple) were derived for various combinations. A good correlation of height was observed with hand length 0.768 and the correlation coefficient between height and left hand length is + 0.725 in males and + 0.678 in females. The results of the present study would be useful for forensic anthropologists and forensic medicine specialists engaged in personal identification of unknown remains.

## Key Words

Forensic anthropology population data, personal identification, stature estimation, anthropometry, hand length, reliability.

## Introduction

Stature is anatomically complex that includes the dimensions of legs, pelvis, vertebral column and skull and the contribution of each of these to the total varies in different individuals and also in different populations. Hence, in the study of human remains, forensic anthropologists must have the necessary knowledge of human variation specific to a given region and population in order to be able to identify any unknown individual. Population based differences exist in both metric and morphological features of the skeleton and these have changed over time. Therefore, it is vital for biological anthropologists to conduct up-to-date research on diverse population groups residing in different geographic zones.

The methods of calculating stature from measurements of hands and feet have been suggested by some authors and they have derived regression equations and formulae for the same. It is a well established fact that hands and feet provide excellent clues regarding personal identity of an individual [1, 2]. The present study was, therefore, conducted to find out correlation between hand length and body height and evaluate the reliability of estimation of height from hand length in the Haryanavi population of North India.

## Material and Methods

The present study was conducted in the department of Forensic Medicine at Pt. B.D. Sharma Postgraduate Institute of Medical Sciences, Rohtak. A total number of 103 (52 male, 51 female) asymptomatic, healthy medical students belonging to various region of Haryana State of north India were included in the study. The subjects were within the

age limit of 21-32 years. Hand length and body height was defined and measured in the following manner.

Hand length - It is projected distance between the points inter-styloid and the tip of the third finger. Technique: The subject was asked to stand erect. The hand, being pendent along the body, was held with the left hand, which pressed on the fingers to keep them fully extended. The Vernier Caliper, held in the right hand was placed along the radial border at the hand, its stem being strictly parallel to the axis of the hand. The fixed part of the outer jaw of the caliper was applied to the inter-styloid point and the mobile part of the outer jaw was approximated to the tip of the third finger and the measurements were taken.

Stature - It is the vertical distance between the point vertex and the heel touching the floor (ground surface). Technique: The subject was made to stand in erect posture against the wall with the feet axis parallel or slightly divergent and the head balanced on neck and measurement was taken without any wear on head and foot using the Anthropometric rod.

## Results

The present study focused on the estimation of stature from the dimensions of hands. The data pertaining to the various anthropometric measurements i.e. Stature, hand length, were subjected to statistical computation i.e. mean, standard deviation (S.D.), "t" test, correlation coefficient, regression analysis and standard error of estimate (SEE). Sexual differences in the studied parameters were assessed with the help of "t" test. In order to predict stature of an individual from the anthropometric measurements, simple linear regression and multivariate regression equations were derived. Regression equations were used to estimate stature from observed data. The SEE predicts the deviations of estimated stature from the actual stature.

Table 1 shows that the mean  $\pm$  S.D. of stature is (173.485 $\pm$ 6.206) in male, (159.045 $\pm$ 5.067) in females. The values of all the measurements of parameter in case of males are higher than in females and these sex differences are statistically highly significant ( $p < 0.001$ ).

**Table 1.** Sexual differences in hand length in Haryanvi population

Measurement	Mean $\pm$ S.D.		t-test	p-value
	Male	Female		
S	173.485 $\pm$ 6.206	159.045 $\pm$ 5.067	12.920	0.000
HRT	19.417 $\pm$ 1.544	17.374 $\pm$ .781	8.449	0.000
HLT	19.3658 $\pm$ 1.5634	17.3067 $\pm$ .7471	8.501	0.000

Table 2 illustrates the correlation coefficients between stature and dimensions of hands on left and right sides in both the sexes. All the measurements exhibit statistically significant correlation with stature ( $p < 0.01$ ). Correlation coefficients of the hand length measurements are higher in males bilaterally. The highest correlation is exhibited by left hand ( $r = 0.725$ ).

Tables 3, 4, 5 list the regression equations for estimation of stature from measurements of hands of both the sexes separately and together. The tables also exhibit standard error of estimate (SEE) along with linear regression equations for hand length on bilateral sides in both sexes together. The SEE ranges from 5.912 to 5.921 of both the sexes

**Table 2.** Correlation between the dependent variable (Stature) and explanatory variable (Hand length).

Measurement	Both sexes together	Female	Male
		Coefficients	
	B		
Stature	1.000	1.000	1.000
HR	0.767**	0.661**	0.708**
HL	0.768**	0.678**	0.725**

\*\* Correlation is significant at the .01 level (two-tailed)

HR= Right Hand length. HL= Left Hand length

**Table 3.** Simple linear regression equation for estimation of stature from hand length of both sexes together.

S= a+bx	Both sexes together	Std. Error	SEE	R <sup>2</sup>
	B			
(Constant)	a. 84.936	6.790		
HRT(x)	b. 4.422	0.368	5.921	0.589
(Constant)	a. 85.455	6.729		
HLT(x)	b. 4.409	0.365	5.912	0.590

X: A measurement of hand

a: Regression coefficient of the dependent variable i.e. stature

b: Regression coefficient of the independent variable i.e. hand length

SEE: The SEE predicts the deviations of estimated stature from the actual stature. A low value indicates greater reliability in the estimated stature.

together. In males, SEE ranges from 5.328 to 5.333 whereas in females it ranges from 3.763 to 3.841. Left hand length exhibits lower values of SEE thus gives better reliability for prediction of stature. The best correlation with stature is demonstrated by left hand length in subjects. The tables also show R-square or the coefficient of determination along with linear regression equations for hand length. Maximum R-

**Table 4.** Simple linear regression equation for estimation of stature from hand length in females

S= a+bx	Female	Std. Error	SEE	R <sup>2</sup>
	B			
(Constant)	a. 84.519	12.099		
HRT(x)	b. 4.289	0.696	3.841	0.437
(Constant)	a. 79.486	12.340		
HLT(x)	b. 4.597	0.712	3.763	0.459

**Table 5. Simple linear regression equation for estimation of stature from hand length in males.**

S= a+bx	Male	Std. Error	SEE	R <sup>2</sup>
	B			
(Constant)	(a)132.377	9.413		
HRT(x)	(b)2.117	0.483	5.328	0.277
(Constant)	(a)133.092	9.280		
HLT(x)	(b)2.086	0.478	5.333	0.276

square is shown by left hand length and minimum is by right hand length.

Table 6 shows the multiple regression equations for estimation of stature on the basis of measurements of both hands. The table also shows standard error of estimate (SEE) along with linear regression equations for hand. It ranges from 5.378 for males, 3.780 for females to 5.917 for both genders together. Hand length of female subjects' exhibits lower values than hand length of male subjects. The table also depicts R-square or the coefficient of determination along with multiple regression equations for hand length. Maximum R-square (R<sup>2</sup>=0.594) is shown by hand length of both the sexes together and minimum R-square (R<sup>2</sup>=0.278) is by hand length of males.

**Table 6.** Comparison of multiple regression equation for estimation of stature on the basis of right and left hand length of both sexes individually and combined.

Stature = a + b1 HRT + b2 HLT	Both gender together		Female		Male	
	Coefficients		Coefficients		Coefficients	
	B	Std. Error	B	Std. Error	B	Std. Error
(Constant)	a. 84.676	6.790	a. 78.788	12.431	a. 80.712	9.503
HRT(x1)+ HLT(x2)	b1. 2.045	2.258	b1. 1.426	1.910	b1. 1.266	3.141
	b2. 2.400	2.248	b2. 3.206	1.996	b2. 0.850	3.101
	R2=0.594 SEE=5.917		R2=0.466 SEE=3.780		R2=0.278 SEE=5.378	

a: Regression coefficient of the dependent variable i.e. stature.

b1: Regression coefficient of the independent variable i.e. right hand length.

b2: Regression coefficient of the independent variable i.e. left hand length.

**Table 7.** Comparison of different regression formulae for estimation of stature from hand length in various Indian populations

S.N	Sex	Regression equations	S.E.E	Value of r	Author
1.	Female	S=68.89+4.96HL	5.40	0.679	Nath and Krishan [22]
2.	Female	S=85.22+4.05HL	5.43	0.594	Nath et al [23]
3.	Male	S=89.13+4.13 HL	4.57	0.599	Kaur [24]
1.	Female	S=88.13+4.04 HL	3.99	0.639	Anand and Nath [25]
4.	Male	S=123.22+2.37 HL	11.57	0.345	
1.	Female	S=96.27+3.56 HL	9.31	0.597	Krishan and Sharma [13]
5.	Male	S=88.243+4.39 HL	5.17	0.609	
1.	Female	S=81.314+4.425 HL	3.82	0.677	Present study (2008-09)
6.	Male	S=132.488+2.114 HL	5.324	0.527	
	Female	S=79.432+4.591 HL	3.750	0.681	

## Discussion

Estimation of stature is a major forensic concern used in the identification of unknown and commingled human remains. In the last few decades, this aspect of forensic medicine has seen astounding progress and this expertise is used to aid law enforcement agencies and legal authorities and other forensic science institutes and laboratories throughout the world.

Various studies have been conducted on the estimation of stature from the human skeleton. There are various methods to estimate stature from the bones but the easiest and the reliable method is by regression analysis [3, 4].

The present study shows sex differences to be highly significant for all the measurements (p < 0.001) which are in consistent with studies of Krishan and Sharma [5] and Ozden et al [6]. In the present study, the significant differences in stature, hand measurements between

males and females can be attributed to the fact that fusion of epiphyses of bones occurs earlier in girls in comparison to boys. In other words, boys have about two more years of bony growth than girls, which were expressed in male surpass of the somatometric measurements of the adult [7].

The correlation coefficients between stature and all the measurements of hands were found to be positive and statistically significant and the left hand length in both the sexes together exhibits the overall highest value of correlation ( $r = 0.768$ ) with stature followed by length of left hand in males ( $r = 0.725$ ). Left hand in males shows highest correlation with stature in Haryanvi subjects. Similar results were observed by Agnihotri et al [8] who noticed that the length of left hand alone explained the stature very significantly ( $P < 0.001$ ).

Table 7 presents the regression equation formulae for prediction of stature from the dimensions of hands in different Indian populations for comparison with the present study. It was observed that there was no significant bilateral difference in hand length. So the data for two sides were pooled for statistical analysis of hand length in both the sexes.

In the present study, stature was taken as the response or dependent variable and hand length was taken as explanatory variable or regressor. All possible (simple and multiple) linear regression models for each of males, females and both genders together were tested for the best model. The multiple linear regression model for both genders together was found to be the best model with the highest values for the coefficients of determination  $R^2 = 0.810$ .

## Conclusion

It is concluded that the dimensions of hands can provide good reliability

in estimation of stature. The left hand length gives better prediction of stature than the right hand length. Stature estimation is more accurate and reliable in case of male Haryanvi medical students than in female medical students.

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# A Study of Palatine Rugae Pattern

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## Abstract

## Introduction

Rugae pattern is specific to racial groups and hence facilitate in population identification. This pattern is genetically determined. *AIM* - To identify the different rugae patterns and to differentiate between the rugae patterns in Male and Female subjects of the population being studied. **MATERIALS & METHODS**-A total of 100 dentate subjects comprising of 50 males & 50 females with an age range of 19-27 are included. A total of 957 rugae pattern were studied and classified using Thomas et al classification system. **RESULTS**-Straight, Wavy & Curved patterns showed predominance in both male & female subjects. Wavy, diverge & fragmented patterns showed statistical significant predominance in female population whereas circular, curved & converge patterns showed statistical significant predominance in male population.

## Key Words

Palatal Rugae, Palate, Identification, Forensic Dentistry

## Introduction

Rugae are anatomical folds or wrinkles; the irregular fibrous connective tissue located on the anterior third of the palate behind the incisive papilla. They are also called as plica palatinae. Rugae patterns have been studied for various purposes mainly in the field of anthropology, comparative anatomy, genetics, prosthodontics & orthodontics. In forensic medicine, three main methods of identifications are used namely the visual, fingerprints and dental characteristics. In many instances, one or all of these methods may not be totally effective or conclusive. Many criminal investigations and victims of aircraft accidents have been identified by their dentition. The use of human palatal rugae was suggested as an alternative method of identification. Rugae are protected from trauma by their internal position in the head and they are insulated from heat by the tongue and buccal fat pads. In one study, it was reported that no two palates are alike in their configuration and that the palatal print did not change. Even between twins, the studies indicated that the patterns are similar but not identical.<sup>1</sup>

It is assumed that the rugae facilitate food transport through the oral cavity (Zietzschmann et al. 1943), prevent loss of food from the mouth (Scott & Symons 1967), and participate in food crushing (Eisentraut 1975). Because of the presence of tactile and gustatory receptors, rugae contribute to perception (Scott & Symons 1967) of taste, mechanical food qualities, and tongue position (Halata & Baumann 1999). Finally, Pourtois (1972) suggested that palatal ridge could participate in prenatal stiffening of the oral epithelium by thickening of lateral processes during the development of the secondary palate. Individual variations in the number and morphology of palatal rugae in man were described in detail by Caruso (1969).<sup>2</sup>

Matravers & Tyldesley (1978) compared morphological characteristics of the surface of normal & malignant oral epithelium in man.<sup>2</sup>

## Classification

The first significant attempt to classify palatal rugae was that by Lysell (1955), who discerned primary, secondary, and fragmentary rugae. A more detailed description of human palatal rugae was published by Thomas & Kotze (1983) who also considered size, specific shape details, and size of rugal patterns and dental arches.<sup>3</sup> The earliest references to the palatine rugae are found in various books about general anatomy. Winslow seems to have been the first to describe them, and the earliest illustration of them probably is by Santorini, a drawing depicting three continuous wavy lines that cross the midline of the palate.<sup>2</sup> At birth, the palatine rugae are well-formed, and the pattern of orientation typical for the person is present.<sup>2</sup> When traffic accidents, acts of terrorism or mass disasters occur in which it is difficult to identify a person according to fingerprints or dental records, palatine rugae may be an alternative method of identification. The palatine rugae are permanent and unique to each person and can establish identity through discrimination (via casts, tracings or digitalized rugae patterns).<sup>4</sup>

## Classification of Palatine Rugae

Lysell's classification in 1955 is the most important, and it has been used widely in research involving rugae. Rugae are measured in a straight line between the origin and termination and are grouped into three categories:

- Primary: 5 millimeters or more
- Secondary: 3 to 5 mm
- Fragmented: 2 to 3 mm

Rugae smaller than 2 mm are disintegrated. The rugae on both sides of the palate are numbered separately from anterior to posterior and classified according to shape, position or origin in relation to the median palatal rugae

Three categories of unification are recognized in this system:

- Common origin diverging laterally;
- Separate origins converging laterally;
- Separate origins converging laterally but involving one primary and one secondary rugae.

Branching, breaks, papillations, annular formations and spirals are counted, while the rugae directions are measured in degrees relative to the median palatal rugae. The clinician observes the distribution of secondary and fragmentary rugae by noting their proximity to the nearest primary ruga while observing the posterior border relationship with the teeth.

## Rugae Dimensions and Prevalence

**Length:** Length is determined according to the greatest rugal dimension, and the rugae are classified according to the system established by Lysell (that is, primary, secondary or fragmentary).

**Prevalence:** The clinician does not count the total number of rugae on each side of the palate, but he or she counts and records the number in each category (that is, primary, secondary or fragmentary).

**Area:** The clinician photographs the palate to determine the surface area of the primary rugae.

## Primary Rugae Details

**Annular rugae:** To be considered annular, the rugae must form a definite ring.

**Papillary rugae:** A ruga is termed "papillate" when three or more clefts traverse the ruga at any depth, but not down to the surrounding mucosal surface.

**Crosslink:** This is a small ruga that is a distinct entity and joins two rugae, usually at a right angle.

**Branches:** A branch extends 1 mm or more from its origin (that is, the parent ruga) in a lateral direction.

**Unification:** This process occurs when two primary rugae are joined at their origination points and then diverge laterally.

**Breaks:** If a papillation cleft extends down to the level of the surrounding epithelium (less than 1 mm), it becomes a break.

**Unification with non primary rugae:** This is a convex or concave unification of a primary rugae and a rugae that is between 1 and 5 mm in length.

## Rugae Pattern Dimensions

**IP to anterior most point (AP) (IP-AP):** This is the distance between the most anterior point on the IP and the most anterior point on the rugae pattern, regardless of side.

**IP to posterior border of last primary or secondary ruga (PB3) (IP-PB3):** This is the distance between the IP & the most posterior point on the last primary or secondary ruga.

**IP to posterior border of last ruga (PBA) (IP-PBA):** This is the distance between the IP & the most posterior point on the last ruga (including fragmentary rugae).

## Angle of Divergence

The clinician measures the angle of divergence of the rugae pattern in degrees between the line formed by the median palatal rugae and the line joining the IP with the origin of the most posterior primary or secondary ruga on one side of the palate. He or she measures the angle of divergence for the other side in the same manner.

## Forensic Identification

Establishing a person's identity can be a difficult task in cases of traffic accidents or acts of terrorism or in mass disaster situations. Visual identifications, use of dental records & finger prints & DNA comparisons probably are the most common techniques used in this context, allowing fast & secure reliable identification.

It is a well-established fact that the rugae pattern is as unique to a human as are his or her fingerprints & it retains its shape throughout life. The anatomical position of the rugae inside the mouth-surrounded by cheeks, lips, tongue, buccal pad of fat, teeth & bone-keeps them well protected from trauma & high temperatures. Thus, they can be used reliably as a reference landmark during forensic identification.<sup>3,5</sup>

## Stone Casts

Jacob & Shalla evaluated the use of dental stone casts derived from maxillary tissues & from the internal aspects of maxillary dentures for postmortem identification of edentulous people. Limson & Julian used a computer software program to evaluate the use of palatine rugae patterns for forensic identification.<sup>7</sup>

## Burn Victims

Muthusubramanian & colleagues examined the extent of palatine rugae preservation for use as an identification tool in burn victims & cadavers, thus simulating forensic cases of incineration & decomposition.<sup>2,3,7</sup>

## Material and Methods ( Figure 1-5 )

A total number of 100 dentate subjects, 50 males and 50 females were selected among the students of the D. J. College of Dental Sciences and Research, Modinagar, Ghaziabad, U.P., India. Their ages were between 19-27 years. All the subjects were healthy individuals free of congenital abnormalities, inflammation, trauma or orthodontic treatment.



Fig 1. Armamentarium



Fig 2. Tray Selection



Fig 3. Impression Making



Fig 4. Pouring the Cast



Fig 5. Making the Study Cast

## The Impressions

Alginate was used as an impression material on an appropriate perforated metal tray for the upper dental arch for all subjects. All instructions by the manufacturers were followed for making impressions. The impressions were then poured into stones. All casts were free of air bubbles or voids especially at the anterior third of the palate.

## Method of Identification

The method of rugae identification was based on the classification of Thomas et al (1983). This classification includes number, length, shape and unification of rugae. The shapes are classified into curved, wavy, straight and circular. Fragmented rugae are those which have length less than 5 mm. Unification is divided into converge where two rugae originate away from the centre and unite towards it. While diverge ones are those rugae which originate from the centre and diverge away from it. The rugae were highlighted by a marker pen on the cast and a magnification lens was used for identification. Measurement was done using ruler in millimeters. All the identification and measurements were done by one examiner and the readings were repeated three times for each cast. The fragmented types were studied separately for a comparative study purpose between males and females.

## Findings

In this study of palatine rugae, out of 100 subjects there were 50 male and 50 female subjects showed different patterns of rugae such as (Converge, Circular, Diverge, Curve, Wavy, Straight and Fragmented). (Table-I). A statistical "t-test" was applied to evaluate the data. Further a high positive & significant correlation coefficient was observed for curve, wavy & circular types of rugae patterns between male & female at 1% level of significance i.e.  $P < 0.001$ . A positive significant correlation was also observed between converge & diverge type of rugae between male & female subjects at 1% level of significance i.e. ( $P < 0.001$ ). However, a weak positive correlation were observed for Straight and Fragmented type of rugae pattern i.e. ( $P > 0.01$ ) (Table - 2).

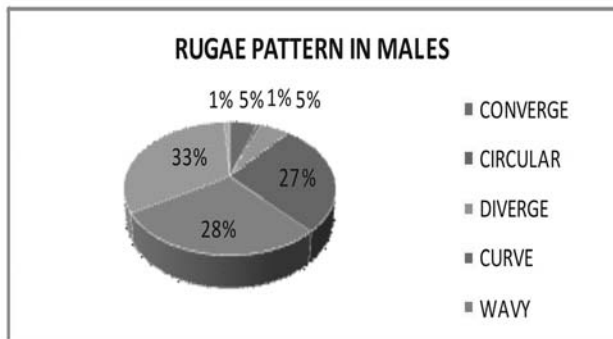
**Table 1.** Total Number of Subjects and Rugae Pattern in Males and Females

SEX	RUGAE PATTERN						
	Converge	Circular	Diverge	Curve	Wavy	Straight	Fragmented
Male (50)	24	3	26	130	135	156	5
Female (50)	16	1	31	119	142	155	14

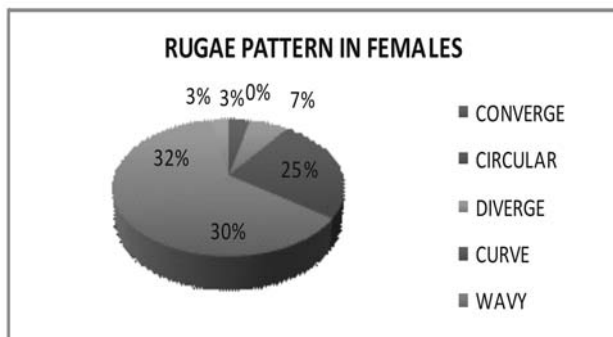
**Table 2.** Percentage Difference And P-value Of Different Rugae Patterns In Males & Females

Pattern	% Difference	P-Value	
Converge	20%	0.0071	$P < 0.01$
Circular	50%	0.000189	$P < 0.01$
Diverge	8.71%	0.0023	$P < 0.01$
Curve	4.41%	0.00012	$P < 0.01$
Wavy	2.52%	0.0041	$P < 0.01$
Straight	0.32%	0.4131	$P > 0.01$ (N.S)
Fragmented	47.36%	0.000358	$P < 0.01$

**Pie Chart 1.** DISTRIBUTION OF RUGAE PATTERN IN MALES



**Pie Chart 2.** DISTRIBUTION OF RUGAE PATTERN IN FEMALES



## Discussion

Rugae are defined as the anatomical folds or wrinkles, the irregular fibrous connective tissue located on the anterior third of the palate, behind the incisive papillae. In forensic dentistry, the oral cavity plays a very important role because of the unique anatomy of the teeth, but if the teeth are missing or lost due to any reason then the palatine rugae are used as an alternative method for the identification. There are different ways to analyze the palatal rugae. Intra oral inspection is the most common method which is easy to perform and economical. The present study was conducted in the Department of Oral Medicine & Maxillofacial Radiology at D.J College of Dental Sciences & Research, Modinagar. It comprised of 100 subjects, out of which 50 subjects were male and 50 were female subjects of the age group between 19 to 27 years.

### Male Subjects

In this study a total of 479 palatal rugae patterns were observed which comprised of straight, wavy, curved, diverge and converge rugae patterns in the male subjects. Straight, Wavy & Curved patterns showed predominance in male subjects. It was observed that the straight rugae patterns showed about 156 patterns, wavy of 135 patterns and curve of about 130 rugae patterns were seen. Diverge patterns were 2 in number and 24 converge patterns were also observed. Circular and fragmented were the least predominant rugae patterns as circular were only 3 in number and only 5 fragmented rugae patterns were seen.

### Female Subjects

In this study a total of 478 palatal rugae patterns were observed which comprised of straight, wavy, curved, diverge and converge rugae patterns in the female subjects. Straight, Wavy & Curved patterns showed predominance in female subjects. It was observed as of the straight rugae patterns showed about 155 patterns, wavy of about 142 patterns, which was higher number of patterns than male subjects. About 119 curve rugae patterns were also seen in the female subjects which was less in number of pattern than the male subjects. A total of 31 Diverge and 16 converge patterns along with 14 fragmented patterns were also observed. Circular showed the least occurrence with only 1 rugae pattern was observed.

### Intergroup Comparison

In the present study on intergroup comparison between male and female subjects which showed a predominance of straight rugae patterns of about 156 rugae patterns in males which was more than that of females which showed about 155 straight rugae patterns. It showed a statistical difference of about 0.32% between the straight patterns of male and female subjects with  $p = 0.4131$  ( $p > 0.01$ ) which was statistically non-significant. A higher predominance of Wavy rugae pattern was observed in female subjects with about 142 patterns, which was greater than male subjects with 135 patterns observed. 2.52% of percentage difference was seen between the wavy patterns of male and female subjects at the p value of  $p = 0.0041$  which was highly significant statistically. About 119 curved rugae patterns were also seen in the female subjects which was less in number of patterns than the male subjects. The percentage difference between the curved rugae patterns between the male and female subjects was about 4.41% with  $p = 0.00012$  showed high statistical significance. A total of 31 Diverge patterns were seen in female subjects which was higher than the male subjects which comprised of 26 diverge rugae patterns. The percentage difference between the diverge rugae patterns of male and female subjects was about 8.71% with  $p = 0.0023$ . A total of about 16 converge patterns were seen in female subjects which was less than 24 rugae patterns of male subjects. The percentage difference between the converge rugae patterns of male and female subjects was

about 20% with  $p=0.0071$  which was statistically significant. About 14 fragmented patterns were also observed in the female patients whereas 5 rugae patterns of the male subjects. The percentage difference between the fragmented rugae patterns of male and female subjects was about 47.36% with  $p=0.000358$ . Circular patterns showed the least occurrence with only 1 rugae pattern observed in female subjects which in comparison to the male subjects showed 3 rugae patterns. The percentage difference between the circular rugae patterns of male and female subjects was about 50% with  $p=0.000189$  which was of high statistical significance.

## Conclusion

The present study showed a Wavy, Diverge & Fragmented patterns predominantly in the female subjects as compared to the male subjects which showed the predominance of Converge, Curve & Circular patterns. Thus it can be concluded that sex differentiation can be done according to the predominance of different rugae patterns in either sex groups. Further improvements are required in the study such as;- Inclusion of the wider range of age groups with a bigger sample size and certain comparative studies can be done involving procedures such as cheiloscopy and bite mark analysis.

**Interest of Conflict:** None Declared

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# Bioweapon in Orthodontics: Botox

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## Abstract

An increase in social and esthetic awareness has fuelled an upsurge in the percentage of adults seeking cosmetic dental treatment in recent times. The goal of enhancing patient appearance requires knowledge of the fundamental concepts of art and beauty. Recently a bioweapon with a tradename of Botox has been introduced for the correction of gummy smile. Hence, a minimally invasive treatment modality that can serve as a substitute for the surgical procedure, i.e., the use of Botulinum toxin (BTX) has been suggested. Patients with gummy smile who are not willing for surgical procedures such as orthognathic surgery can be best treated by botox therapy.

## Key Words

Esthetics, Gummy Smile, Botox therapy.

## Introduction

An increase in social and esthetic awareness has fuelled an upsurge in the percentage of adults seeking cosmetic dental treatment in recent times. The primary motivating factor for patients seeking orthodontic treatment is aesthetic improvement. A smile has a tremendous impact on the perception of one's attractiveness and personality. It is known to be a window through which people perceive the personality of an individual. Psychological research has shown that attractive people are professed as more successful, intelligent, and friendly.

The anatomy of the facial musculature must be understood by orthodontists, whose main interest is the appearance of the teeth and periodontal tissue, because the behavior of perioral muscles critically influences the structure of a smile. Excessive gingival display during smiling is known as "gummy smile". Hyperactive lip elevator muscles, skeletal and gingival causes of this condition have been described in the literature.<sup>1-3</sup> Patients with a gummy smile had 20% or greater facial muscular capacity to raise the upper lip on smiling.<sup>4</sup>

Garber and Salama<sup>5,6</sup> have suggested that the relationships between the three primary components: the teeth, the lip framework, and the gingival scaffold – determine the esthetic appearance of a smile. The appearance of this lip framework is determined by the activity of various facial muscles, such as the levator labii superioris (LLS), the levator labii superioris alaeque nasi (LLSAN), and the zygomaticus minor (ZMi)/major muscles (ZMj). Among these, the LLS, the LLSAN, and the ZMi determine the amount of lip elevation that occurs during smiling. The LLS originates from the orbital rim of the maxilla and inserts into the upper lip; the LLSAN originates from the frontal process of the maxilla and inserts into the upper lip and the skin tissue of the ala of the nose. The ZMi originates from the zygomatic bone and inserts into the skin tissue of the upper lip.<sup>6,7</sup> Variations in the morphology, distribution, and activity of the facial muscles of expression account for variations in facial expression.<sup>6,8</sup>

The literature reports that several surgical procedures have been performed to correct gummy smiles caused by hyperfunctional muscles.<sup>1,6,9-11</sup> However, surgical procedures may lead to frequent relapse and undesirable side effects such as scar contraction. Recently a bioweapon with a tradename of Botox has been introduced for the correction of gummy smile.<sup>12</sup> BOTOX is the brand of botulinum toxin type A, a registered product by Allergan Inc. in India and worldwide. The product is supported by an extensive clinical research and the

efficacy and safety are claimed based on these evidences. It is the first product of its type to be approved by United States Food and Drug Administration (US FDA) in 1989, to be used for therapeutic purposes and is the only of its type approved by US FDA in 2002, for cosmetic use. Hence, a minimally invasive treatment modality that can serve as a substitute for the surgical procedure, i.e., the use of Botulinum toxin (BTX) has been suggested.<sup>6</sup>



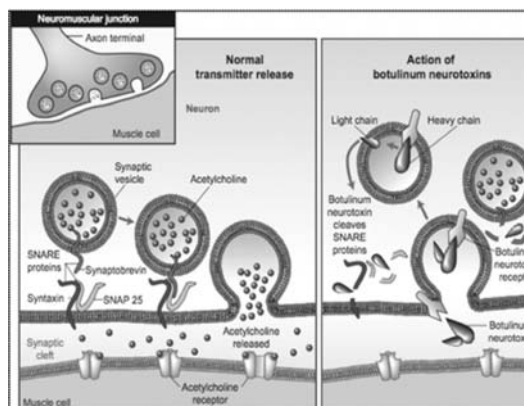
## Chemical Structure

The botulinum toxin is a neurotoxin that is among the most deadly naturally occurring toxicants and its responsible for the fatal disease Botulism. Botulinum toxin is a protein consisting of seven related A-B toxins. Each botulinum toxin molecule is comprised of a heavy chain and of a light chain, connected by a disulfide bond.

Very minute doses of the toxin can be fatal and according to Arnon et al, "a single gram of crystalline toxin, evenly dispersed and inhaled, would kill more than 1 million people" (Arnon et al, 2001).<sup>14</sup> It is classified by the Center for Disease Control as one of the six highest-risk threat agents of bioterrorism. It is produced in the naturally occurring anaerobic bacteria *Clostridium botulinum*, potentially usable as a bioweapon. Despite its impressive toxicity, the botulinum toxin is familiar to many under the trade name "Botox", and has a variety of cosmetic and medical uses (Schiavo et al<sup>15</sup>, Dickerson and Janda<sup>16</sup>, Dressler and Benecke<sup>17</sup>). The toxin is diluted heavily then injected into areas of the skin where the adherents want to rid the skin of wrinkles. The toxin, called botox in this formulation, temporarily paralyzes the tiny face muscles that lead to the wrinkles.

## Mode of Action

The botulinum toxin is a "blocking agent" which prevents the release of certain neurotransmitters (Kent)<sup>18</sup>. Specifically, the toxin prevents the release of acetylcholine from the endings of the motor nerves so that the muscles they innervate are paralyzed (Kennedy)<sup>19</sup>.



1. The first step is binding of the toxin to specific receptors on the surface of the presynaptic cell surface, mediated by the C-terminal half of the heavy chain. This step occurs over approximately 30 minutes.



- The second step is *internalization*, an energy-dependent receptor-mediated endocytic process. In this step, the plasma membrane of the nerve cell invaginates around the toxin-receptor complex, forming a toxin-containing vesicle inside the nerve terminal.
- The third step is *translocation*. After internalization, the disulfide bond is cleaved, and the 50-kDa light chain of the toxin molecule is released across the endosomal membrane of the endocytic vesicle into the cytoplasm of the nerve terminal.
- The final step is blocking. The 50-kDa light chain of serotypes A and E inhibit acetylcholine release by cleaving a cytoplasmic protein (SNAP-25) required for the docking of acetylcholine vesicles on the inner side of the nerve terminal plasma membrane. Botulinum toxin type D is specific for VAMP/synaptobrevin. Botulinum toxin types B and F also affect the VAMP/synaptobrevin protein. These actions impede the release of acetylcholine into the synaptic cleft.

Botulinum toxin has a light chain and a heavy chain, each of which contributes to the toxicity. The heavy chain allows the protein to bind to and enter a neuron. After the heavy chain allows entry, the light chain acts like a protease and cleaves proteins that would normally allow neurotransmitters to leave the cell. This is essentially a disruption of exocytosis or the release of neurotransmitters (Dong et al.).<sup>20</sup> The blocked neurotransmitter, acetylcholine, normally transmits a nerve impulse to a muscle, signaling the muscle to contract. By blocking this neurotransmitter, botulinum toxin causes its characteristic flaccid paralysis (Madigan and Martinko).<sup>21</sup>

When the muscles are kept under the influence of BOTOX, they become shrunken (atrophic) and the BOTOX effect starts to become more long lasting.

## Indications

BOTOX is a highly purified naturally occurring protein complex that has been used for over twenty years, in adults, children and even infants for the treatment of a variety of conditions caused by muscle spasm, including spasm of the vocal cords. The cosmetic use of BOTOX is a direct outgrowth of these previous uses.

- Gummy Smile.
- Treats upper facial lines and wrinkles.
- Hyperhidrosis (excessive sweating), and some headaches.
- Can be used to shape the eyebrows.
- Treats some thickened lower eyelids and enlarged jaw muscles.

## Contraindications

- Pregnancy.
- Breast feeding.
- Patients having neurological disorders.
- Patients allergic to albumin.

## Injection Sites & Procedure

There are injection sites on face as shown in figure. BOTOX is stored in a freezer at or below -5°C. The package insert for BOTOX recommends dilution with sterile nonpreserved saline. Studies have



demonstrated that preserved saline provides increased patient comfort without decreasing efficacy. The practice of adding lidocaine to BOTOX has been abandoned following an unrelated death. Topical anesthetics are dilators (with the exception of cocaine) and, therefore, may increase migration of BOTOX to unwanted areas. Injections are administered with a tuberculin syringe to sites on the face that have been carefully chosen based on a study of the patient's facial anatomy. Facial symmetry and asymmetry are very important. The patient needs to have a neuromuscular imbalance to be eligible for Botox.<sup>13</sup>

Correct dosage for patients with moderate to severe cases is 2.5 units per 0.1 cc solution injected at a maximum of four sites. This dosage is appropriate for those with more than 3 mm of gingival exposure. What varies is the number of injection sites: two sites for patients with 3 to 5 mm exposure, four sites for those with more than 5 mm exposure.<sup>13</sup>

The effect lasts about 6 months, with a range of 4 to 8 months, at which time the patient can return to repeat the process. It's important not to give injections prematurely (before the effects of the treatment have worn off), as this can result in a buildup of antibodies to Botox that would dilute the effect of further treatments.<sup>13</sup>

## Clinical Reports

These are the two treated cases by Dr. Mario Polo with BOTOX therapy.<sup>12,13</sup>



## Conclusion

The goal of enhancing patient appearance requires knowledge of the fundamental concepts of art and beauty. For obtaining the desired results in a patient, options such as surgical and non surgical procedures are available. Cosmetic dental treatment with Botox (Botulinum Toxin) comes under non surgical procedure. It is atraumatic and less time consuming technique for obtaining good esthetic results. Patients with gummy smile who are not willing for surgical procedures such as orthognathic surgery can be best treated by botox therapy. In the field of Orthodontics where esthetic harmony, funtional efficiency and structural balance (*Jackson's Triad*) are mainly concerned, botox can be regarded as a bioweapon in Orthodontics.

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# Deliberate Self Harm: Socio-Demographic Profile

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## Abstract

Deliberate self-harm is a challenging public health issue. We aimed to understand the behavior of deliberate self-harm, both fatal and nonfatal, in a tertiary health care setting. A two year retrospective hospital record-based research was conducted in a tertiary care hospital attached to a teaching medical institution in Karnataka to record socio-demographic profile and clinical outcome of suicidal behavior. Data were collected by using specially devised deliberate self-harm proforma. During the two year research period 137 patients were reported with deliberate self harm, among which 17 had fatal outcome and 120 recovered after treatment. Of these 58.4% were females and 41.6% males. The majority (48.2%) cases were from age group of 21–30 years. Victims were predominantly belonged to Hindu community (83.2%). The majority of acts of deliberate self-harm (90%) were committed inside the home. Poisoning was the commonest (57.7%) method of self-harm, particularly using pesticide. Psychiatric illness was seen in 67.9% deliberate self harm victims.

## Key Words

Deliberate self harm; Suicide; Poisoning

## Introduction

Deliberate self-harm (DSH), both fatal and non-fatal, is a challenging public health issue. Fatal DSH (suicide) caused about 54% of all violent deaths globally in 2002 and more people died by committing suicide than due to homicides and wars combined.<sup>1</sup> Suicide is an intricate phenomenon, associated with psychosomatic, biological and social factors. The World Health Organization estimates that approximately one million people commit suicide per year.<sup>2</sup> Suicide is widely prevalent and no nation and culture has escaped from it, though the toll varies from place to place. In most countries, based on the data that are available, suicide ranks among the top 10 causes of death for individuals of all ages and among the 2 or 3 leading causes of death for those aged 15-34 year.<sup>3</sup> In India about one lakh people commit suicide every year, contributing to about 10% of suicides in the world.<sup>4</sup> There are considerable regional differences in the rates of suicide in different parts of India over different time periods, ranging from 22.8 to 95.2 per 1,00,000 population.<sup>5-9</sup> It is estimated that the incidence of non-fatal DSH is 250 per 100 000 persons per year.<sup>10</sup> Non-fatal DSH is considered to be 10 times more common than completed suicide.<sup>11</sup> Morbidity and mortality due to deliberate self harm is preventable if sufficient knowledge and understanding of this maladaptive behavior can lead to timely intervention. This study aimed to understand DSH behaviour, both fatal and non-fatal, at the tertiary care setting in this coastal region of Karnataka

## Material and Methods

This is a retrospective hospital record-based study conducted at one of the tertiary health care center and teaching hospital of southern Karnataka, for a period of 2 years. All the patients who were admitted with history of deliberate self harm during the period from January 2009 to December 2010 were included in this retrospective research. Informed consent was taken from all the patients who were included in the study. The study included 137 cases of deliberate self harm and

data regarding socio-demographic profile and clinical outcome were collected in the pre-structured proforma. The data collected using the proforma was analyzed using SPSS 11.0 software.

## Results and Observations

One hundred thirty seven patients were admitted in the hospital with the history of deliberate self harm during the period of 2 years (January 2009 to December 2010) as depicted in the Table No. 1. Maximum numbers of deliberate self harm cases were found to be in the age group of 21 to 30years, followed by the age group of 31 to 40 years, and 11 to 20 years respectively, as depicted in the Table No. 2. In our study, we observed that females outnumbered males, as depicted in the Table No. 3. 83.2% of the victims were Hindus, followed by Muslims and Hindus, as depicted in the Table No.4. The majority of acts of deliberate self-harm (86.1%) were committed inside the home, as depicted in the Table No.5. Poisoning was the commonest (57.7%) method of self-harm, particularly using pesticide, followed by deliberate self harm by drowning (25.5%) and hanging (13.1) as depicted in the

**Table 1.** Year wise distribution of cases of deliberate self-harm (n=137)

Year	Number of cases
2009	69
2010	68

**Table 2.** Age incidence (n=137)

Age group in years	No of cases	Percentage (%)
< 10	3	2.2
11-20	22	16.1
21-30	66	48.2
31-40	29	21.2
41-50	5	3.6
51-60	9	6.6
>61	3	2.2

**Table 2.** Gender distribution (n=137)

Sex	No. of cases	Percentage (%)
Male	57	41.6
Female	80	58.4

**Table 4.** Religion-wise distribution of victims (n=137)

Religion	No. of cases	Percentage (%)
Hindu	114	83.2
Muslim	13	9.5
Christian	10	7.3

**Table 5.** Place of occurrence (n=137)

Area	No. of cases	Percentage (%)
Home	118	86.13
Outside	19	13.87

**Table 6.** Method employed (n= 137)

Nature of poison	No. of cases	Percentage (%)
Burns	4	2.9
Drowning	35	25.5
Fall	1	0.7
Hanging	18	13.1
Poisoning	79	57.7

**Table 7.** Outcome (n=137)

Outcome	No. of cases	Percentage (%)
Survival	120	87.6
Expired	17	12.4

**Table 8.** Reason for deliberate self-harm (n=137)

Reason	No. of cases	Percentage (%)
Psychiatric illness	93	67.9
Financial problem	20	14.6
Love failure	12	8.8
Marital problem	7	5.1
Family problem	3	2.1
Exam failures	2	1.5

Table No.6. It was observed in our study that, 87.6% of deliberate self harm cases reported to our hospital had survived while 12.4% cases had expired, as depicted in the Table No.7. Psychiatric illness was said to be the reason for deliberate self harm in 67.9% of victims as depicted in the Table No.8.

## Discussion

Deliberate self-harm (DSH), both fatal (suicide) and non-fatal (parasuicide), is a challenging public health issue. The term parasuicide was originally coined by Norman Kreitman, a British researcher and clinician.<sup>12</sup> Parasuicide is defined as an act with non-fatal outcome, in which an individual deliberately initiates a non-habitual behavior that, without intervention from others, will cause self harm, or deliberately ingests a substance in excess of the prescribed or generally recognized therapeutic dosage, and which is aimed at realizing changes which the subject desires via the actual or expected physical consequences.<sup>13</sup> Suicide is an act with a fatal outcome, that is deliberately initiated and performed by the deceased himself or herself, in the knowledge or expectation of its fatal outcome, the outcome being considered by the actor as instrumental in bringing about desired changes in consciousness and/or social conditions.<sup>14</sup> The rate of suicide for people who have had an episode of parasuicide is 100 times higher in the year following the episode than that of the general.<sup>15</sup> Parasuicide is important since 30% to 60% of suicides have been preceded by an attempt, and 10% to 14% of those who attempt suicide eventually kill themselves.<sup>16</sup>

The age group with maximum incidence of deliberate self harm was between 21 - 30 years and showed significant decrease in the extremes of age, which is in consistent with the study reported from Rajasthan.<sup>17</sup> With regard to the age distribution, several explanations may be taken into account. Children do not develop first indistinct ideas of the nature and definitiveness of death before the age of 7 or 8 years and do not get a more reliable insight in the phenomenon before the age of 12 or 14 years.<sup>18</sup> Furthermore; their cognitive immaturity hampers emotions of desperation as well as the planning ahead of the suicidal act. At least, in comparison with adolescents, children are better protected against contemplating and planning suicide by the lower incidence of depressive disorders, the higher extent of family care and the warmer relationship to the parents. The victims younger than 15 years of age less frequently suffered from psychiatric disorders, expressed less suicidal intent and were less exposed to stressors like interpersonal/parental conflicts or romantic disappointment. The conclusion was drawn that children are not more resilient but are less exposed to risk factors and for that reason have a lower suicide rate.<sup>19</sup>

Prevalence of females was more in our study when compared to females, corroborating with other studies.<sup>20-27</sup> The studies indicating the male preponderance has also been reported in the literature.<sup>28-30</sup> Low educational attainment (32.2% being illiterate) was common especially among women. Low education may influence decision-making and help-seeking and thus could be an important risk factor for deliberate self harm among women.<sup>21,31</sup> Most women were engaged

only in housework (no formal occupation) and over 10% of men and women were students. A report from Himachal Pradesh also showed a high frequency of DSH attempt among housewives and students.<sup>22</sup> The majority of cases were Hindus and a low incidence was evident among Christians and Muslims, and this may be due to a strong religious sentiment against DSH among these communities.

Our study is in agreement with earlier studies which indicate that deliberate self harm are generally performed when the patient is alone.<sup>32-34</sup> Suicide was most frequently committed in surroundings familiar to the victim, in particular the parental flat or the close vicinity of their home. In keeping with the reflections concerning the choice of the method, the familiar setting is possibly preferred because it provides easy access to the necessary implements and makes possible the commitment of suicide within a short time leaving no opportunity to reconsider the decision.<sup>33</sup>

Poisoning was the commonest method of self-harm, particularly using pesticide, followed by deliberate self harm by drowning and hanging. The methods of suicide employed generally reflect the different avenue available in the community. However, Birkhead et al indicated that ingestion of drugs or poison was the most common method of attempted suicide (71.1%), and the use of firearms was the most common method of suicide (69.8%).<sup>35</sup> The studies from the US reported a substantially higher proportion of self-inflicted gunshot wounds.<sup>33,36</sup> It is pertinent to mention here that cases of suicidal death due to firearm, sharp edged weapons are not found in our study.

The ratio of fatal to non-fatal DSH in our study was 1:7, which is in more or less in accordance with the other Indian reports.<sup>36-39</sup> Psychiatric illness was said to be the reason for deliberate self harm in our study. A widely held view is that being suicidal is itself a psychopathological condition or is a strong indication of mental illness.<sup>16</sup> Psychological autopsies have found evidence of various forms of psychopathology in as many as 90% of completed suicides.<sup>16</sup> In many of the studies marital disharmony and shattered family relations were the motives behind deliberate self harm.<sup>40,41</sup>

## Conclusions

- Maximum numbers of deliberate self harm cases were found to be in the age group of 21 to 30 years.
- Females are affected more often than the males; male to female ratio being 1:1.4.
- Sixty nine of deliberate self harm victims were in the 2<sup>nd</sup> to 4<sup>th</sup> decade of life.
- Most of the victims belong to Hindu faith.
- The majority of acts of deliberate self-harm (86.1%) were committed inside the home.
- Poisoning was the commonest (57.7%) method of self-harm.
- The mortality rate in our study is 12%.
- The most common reason of deliberate self harm revealed to be underlying psychiatric illness.

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# Bedside Diagnosis of Commonly Used Pesticides by Thin Layer Chromatography

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## Abstract

Pesticides are reckoned to be the most important source of poisoning worldwide, with a high incidence and fatality rate. Agrochemical pesticides are a major public health problem throughout the developing world. Organophosphate pesticides were responsible for the majority of deaths in most series of poisoning cases, particularly those in rural areas. The reported fatality in hospital-based surveys was as high as 46%.

It is also evident that pesticides form the bulk of cases admitted to hospitals with a history of poisoning. The earliest that reports of chemical analysis samples of gastric lavage, blood and urine are received from government forensic science laboratories to which they are sent is 6 months, by which time the victims are either discharged or dead. On the other hand, the maximum time required for the qualitative assay of a poison by using thin layer chromatography is 2 hours. By this study, we were, therefore, trying to establish easy, rapid and cost-effective methods for the early diagnosis of cases of specific poisoning by pesticides, which will help attending physicians to immediately institute specific treatment instead of relying merely on history, and symptoms and signs.

## Key Words

Pesticide poisoning, Spot test, Thin layer chromatography

## Introduction

The current study was conducted on 87 cases in the Department of Forensic Medicine and Toxicology of a municipal tertiary medical institution in Mumbai. Thin-Layer Chromatography was performed on all samples of gastric lavage collected from only victims of known or suspected pesticide poisoning (according to history given) admitted between the period January to June 2006. Only those cases with a history of pesticide poisoning as given by relatives or clinically diagnosed/suspected by the attending physician on the basis of symptoms and signs.

As a part of the treatment, gastric lavage in all 87 cases was done by the treating physicians and sent for further medicolegal investigation by qualitative and quantitative estimation by the Forensic Science Laboratory at Kalina, Mumbai. Part of such samples so preserved (approximately 15 ml) was taken for this study.

The samples of 87 cases thus collected were first subjected to the spot test for carbamates, then analyzed by thin layer chromatography and compared with earlier prepared standards of Malathion, Propoxur, Dimethoate and Dichlorvos.

## Material

- **Standards:** a) Malathion b) Dimethoate c) Dichlorvos d) Propoxur
- **Test sample:** 25ml of gastric aspirate.
- **Sample size:** 87 patients of suspected poisoning by pesticides admitted to a tertiary health care facility in Mumbai.

Express written informed consent for participation in the study was obtained from the patient/parent/guardian, or, if none of those is present, from the Administrative Medical Officer of the hospital.

**Inclusion criterion:** Gastric aspirate collected within 2 hours of all

admitted cases of pesticide consumption irrespective of age and sex.

## Exclusion Criteria

1. All cases of poisoning by substances other than pesticides.
2. Patients in whom ingestion of pesticides is known to have occurred more than 2 hours prior to admission.
3. Patients in whom gastric lavage is contraindicated such as coma, impaired gag reflex, pregnancy, bleeding diathesis, oesophageal varices, recent surgery

**Chemicals for extraction:** Hexane, Anhydrous sodium sulphate, Methanol

**Chemicals for spotting:** Concentrated HCL, Furfuraldehyde solution

**Thin layer chromatography kit:** Perspex base, Spreader or applicator, Glass plate, Developing tank with lid, Spotting template, Glass sprayer with rubber below cabinet containing iodine resublimed vapours, Micropipette

**For preparation of plate:** Silica gel G

**Solvent system:** N-hexane: acetone

**Reagent:** Resublimed iodine or antimony molybdate and ascorbic acid

**Apparatus:** Petri dish, Filter paper, Separating funnel, Beaker, Funnel, Micropipette

## Methods

**Preparation of Standards:** 5ml of standard (malathion/diamethoate/dichlorvos/propoxur) was taken in a beaker. To this 20ml of distilled water was added, and mixed properly with the help of a stirrer. This mixture was then taken into a separating funnel to which 25ml of hexane was added. After 30 minutes, the hexane layer which had adsorbed the compound present in that sample rose to the top. The lower layer was discarded. The hexane layer was filtered through anhydrous sodium sulphate, collected in a beaker, and evaporated to dryness. The residue contained the compound in its crystalline form. 0.1 ml of methanol was then added to the residue, and the resultant solution aspirated into a micropipette for application of a spot<sup>1</sup>.

**Extraction of gastric/urine sample:** As with preparation of standards described above.

**Spot test for carbamates:** A spot of the resultant solution was applied to filter paper and allowed to dry in air. 0.1ml of furfuraldehyde solution was then applied to the spot and allowed to dry in air, after which the filter paper was exposed to fumes of concentrated hydrochloric acid for 5 minutes in a Petri dish. A positive result for carbamates is indicated by a black spot (Meprobamate and non-pesticide carbamates interfere with this test), whereas organophosphorus and organochlor compounds do not.

Thin layer chromatography procedure was carried out according to standard procedure. Then the spot was visualized by keeping the plate in iodine resublimed cabinet. A positive test was indicated if the spot of the test sample matched that of the standard prepared earlier.

## Observation & Results

The observations made in the 87 cases were recorded and the data thus collected was scrupulously arranged and meticulously analyzed as shown in the tables below. In table no.1, it was observed that the maximum number of cases of suspected poisoning by insecticide was

in the age group of 21 to 30 years and also among 87 cases with suspected pesticide poisoning, the number of male cases was 47(54.02 %). When compared with that of females -40 (45.97%)-the difference between them is not of much significance, the ratio being a mere 1.17: 1. In the table no.2, it was observed that the majority of the cases were suicidal in nature, followed by accidental in nature. In the table no.3, it was seen that in all the cases there was gastrointestinal distress in the form of nausea and abdominal pain. In majority of the cases, there was lacrimation (64.36%), salivation (79.31%) and sweating (85.05%). In the table no.4, it was observed that in majority of the cases i.e. 67 (77.01%) there was constriction of the pupils after consumption of pesticide poisons. In the table no 7, it was observed that the majority of cases of pesticide poisoning were due to Malathion (33.3%), followed by Propoxur (27.6%).

## Discussion

**Table 1.** Sex-wise distribution of cases of suspected poisoning by insecticide with regard to different age groups.

Age group in years	Females	Males	Total
00-10	02	01	03
11-20	13	14	27
21-30	19	17	36
31-40	04	13	17
41-50	01	01	02
50 & above	01	01	02
Total	40	47	87

**Table 2.** Distribution of circumstances of cases of suspected poisoning by insecticide

Sr. No.	Circumstances	No. of cases	Percentage
1	Accidental	13	14.94%
2	Suicidal	63	72.41%
3	Homicidal	00	0%
4	Not known	11	12.64%
Total		87	100%

**Table 3:** Clinical features after consumption of insecticidal poisons

Clinical features	Gastrointestinal distress	Lacrimation	Salivation	Sweating
Present	87	56	69	74
Absent	00	31	18	13

**Table 4.** Pupillary changes in cases of suspected poisoning by pesticides

Sr.No	Changes in pupil	No. of cases	Percentage
1	Constriction	67	77.01%
2	Dilatation	00	00%
3	No change	20	22.98%
Total		87	100%

**Table 5.** Smell of gastric lavage in cases of suspected poisoning by pesticides

Sr.No.	Gastric lavage	No. of cases	Percentage
1	Smell	57	65.5%
2	No smell	30	34.5%
Total		87	100%

**Table 6.** Detection of pesticides by thin layer chromatography with respect to smell

Test	Smell positive	Smell negative	Total
Chromatography +	53	21	74
Chromatography -	4	9	13
Total	57	30	87

Chi-Square test	Value	Df	P-value	Association
Pearson Chi-Square	6.46	1	0.0110	Significant

**Table 7.** Pesticides detected by thin layer chromatography

Pesticide	No of cases	Percentage
Malathion	29	33.3
Propoxur	24	27.6
Dimethoate	14	16.1
Dichlorvos	07	8

The 87 cases studied were divided into 6 different age groups viz 0-10 yrs, 11-20 yrs, 21-30 yrs, 31-40 yrs, 41-50yrs and more than 51yrs. It was found that the minimum age of the person in the study was of 5 years; the oldest subject was 55 years of age. The maximum number of cases of known or suspected insecticide poisoning i.e. 63 (72.40%) was in the age group of 11 to 30 years. The average age incidence was 25.4 years. The incidence in third decade of life was 41.37 %. Thus the findings of this study in this aspect are consistent with those of Bhullal et al and Dalal et al<sup>2,3</sup>. It was found that the clinical features and signs and symptoms as observed in this study subjects correlate with the standard literature available. It was found that smell was a good indicator of poisoning by organophosphorus compounds. Organophosphorus compounds emit a kerosene- and garlic-like smell. Of the 87 cases (table no.5), such an odour was noted in the gastric lavage of 57 cases (65.5%), while it was absent in the remaining 30 (34.5%). When thin layer chromatography of samples was done (table no.6), results were positive in 53 of the 57 cases which had emitted the characteristic odour, and in 21 of the 30 cases in which the samples were odourless. Thus the results of thin layer chromatography proved statistically significant (Chi-Square Test: P=0.0110), which indicates that the smell of the gastric lavage in suspected cases of pesticide poisoning was a good indicator of the presence of organophosphorus compounds. It was observed that of the 87 cases in which thin layer chromatography was done, 29 samples (33.3%) contained Malathion, 24 (27.6%) Propoxur, 14 (16.1%) Dimethoate and 7 (8%) Dichlorvos. However, 13 samples did not test positive, even though, the clinical features were suggestive of pesticide poisoning. The probable reasons for these negative results may be consumption of a very low amount of the pesticide, early excretion of the consumed pesticide via vomitus or an ingredient of the pesticides different from the four standards which used in this study. TLC results in this study were compared with those of the work of Getz & Wheeler, Villeneuve et al, Tiwari & Sharma, Curini et al and Zoun & Spiernburg<sup>4,5,6,7,8</sup>. The spot test for carbamates was applied to all the samples, but all yielded negative results. The probable reason for this was that the commercially available preparation was itself steel blue in colour. It was, therefore, concluded that the spot test used was neither sensitive nor specific for carbamates.

## Conclusions

- The majority of victims were in the age group of 21-30 years.
- There was no significant difference between males and females.
- The highest number of cases was of suicidal nature, followed by accidental. In 12.64 per cent of cases, the circumstance of poisoning was not known.
- The clinical features and presenting signs and symptoms were gastrointestinal distress, constriction of pupil, salivation, sweating, lacrimation, drowsiness, cyanosis, bradycardia and hypotension.
- There was a typical smell of kerosene in most of the cases.
- The spot test for carbamate was negative in all samples.
- Malathion, Propoxur, Dimethoate and Dichlorvos was detected by TLC and comparing the retention factor of the sample with the standards prepared earlier.
- Malathion was detected in 33.3% of samples tested, Propoxur in 27.6%, Dimethoate in 16.1% and Dichlorvos in 8%.
- The observations of the present study tallied in almost all respects

with studies conducted by previous researchers.

- Early collection and analysis can produce early TLC reports. Physicians can then start specific treatment based on these, which can reduce morbidity as well as mortality rates in cases of pesticide poisoning.
- Another benefit of TLC over other modalities of detection of poison is that it is cheaper and specific as well as sensitive.
- If such methods of early detection can be developed for other commonly occurring poisons in a particular region, it would help treating physicians to commence specific treatment (rather than general treatment based only on clinical suspicion) early.

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# Importance of Diameters of Foramen Magnum in Sexing of Crania

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## Abstract

### Purpose

The diameters of the foramen magnum are mainly taken for the sexing of crania

### Methods

Total 310 adult human crania of known sex were studied for the present study. Out of 310 crania, 155 were of male and 155 were of female. The anteroposterior and transverse diameters of the foramen magnum were taken with the help of sliding caliper.

### Result

The mean values of the anteroposterior and transverse diameters of the foramen magnum are showing the statistical significant difference ( $P < 0.01$ ) in sexing of crania. The anteroposterior diameter is more useful than the transverse diameter of foramen magnum in the sexing of the foramen magnum.

### Conclusion

The present study is important for the medico-legal cases in the fragmentary crania.

### Key Words

Foramen magnum, sexing, crania, diameter, medico-legal

## Introduction

In the sexing of the bones, metrical and non metrical methods are used. Metrical studies may provide certain advantages because they are more objective way of attaining data with the use of osteometric techniques. The basal region of the occipital bone is covered by a large volume of soft tissue and relatively well protected in anatomical position. Hence the classification of sex using the occipital bone may prove useful in cases of significantly disrupted remains Gapert R<sup>[1]</sup> Determination of sex from the skulls relied very much on statistical analysis.<sup>[2]</sup> The metrical study of the foramen magnum is mainly taken for the sexing of crania and the dimensions of the foramen magnum have clinical importance because vital structures pass through it may suffer in foramen magnum achondroplasia.<sup>[3]</sup> The knowledge of the foramen magnum is also useful for anthropological purpose and these measurements utilized in neurosurgical approach for posterior fossa tumour and ectopia cerebella.<sup>[4,5]</sup>

## Material and Methods

310 adult human crania (155 Male and 155 female) were assessed for the present study. Only fully ossified adult crania were included in the present study. Crania showing wear and tear, any fracture or pathology were excluded. The anteroposterior diameter and transverse diameter of the foramen magnum were taken. In the metrical methods different cranial measurements were taken. Range, mean and standard

deviation of these measurements of were calculated.

The identification point for each parameter was calculated from the range of each measurement. From this percentage of identified

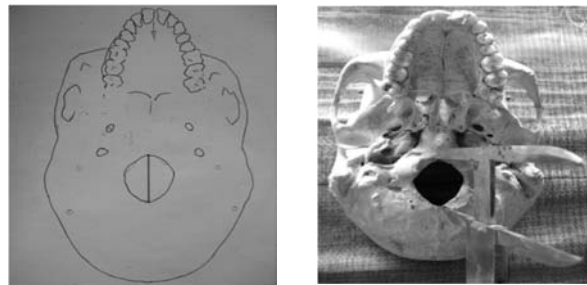


Fig I, II: Foramen Magnum- Anteroposterior Diameter

crania was calculated.

Demarking points were worked out from calculated range. The percentages of crania identified by each demarking point in both sexes

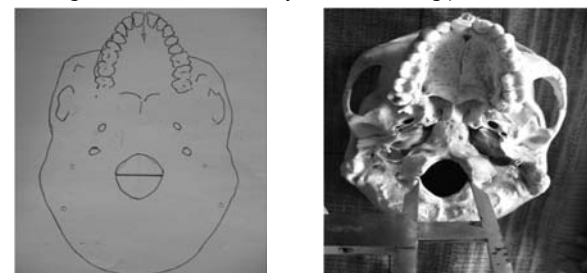


Fig III, IV: Foramen Magnum- Transverse Diameter

were estimated. The demarking points identify sex with 100% accuracy.

Table I. Foramen Magnum- Anteroposterior Diameter (H)

Sr. No.	Details of measurements	Male	Female
1.	No. of bones	155	155
2	Range	2.4-4.2	2.4-3.9
3	Mean	3.38	3.3
4	Standard deviation	0.31	0.26
5	Statistical significance	$P < 0.01$	
6	Identification point	>3.9	<2.4
7	Percentage of identified bones	3.23	0
8	Calculated range	2.44-4.32	2.52-4.08
9	Demarking point	>4.08	<2.44
10	Percentage beyond demarking point	1.29	0.65

The difference observed between means of male and female to know whether it is statistically significant, that is value of 'P' is calculated by applying 'Z' test.

**Foramen Magnum-Anteroposterior Diameter:** The anteroposterior diameter of foramen magnum is the maximum distance between the anterior and posterior margin of the foramen magnum in median plane; which was measured with a sliding caliper. [Fig I, II]

### Foramen magnum-Transverse diameter

With the help of Sliding caliper, distance between most lateral and

medial point of the foramen magnum was recorded. [Fig III, IV]

## Findings

The anteroposterior diameter of foramen magnum of male crania varies from 2.4cm to 4.2cm with an average of 3.38cm  $\pm$  0.31 whereas in female crania it varies from 2.4cm to 3.9cm with an average of

**Table II.** Foramen Magnum- Transverse Diameter (H)

Sr. No.	Details of measurements	Male	Female
1.	No. of bones	155	155
2	Range	2.1-3.6	2-3.6
3	Mean	2.9	2.79
4	Standard deviation	.25	.27
5	Statistical significance	P < 0.01	
6	Identification point	>3.6	<2.1
7	Percentage of identified bones	0	0.65
8	Calculated range	2.15-3.64	1.99-3.60
9	Demarking point	>3.6	<2.15
10	Percentage beyond demarking point	0	0.65

3.3cm  $\pm$  0.26. So the crania with anteroposterior diameter of foramen magnum above 3.9cm are within the male range while crania with diameter less than 2.4cm are within female range. By this point percentage of identified male crania is 3.23% and in case of female no single cranium can be identified.

The calculated range varies from 2.44cm to 4.32cm in male and 2.52cm to 4.08cm in female crania. On applying demarking points, cranium with anteroposterior diameter of foramen magnum above 4.08cm is definitely of male while cranium with diameter less than 2.44cm is definitely of female. By these points percentage of identified crania in males is 1.29% and in female is 0.65%.

Thus, the percentage in the mean value of anteroposterior diameter of foramen magnum of crania is statistically significant ( $p < 0.01$ ).

The transverse diameter of foramen magnum of male crania ranges from 2.1cm to 3.6cm with an average of 2.9cm  $\pm$  0.25 whereas it ranges from 2cm to 3.6cm with an average of 2.79cm  $\pm$  .27 in case of female crania. Thus, the cranium with diameter more than 3.6cm is in male range whereas cranium with diameter less than 2.1cm is in the female range.

By applying the identification points, no crania identified in case of male while in case of female it is 0.65%. The calculated range found in male is 2.15cm to 3.64cm and 1.99cm to 3.60cm in female crania. On applying demarking points, cranium with transverse diameter of foramen magnum, above 3.6cm is definitely of male while cranium below 2.15cm is definitely of female. Thus, the percentage of identified crania in males is 0 and that of female is 0.65%.

The sex difference in the mean values of transverse diameter of foramen magnum of cranium is statistically significant ( $p < 0.01$ ).

The present study is compared with the studies of Holland TD, Deshmukh AG, Kreniotti EF, Galdames ICS, Routal RR, Murshed, Manoel C. [5-10]

The mean values of the anteroposterior diameter of the foramen magnum in male and female crania in the present study are comparable with all the above studies except the studies of Deshmukh AG and Holland TD. In the study of Deshmukh AG mean value of anteroposterior diameter of the foramen magnum in female crania is lower than the present study. While in the study of Thomas D Holland mean value in

male crania is higher than present one.

The mean values of the transverse diameter of the foramen magnum in the present study in male and female crania are comparable with the all the other studies except the study of Deshmukh AG.

## Conclusion

1. The mean values of the anteroposterior and transverse diameters of the foramen magnum are showing the statistical significant difference in sexing of crania.
2. The anteroposterior diameter is more useful than the transverse diameter of foramen magnum in the sexing of the foramen magnum.
3. The present study is having the medico- legal importance regarding the determination of sex from the crania.

## Acknowledgements

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## Interest of Conflict

We have no conflict of interest

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# Light Weight Obturator for Patient with Congenital Cleft Palate-A Case Report

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## Abstract

Although patients with cleft lip and palate (CLP) are not seen regularly in general dental practice, this is a frequent congenital anomaly; approximately one in every 800 live births results in a CLP. The cause of CLP is unknown, but possible causes are malnutrition and irradiation during pregnancy, psychological stress, teratogenic agents, infectious agents (viruses), and inheritance. Most clefts are likely caused by multiple genetic and nongenetic factors. This article presents a case report of a partially edentulous patient with palatal insufficiency due to cleft palate successfully rehabilitated with closed hollow bulb obturator.

## Key Words

Cleft palate, hollow bulb obturator, palatal insufficiency, prosthetic rehabilitation

## Introduction

Cleft lip (cheiloschisis) and cleft palate (palatoschisis), which can also occur together as cleft lip and palate, are variations of a type of clefting congenital deformity caused by abnormal facial development during gestation. A cleft is a fissure or opening—a gap. It is the non-fusion of the body's natural structures that form before birth. These anomalies include, but are not limited to, decreased vertical dimensions of occlusion, decreased facial support, temporomandibular joint symptoms, lack of functional occlusion, altered speech, poor esthetics, teeth sensitivity due to abnormal wear and abrasion, lack of a normal smile line, and altered anatomy in the lower third of the face.

A prosthesis used to close a palatal defect in a dentate or edentulous mouth is referred to as an obturator. The obturator prosthesis is used to restore masticatory function and improve speech, deglutition and cosmetics for maxillary defect patients.

In this article, a case report of a partially edentulous patient with cleft palate rehabilitated prosthodontically with a closed hollow bulb obturator is presented.

## Case Report

A 50-year-old female patient reported to the Department of Prosthodontics, Desh bhagat dental college, with a chief complaint of inability to masticate and defective speech. An examination revealed a palatal defect and missing right maxillary posterior teeth and mandibular anterior teeth. She gave the history of extraction of teeth due to mobility. Detailed case history revealed that the oronasal communication was present since birth and the defect was not treated surgically. Considering her socio-economic condition and her functional and esthetic requirements, a closed hollow bulb obturator was planned for the patient.

## Steps Involved

1. Preliminary upper and lower irreversible hydrocolloid impression was made in a stock metal tray
2. The undercuts on the defect area of cast were blocked and a one piece bulb was designed and fabricated. It should be hollow to aid speech resonance, to reduce the weight on the unsupported side.
3. It should always be closed superiorly. If the obturator is left open,

- nasal secretions accumulate leading to odour and added weight.
4. Then, custom trays of auto polymerizing resin were fabricated over the primary cast.
5. Jaw relations were recorded using conventional method.
6. Artificial teeth arrangement was done. Following the trial, the denture was waxed-up.
7. Then, curing, finishing and polishing of the prosthesis was done. The patient was kept under observation after delivery of prosthesis for one week.
8. The patient had showed remarkable improvement in taking food and drinking liquids without any nasal regurgitation. And her speech was much improved.
9. Post insertion check-up was done at one week, one month, and three-month intervals and the patient was very much satisfied with the treatment



Figure 1: Patient with palatal defect



Figure 2: Preliminary impressions



Figure 3: Preliminary cast showing palatal defect



Figure 4: Hollow obturator



Figure 5: Hollow obturator placed in patient mouth

## Discussion

Cleft lip and cleft palate are among the most common congenital anomalies. Prosthodontic management of palatal defects has been employed for many years. The history of maxillary obturator prostheses is well documented. Ambroise Pare was the first to use artificial means to close a palatal defect as early as the 1500s. The early obturators were used to close congenital rather than acquired defects. Claude Martin described the use of surgical obturator prosthesis in 1875. Fry described the use of impressions before surgery in 1927, and Steadman described the use of an acrylic resin prostheses lined with gutta-percha

to hold a skin graft within a maxillectomy defect in 1956 (Desjardins, 1978; Huryñ & Piro, 1989).

In the case presented in this article, a hollow obturator bulb design was used for cleft palate prostheses. The advantages of a hollow bulb obturator are-

1. The weight of the obturator is reduced, making it more comfortable and efficient.<sup>6</sup>
2. The lightness of the obturator improves one of the fundamental problems of retention and increases physiological function so that teeth and supporting tissues are not stressed unnecessarily.
3. The decrease, in pressure to the surrounding tissues aids in deglutition.

The approach described here allows construction of the obturator in less time and with improved retention due to hollow bulb design and engagement of tooth undercuts.

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# Surgical Guide Templates-Implants Made Easier - a Review

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## Introduction

Optimal implant placement is finally determined by requirements of prosthesis<sup>1</sup>. To establish a logical continuity between the planned restoration and the surgical phases, it is essential to use a transfer device. Fabrication of a surgical guide template has been advocated to achieve predictable final prosthetic results through accurate implant placement<sup>2</sup>. The surgical guide template is fabricated by the restoring dentist after the presurgical restorative appointments, once the final prosthesis optional abutment's number and location, occlusal scheme, and implant angulations have been determined. The surgical template dictates to the surgeon the implant body placement that offers the best combination of support for the repetitive forces of occlusion, esthetics, and hygiene requirements.

## Ideal Requirements

Several methods of fabrication for the surgical template are available. The template should be stable and rigid when in correct position. If the arch treated has remaining teeth, the template should fit over and/or around enough teeth to stabilize it in position. When no remaining teeth are present, the template should extend onto unreflected soft tissue regions (i.e., the palate and tuberosities in the maxilla or the retromolar pads in the mandible). In this way, the template may be used after the soft tissues have been reflected from the implant site. The ideal angulation for implant insertion should be determined on the diagnostic wax-up, and the template should relate this position during surgery. This requires at least two reference points for each implant. For that purpose, the surgical guide must be elevated above the edentulous bone. The distance between two points located respectively on the occlusal surface (central fossa or incisal edge) of the planned abutment crown and the crest of the ridge represents about 8 mm. As a result, these two points of reference can be joined by a line that represents the path of ideal implant insertion. The ideal angulation is perpendicular to the occlusal plane and parallel to the most anterior abutment (natural or implant) joined to the implant.

Other ideal requirements of the surgical template include size, surgical asepsis, transparency, and the ability to revise the template as indicated. The template should not be bulky and difficult to insert or obscure surrounding surgical landmarks. The surgical template must not contaminate a surgical field during bone grafts or implant placement. It should be transparent. In this way, the bony ridge and drills can be observed more easily when the template is in place. The surgical template should relate the ideal facial contour. Most edentulous ridges might have lost facial bone, and the template can determine the amount of augmentation required for implant placement or support of the lips and face. The surgical template may be used in conjunction with a bone graft, and later the same template may be used for insertion of implants and again for implant uncovering. A sturdy template permits resterilization and use for several procedures.

## Construction

To construct the implant surgical template, the easiest method is to use a modification of Preston's clear splint for the diagnosis of tooth contours, tooth position, and occlusal form." The diagnostic wax-up is completed to preview the tooth size, position, contour, and occlusion in the edentulous regions where implants will be inserted.

No selective grinding or modification is performed on any teeth that have not been altered before surgery; otherwise, the template will not fit correctly in the mouth. A full arch irreversible, hydrocolloid impression is made of the diagnostic wax-up and poured in dental stone. On the duplicate cast of the wax-up teeth, a vacuum acrylic shell (.060 to .080 inches) is pressed and trimmed to fit over the teeth and gingiva contours of the buccal aspect of the ridge<sup>3,4,5</sup>. If no natural teeth remain, the posterior portion of the template should be maintained and cover the retromolar pads or tuberosities and palate to aid in positioning. The occlusal surface is trimmed off over the ideal and optional implant sites, maintaining the facial and facio-occlusal line angle of the surgical template. A black line is then drawn on the template with a marker indicating the center of each implant and the desired angulation. This provides maximum freedom for implant placement, yet communicates the ideal tooth position and angulation during surgery. A surgical guide template with 2-mm holes through the occlusal surface of a denture tooth is too limiting for the surgeon, although it identifies precisely the ideal implant placement. While the template is in position, the crest of the edentulous ridge should be visible to avoid stripping of the facial plate of bone during the osteotomies. In the edentulous arch the vacuum form may be of the existing removable prosthesis, if within accepted guidelines. A soft tissue liner may then be added in the tuberosity or retromolar pad regions and other soft tissue areas not involved in surgery. Acrylic resin is then added over the occlusal portion of the template where no implants are planned and patient is instructed to occlude into this index after using petroleum jelly over the opposing teeth. In this manner, the template can be correctly positioned over the edentulous ridge during surgery once the tissue is reflected. Different types of surgical stents have been described including acrylic resin stent (fig.1), radiographic stent<sup>6</sup> (fig.2), previous dentures (fig.3) and duplicated previous dentures (fig.4).

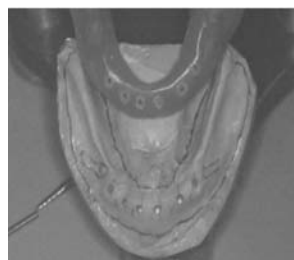


Figure 1: Acrylic resin stent

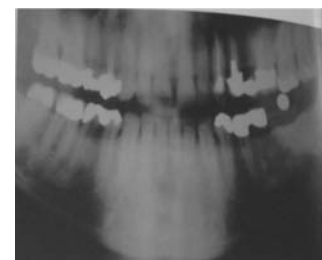


Figure 2: Radiographic stent



Figure 3: Previous dentures as surgical stent



Figure 4: Duplicated dentures as surgical stent

## Conclusion

In short, the surgical guide template increases the input of the final prosthesis in the surgical treatment. Combining the ability to alter soft and hard tissue architectures and using a very precise template allows the surgical procedure to adhere to the dictates of the final restorative prosthesis. After further assessment, it is hoped that the introduction of imaging technology in oral implant surgery will modify surgical protocols toward minimally invasive procedures. Reflexion of the mucoperiosteal flap will probably be able to be avoided

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# Determination of Personal Height from Foot Dimensions

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## Abstract

This study was carried out to estimate the relationship between foot dimensions and stature using simple linear regression analysis based on a sample of male and female of Kolhapur district. Measurements of the foot length, foot breadth and stature were taken from 1200 subjects (600 male, 600 female). Obtained data was analysed and attempt was made to find out correlation between the foot dimensions and stature of an individual. A good correlation of height was observed with foot dimensions and it was statistically significant. The results of the present study would be useful for anthropologists and forensic medicine experts.

## Key Words

Stature, foot length, foot breadth

## Introduction

Stature of an individual came into discussion when primitive mammal changed its posture from pronograde to orthograde.

The study of human evolution, racial differences, inheritance of body traits, growth and decay of human organism is called physical anthropology. These informations are of interest to an anatomist and also helpful in medico-legal works. The foot has been extensively studied to provide valuable information about an individual when an individual foot is recovered and brought for forensic examination. The problem is encountered in cases of mass disasters, explosions, and assault cases where the body is dismembered to conceal the identity of the victim. Stature has been

estimated from foot prints, and various measurements of the foot such as foot length and foot breadth<sup>1,2,3,4,5,6,7,8,9,10,11</sup>, based on the statistical equations and formulae.

Morphology of human feet is influenced by combined effects of heredity and life style. Telkka (1950)<sup>12</sup> opined that each racial group will need a different formula, and regional studies of the subjects are very much needed.

The purpose of the present study is to analyze the anthropometric relationship between dimensions of the foot with stature and to devise regression formulae to estimate height from foot length and foot breadth of known sex from residents of Kolhapur district as it is essential to build a context of reference for a given population.

## Methodology

Present study has been carried out on 1200 residents of Kolhapur district (600 male; 600 female) aged between 12 to 30 yrs for males and 11 to 30 yrs for females. All the subjects were healthy and free from any apparent symptomatic deformity of foot and spine. They will be divided into 3 groups.

### Prepubescent

11-12 yr (female)

12-14 yr (male)

### Pubescent

12-14 yr (female)

14-16 yr (male)

### Post Pubescent

Above 14 yr for female

Above 16 yr for male

## Measurement Technique

- Stature:** is measured as the vertical distance between the vertex and the floor. The subject was made to stand bare foot in an erect posture against a wall with both feet kept close together, buttocks & occiput touching the wall and hands hanging down on the sides. Measuring tape was kept fixed on wall and height is recorded with a right angled device.
- Foot length:** is the distance between the most backward and prominent part of the heel (pternion) and the most distal part of the longest toe of the foot (acropodian). The foot length of each individual was measured with a sliding caliper.
- Foot breadth:** is the distance between the most prominent point on inner side of the foot and the most prominent point on the outer side of foot. Obtained data was analysed by linear regression analysis and results were tabulated.

## Results

**Table 1.** Mean of height and foot dimensions in all age groups

Group	Mean height (cm.)		Mean foot dimension (cm.)	
	Male	Female	Male	Female
Pre pubescent	149.7	148.83	23.35(R.F.L.)	22.35 (R.F.L.)
			23.25(L.F.L.)	22.20(L.F.L.)
			8.95(R.F.B.)	8.67(R.F.B.)
			8.93(L.F.B.)	8.64(L.F.B.)
Pubescent	161.9	154.49	24.78(R.F.L.)	23.51(R.F.L.)
			24.64(L.F.L.)	23.43(L.F.L.)
			9.48(R.F.B.)	8.9(R.F.B.)
			9.45(L.F.B.)	8.84(L.F.B.)
Post pubescent	172.4	157.85	25.47(R.F.L.)	23.52(R.F.L.)
			25.39 (L.F.L.)	23.44(L.F.L.)
			9.84(R.F.B.)	8.91(R.F.B.)
			9.82(L.F.B.)	8.84(L.F.B.)

R.F.L.: Right foot length, L.F.L.:Left foot length,

R.F.B.:Right foot breadth, L.F.B.: Left foot breadth

Linear regression equations for stature estimation in prepubescent male and female

Male(n=200)			Female (n=200)		
	Equation	r		Equation	r
<b>R. FL</b>	=69.33+3.4(RFL)	0.6		=110.74+1.70(RFL)	0.4
<b>L. FL</b>	=70.47+3.4(LFL)	0.6		=112.07+1.66(LFL)	0.4
<b>R. FB</b>	=102.2+5.3(RFB)	0.4		=133.79+1.73(RFB)	0.1
<b>L. FB</b>	=107.7+4.7(LFB)	0.3		=142.5+142.5(LFB)	0.1

r: Correlation coefficient

Linear regression equations for stature estimation in pubescent male and female

Male(n=200)			Female (n=200)		
	Equation	r		Equation	r
<b>R. FL</b>	=124.9+1.5(RFL)	0.2		=124.99+1.2(RFL)	0.4
<b>L. FL</b>	=125.9+1.5(LFL)	0.2		=123.03+1.3(LFL)	0.4
<b>R. FB</b>	=126.5+3.7(RFB)	0.3		=149.20+0.6(RFB)	0.1
<b>L. FB</b>	=125.1+3.9(LFB)	0.3		=146.47+0.9(LFB)	0.1

Linear regression equations for stature estimation in post pubescent male and female

	Male (n=200)		Female (n=200)	
	Equation	r	Equation	r
<b>RFL</b>	=83.37+3.5(R.FL.)	0.7	=83.9+3.14(RFL)	0.5
<b>L.FL</b>	=79.22+3.7(L.FL.)	0.7	=84.65+3.1(L.FL)	0.5
<b>RFB</b>	=144+2.9(R.FB.)	0.2	=155.2+0.3(RFB)	0.1
<b>LFB</b>	=142.4+3.1(L.FB.)	0.2	=136.4+2.4(L.FB)	0.3

## Discussion

Higher values of all the studied parameters (stature and foot dimensions) in case of males in the present work are in conformity with other researchers<sup>13</sup>.

Stature is an inherent characteristic and males are constitutionally taller than females. An association of Y chromosome with stature has been documented<sup>14</sup>.

Correlation value (r) is relatively high for F.L. than for F.B. for both males and females of each age group suggesting that F.L. provides a more reliable estimate of stature than F.B.

## Conclusion

Height can be estimated from foot length and foot breadth. Stature estimation from foot breadth may not be as reliable as obtained through foot length. Our study is useful for anthropologist and medico legal person by knowing the height of a person from foot length and foot breadth in Kolhapur district.

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# A Study of Fatal Road Traffic Accidents in Aurangabad, Maharashtra

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## Abstract

## Background

Road Traffic Accidents (RTAs) is a serious public health problem and an important cause of morbidity and mortality worldwide. Present study is done to understand the pattern of RTAs in Aurangabad belonging to Marathwada Region of Maharashtra.

## Methods

This hospital based retrospective research study was conducted at Govt. Medical College Mortuary, Aurangabad, wherein 351 RTAs cases were included, during the period: 1<sup>st</sup> January, to 31<sup>st</sup> December 2000.

## Results

Majority victims are males between 21-40 years involving maximum fatal accidents more common on Monday and occurred between 6 am to 6 pm and in the month of October. Maximum victims died in first 24 hours due to multiple and head injuries. Pedestrians were the most vulnerable victims.

## Key Words

Male, 21-40 years, Head injury, multiple injuries, Pedestrian, Aurangabad.

## Introduction

Though wheel was discovered centuries ago, due to lack of speed and less number of vehicles, accidents must have been uncommon with those non-mechanized vehicles. But now due to rapid industrialization and increasing use of vehicles, simultaneous increase in road users, road traffic accidents have become more common.

Increased population, urbanization and industrialization are mainly responsible for the heavy load on transport system. Though there are tremendous benefits of the road and vehicles there are certain drawbacks also one of the most important and hazardous drawback is loss of life and loss of man power. Other drawbacks are air and noise pollution.

Trauma is a major cause of morbidity and mortality in the general population worldwide. Trauma from road traffic accidents is rising in India; the number of vehicles is 1% of the total number of vehicles in the world. But, vehicular accidents in India constitute 6% of the World's vehicular accidents. The condition is so grave in our country that, at every 4 minutes usually one person becomes the victim of this man made epidemic [1].

As a special class of accidental trauma, road traffic accidents (RTAs) constitute a major cause of accidental death in the developing world [2].

Road conditions are important etiologic factors in RTAs worldwide. Rural roads tend to pose special and additional hazards [3]. In the developing world context, the road is a major factor in RTAs [2].

The increase in vehicular population has also registered ten folds increase in the road accidents and more than 10 lakh persons have lost their lives in road accidents since independence. On an average, 155 persons die per day in road accidents in the country and about 700 people get injured. Statistics has shown that mortality in road traffic accidents is very high among young adults in their prime and who

constitute the work force [3]. Innocent children are often direct victims of road mishaps and many become orphaned from these accidents. This imposes harsh social conditions made much worse in countries without social security services.

## Material and Methods

One year retrospective review was carried out at Govt. Medical College Hospital, Aurangabad. As all were the medicolegal cases, details are available in the Department of Forensic Medicine of the above college. The required information on various aspects was collected from medicolegal documents of each case, and also by discussion with investigating officers including interrogation with relatives and friends

**Table 1.** Sex-wise Distribution of Cases

Sex	No. of Cases	Percentage
Male	304	86.60
Female	47	13.40
Total	351	100.00

Above Table shows male preponderance with 86.60% males and 13.40% female contribution.

**Table 2.** Age-wise Distribution of Cases

Age Group in years	No. of Cases	Percentage
0-10	18	5.12
11-20	48	13.68
21-30	94	26.78
31-40	98	27.93
41-50	49	13.96
51-60	29	8.26
61 & above	15	4.27
Total	351	100.00

The most vulnerable age group involved was between 31 to 40 years (27.93%), followed by 21 to 30 years (26.78%). The victims from age group 11 to 20 years constitute (13.67%), 41 to 50 years constitute (13.96%), 51 to 60 years constitute (8.26%), above 60 years (4.27%) and (5.12%) victims were belonged to 0-10 years' age group.

**Table 3.** Distribution of Cases by Day of Accidents

Day	No. of Cases	Percentage
Sunday	53	15.00
Monday	59	16.80
Tuesday	34	9.68
Wednesday	40	11.39
Thursday	54	15.38
Friday	57	16.23
Saturday	54	15.38
Total	351	100.00

In the present study maximum fatality was observed on Monday (16.80%) followed by Friday (16.23%), Thursday and Saturday (15.38%) each.

**Table 4.** Distribution of Cases by Time of Accidents

Time of Accidents	No. of Cases	Percentage
00-06 am	45	12.82
06 am-12 noon	90	25.64
12 noon-06 pm	96	27.35
06 pm-12 midnight	91	25.92
Not known	29	8.27
Total	351	100.00

Above Table shows that maximum cases occurred during 6 am to 6 pm (65.81%) while less cases were occurred during 6 pm to 6 am (38.74%),

whereas no information about time of accident was available in 8.27% cases.

**Table 5.** Month wise Distribution of Cases

Month	No. of Cases	Percentage
January	32	8.83
February	28	7.69
March	33	9.11
April	37	10.54
May	31	8.83
June	26	7.12
July	15	4.00
August	16	4.55
September	19	5.69
October	39	11.11
November	38	10.82
December	37	10.54
Total	351	100.00

The table shows that maximum cases were involved in October (39) followed by November (38), December and April (37) each.

**Table 6.** Time interval between sustaining injuries and death

Time Interval	No. of Cases	Percentage
Spot Deaths	54	15.38
< 12 Hours	150	42.74
13-24 Hours	36	10.26
1-7 Days	65	18.52
>7 Days	18	5.12
Not known	28	7.98
Total	351	100.00

**Table 9.** Types of vehicles involved in fatal accidents

Offending Vehicles	Motorcycle	Jeep	Rickshaw	Train	Car	Scooter	Tempo	Tractor	UKV	Bullock	Truck	Matador	Obstacle	Bus	Total
Victims Vehicles													9		
Truck													3		12
Tempo											1		8		1
Tractor											1		2		9
Matador													3		2
Car		1									2		17		6
Jeep		1	1				1	2	1		11	1	13	9	44
Rickshaw		8						1	1		8	2	37	1	34
Motor-cycle	4	5			2		1	2	9	1	20	2	3	1	84
Scooter	1				2				2		3	1	1		12
Bicycle	3	2				1	1		6		5			2	21
Pedestrian	14	20	2	36	7		1	1	4		20	2		5	112
Bullock cart													1		1
Total	22	37	3	36	11	1	4	6	23	1	74	8	94	18	338

(338+12 not known + 1 instrument fault = 351)

of the victims. Separate pretested proforma was used for registering findings. In this study, an attempt is made to analyze the cases as regards victim's age, sex, vehicles involved, type of victims, distribution and pattern of injuries sustained in road traffic accidents and survival period.

### Observation

The Table shows that truck was the commonest offending vehicle claiming 74 deaths. Of 74 deaths, 20 each from pedestrians, motorcycle and 11 from truck-jeep collision.

Jeep was the next common offending vehicle responsible for 37 deaths; being 20 pedestrians followed by Train causing 36 deaths including accidental and suicidal deaths. Unknown vehicle, Motorcycle, Bus and Car caused 4, 14, 5 and 7 pedestrian deaths respectively.

The table shows that in maximum 68.38% deaths occurred within 24 hours of accidents, 15.38% died on spot, 18.52% between 1-7 days, 5.12% after 7 days and in 7.98% deaths, the status was unknown.

**Table 7.** Mode of Accident

Mode of Accident	No. of Cases	Percentage
Dash	131	37.33
Run Over	27	7.70
Fall	31	8.80
Collision	84	23.97
Slip	30	8.50
Turn Over	25	7.10
Obstacles	7	2.0
RTA with accidental strangulation	1	0.30
RTA with traumatic asphyxia	1	0.30
Voluntary jump from vehicle	1	0.30
Not known	13	3.70
Total	351	100.00

From Table No. 7 above, it is clear that the commonest mode of accident is dash by vehicle (37.33%) followed by collision (23.97%), fall from vehicle (8.80%), slip from vehicle (8.50%), run over (7.70%), turn over (7.10%) & obstacle (2.0%). In 0.3% each was of accidental strangulation, traumatic asphyxia and voluntary jump. In 3.70% cases mode of vehicular accident was not known.

### Discussion

Male to female ratio was 6.46 : 1. It is probably due to more male population on the road because of the male dominating society. Also majority of the males are engaged in the outdoor activities and hence exposed to accidents. Similar observations were made by Pande C.D. et al (1970)[4], Fimate L.(1980)[5] and Pillay V.V.et al (1992)[6].

In the present study the most vulnerable age group involved was between 31-40 years (27.92%) followed by 21-30 years(26.78%) age groups. This may be due to the fact that this is the most active period of the life, and therefore, one is most commonly exposed to the vehicular accident. Similar observations were made by the Authors Pande C.D. et al(1970)[4], Srivastava A.K. et al(1989)[7] and Dogra T.D. et al(1989)[8].

During the course of the study, maximum vehicular accidents were found on Monday (16.80%) with next common occurrence of RTAs on Friday (16.23%) and also on Thursday and Saturday (15.38% each) exhibited in Table No. 3. In the present study, we could not

arrive at significant conclusion as to the day wise occurrence of RTAs. This may be due to good urbanization and industrialization of divisional place Aurangabad, the scenario of accidents does not change throughout week as on Sunday most of the families are in the habit of outing so as to get rid of routine schedule. The one Edna Tom – Herald et al (1985)[9] observed significant increase in victims from Friday to Monday.

It was also found in the study that maximum victims were injured between 6 am to 6 pm (65.81%). This might be due to overcrowding of road users on road, during daytime. Similar observations were noted by Fimate L. (1980)[5].

The present study revealed that maximum number of victims were involved in the accidents during October (39) followed by November (38), December and April (37) each, while least were involved in July (14), August (16) and September (19). Similar observations were made by Prasannaraj P. (1992)[10].

Maximum deaths (68.38%) were occurred within 24 hours of accidents as observed in our study with 54 victims (15.38%) died on spot, 42.73% died within 12 hours, 10.25% died within 13 hours to 1 day. Similar observations were made by Haddon William et al (1961)[11], Kaare Solheim (1964)[12], Dogra T.D.(1989)[8] and Srivastava A.K. et al(1989)[7].

Dash by vehicle and collision are the commonest mode of vehicular accidents in present study. This could be attributed to reckless driving, faulty overtaking, driving under the influence of alcohol or narcotics, over loading of vehicles, etc.

In the present study multiple injuries (45.90%) and head injury (41.02%) were the commonest cause of death in the vehicular accidents (Table No.8). The other causes of deaths in vehicular accidents were thoraco-abdominal injuries (3.98%), thoracic injuries (4.27%) and abdominal injuries (3.98%). In 3 cases (0.85%) there were injuries to spine and spinal cord. Similar were the observations by Sevitt Simon (1968)[13] and Dogra T.D. et al (1989)[8].

Our study observed maximum victims involved were pedestrians and the commonest offending vehicle was Truck, Jeep, Train, Motorcycle, Bus, Tempo and Rickshaw. Similar observations were observed during the study carried out by Pande C.D. et al(1970)[4], Fimate L.(1980)[5], Srivastava A.K. et al(1989)[7].

## Conclusions

Majority victims are males between 21-40 years involving maximum fatal accidents more common on Monday and occurred between 6 am to 6 pm in the month of October. Maximum victims died in first 24 hours with cause of deaths as multiple injuries followed by head injury. Commonest mode of accidents was 'vehicle dash' being Truck offending more common and pedestrians were the most vulnerable victims.

## Suggestions

### To reduce road accidents:

1. Compulsory use of helmets, seat belts and other safety measures.
2. Provision of preventive and protective facilities for pedestrians, for cyclists.
3. Improvement in the design and safety features of vehicles with their regular inspection be rigorously enforced.
4. Proper & regular road maintenance.
5. Thorough investigation of accidents and data analysis.
6. Strict Legal issuance of Driving License with regular campaign for educating the public about traffic sense and awareness.
10. Strict punishment for careless driving, breaking of traffic rules and driving under influence of any drug.

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# Organophosphorus Poisoning Presenting as Pulmonary Thromboembolism

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## Abstract

In situ pulmonary artery thrombosis (PAT) in adults is a potentially life-threatening disorder rarely recognized ante mortem. The literature pertaining to PAT is limited to isolated clinical case reports or small descriptive pathological series stating a close association with concurrent morbidity such as thrombophilia, pneumonia or pulmonary arterial flow disturbance.

A rare case of extensive in situ central pulmonary artery thrombosis in organophosphorous poisoning is presented. We report a case of 37-year-old woman with history of consumption of organophosphorous compound (mahaphos). She presented with vomiting, drowsiness, poor response to oral commands, fasciculations and shallow breathing. She was admitted and treated in ICU for 20 days wherein her general condition improved. She developed respiratory distress and collapsed all of a sudden. On autopsy, she had a large immobile wall-adherent thrombus located in the pulmonary trunk extending into the right pulmonary artery. Left pulmonary artery showed emboli and right coronary artery showed a thrombus attached to the arterial wall. Histopathology revealed multiple areas of infarction in lung and wide spread toxic injury to hepatocytes, spleen and kidney.

We conclude that op compound poisoning caused wide spread endothelial damage resulting in pulmonary and coronary thrombosis leading to cardiac arrest.

## Key Words

Organophosphorus (OP), pulmonary artery, coronary artery thrombosis.

## Introduction

Organophosphorus (OP) poisoning is the commonest mode of suicidal deaths in rural part of India. Easy availability and accessibility to OP compounds is the reason for the increased incidence of its acute poisoning in these parts with agricultural background.

In our intensive care unit (ICU) which is a multidisciplinary unit, OP compound poisoning forms a significant number of total medical admissions. Last year, of total 462 medical cases there have been 116 OP admissions with Case fatality rate of 16%. We report a case of sudden cardiac arrest in a patient recovering from OP compound poisoning. The cause of death was due to known but less discussed manifestation of OP compound toxicity.

## Case Report

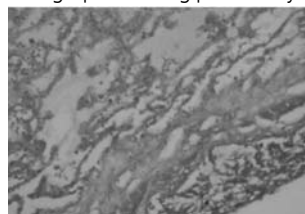
A 37 year old lady was brought to our casualty with h/o consumption of OP compound (mahaphos) presenting with flaccidity, drowsiness, poor response to verbal commands, diaphoresis, generalised fasciculations, ptosis, tachypnea and pinpoint pupils. Respiration was shallow with inadequate respiratory attempts and oxygen saturation (SPO<sub>2</sub>) was 88% with 10 litres of oxygen with Hudson mask. Her heart rate was 120 beats/min and blood pressure was 150/110 mm Hg. Systemic examination revealed no other significant abnormality. After decontamination, gastric lavage through Ryles tube and urinary catheterization, atropine 5 mg was given iv every 5 minutes till atropinisation and atropine infusion later on. Pralidoxime (PAM) was

started at 0.5g/hr. After explaining to the patient's attendants about the need for ventilatory support, patient was shifted to ICU for further management. Patient was intubated with 7.5 mm internal diameter portex tube and put on Pressure cycled synchronised intermittent mandatory ventilation (P-SIMV) mode of ventilation. Vitals and input output chart was monitored. Graded compression stocking was used for deep vein thrombosis (DVT) prophylaxis. Investigations revealed no significant abnormality other than decreased pseudocholinesterase levels (3813 U/l). Chest and passive limb physiotherapy was started. She was tracheostomised on 3<sup>rd</sup> day. Weaning started on 5<sup>th</sup> day. Atropine infusion tapered and stopped. She was put on T-piece on 12<sup>th</sup> day. Though patient had good muscle power and respiratory efforts, she desaturated on removal of supplemental oxygen and had recurrent episodes of dyspnoea. So she was observed in ICU for 8 more days during which she was ambulant. She was due to be shifted out of ICU when she suddenly developed restlessness and became tachypneic and collapsed. Her heart rate was 120beats/min, pulse was feeble, BP not recordable and later she developed bradycardia and cardiac arrest. Cardiopulmonary resuscitation (CPR) was started. After 30 minutes of resuscitation she could not be revived. Clinically, cause of death was thought to be due to DVT and thromboembolism as other causes of sudden death like ventricular arrhythmias, myocardial infarction and hypoxia due to tracheostomy tube block were ruled out. On autopsy, she had a large immobile wall-adherent thrombus located in the pulmonary trunk extending into the right pulmonary artery. Left pulmonary artery showed emboli and right coronary artery showed a thrombus attached to the arterial wall (fig 1). Histopathology revealed multiple areas of infarction in lung (fig 2) and wide spread toxic injury to hepatocytes (fig 3), spleen and kidney (fig 4).

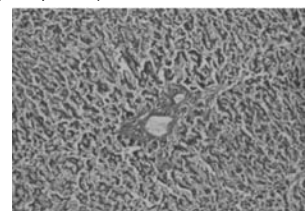
**Fig. 1:** Gross photograph showing pulmonary artery with wall adherent thrombus



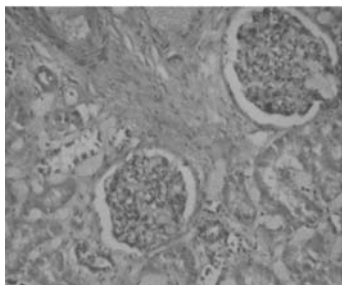
**Fig. 2:** Microphotograph showing pulmonary infarction (H&E,X100)



**Fig. 3:** Microphotograph showing feathery degeneration of hepatocytes (H&E,X100)



**Fig 4:** Microphotograph showing acute tubular necrosis with macrophages (H&E, x40).



## Discussion

Signs and symptoms of organophosphate poisoning can be divided into 3 broad categories, including (1) muscarinic effects, (2) nicotinic effects, and (3) CNS effects.

The known but less discussed manifestation includes aberration of clotting mechanism. It manifests as a biphasic reaction consisting of coagulation followed by prolongation of clotting time. Increased coagulation is associated with increased prothrombin activity and consumption secondary to increased factor VII<sup>1</sup>. Jastrzebski et al<sup>2</sup> presented a case of suicidal poisoning with organophosphate pesticide, associated by acute activation of blood coagulation where heparin treatment efficiently inhibited this activation whereas Zieman et al<sup>3</sup> contradicted and reported that OP compounds caused thrombocytopenia and decreased fibrinogen, plasminogen and antithrombin III levels necessary for coagulation thereby causing hypocoagulation. George A Petrioanu<sup>4</sup> reported that in OP intoxication, hypercoagulability was seen in the sympathomimetic phase (in our case), due to massive release of catecholamines from the adrenals whereas hypocoagulability in the vagal phase, shown by the PTT-prolongation due to influence on platelet function or inhibition of clotting factors.

In our case, there was a coronary thrombus and a primary pulmonary artery thrombus (PPAT) which is rare. In fact, in situ pulmonary artery thrombosis in adults is considered potentially life-threatening and rarely recognized antemortem. The literature pertaining to PPAT is limited to isolated clinical case reports or small descriptive pathological series stating a close association with concurrent morbidity such as thrombophilia, pneumonia or pulmonary arterial flow disturbance<sup>5,6</sup>.

Case reports suggest association of PPAT with pulmonary hypertension either primary<sup>7</sup> or secondary to pulmonary artery hemangiosarcoma<sup>8</sup>, and Eisenmenger's syndrome<sup>9</sup>. Steroid responsive nephrotic syndrome<sup>10</sup>, severe acute respiratory syndrome<sup>11</sup>, tetralogy of fallot<sup>12</sup>, thrombangitis obliterans<sup>13</sup>, antiphospholipid syndrome<sup>14</sup> and pulmonary arteritis<sup>15</sup> associated PPAT have also been reported. OP poisoning with PPAT has not been reported till date. The course of acute massive PAT is serious and may result in sudden death. PAT may also cause subacute cor pulmonale or have a more chronic fatal course in cases with missed diagnosis. Unfortunately due to its presumably inconstant and non-specific clinical symptoms, ante mortem diagnosis is difficult and the true incidence of this under diagnosed disorder is unknown.

In our case, initial diagnosis of sudden death was thought to be due to DVT and thromboembolism as the patient was clinically stable throughout her stay in ICU. But, autopsy revealed PPAT and coronary thrombosis as cause of death.

## Conclusion

As OP compounds cause wide spread endothelial toxic injury and hypercoagulable or hypocoagulable states which can be potentially life threatening, we conclude that monitoring the hematologic parameters and coagulation profile should be considered.

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# Medicolegal Aspects of Dental Cases-A Review

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## Abstract

With advancements in medical and dental diagnostic sciences and concurrent increase in demand for precise opinions for investigations related to medicolegal cases, more and more contribution are nowadays being called upon from dental fraternity. This article aims at giving an insight into the medicolegal aspects of dental cases.

## Key Words

Medicolegal, forensic odontology, dental identification

## Introduction

Medico legal as the name suggest is an important aspect of medical science. What more could be better than the fact that we as practitioners can play a valuable role in providing medicolegal information. Forensic experts do play a major role in these information. A dentist too can provide a lot of information regarding clues and evidences and through the best use of his knowledge can contribute significantly to medico legal cases. The article aims at describing the dental aspect of medicolegal cases and the dentist role for the same, that in turn can play a substantial contribution. These efforts would in turn be a boon for the concerned individuals.

## Dental Aspect

Medico legal information obtained from examination of teeth applicable to law in the administration of justice falls within Forensic Odontology. Forensic Odontology is a combination of art and science of dental medicine. It is the proper handling, examination and evaluation of dental evidence which are presented in the interest of justice. This too is important that the dental examination should be done by a proper qualified dentist who can use the best of his knowledge and give a satisfactory result. The information so obtained is concerned primarily with:

1. Establishment of identity
2. Investigation of criminal cases
3. Research purposes

Dental evidences represent one of the most scientifically reliable methods of identification. On exposure to physical injury and putrefactive changes the human dentition preserves itself but the enamel which is the hardest part of the body, lasts much longer than the other tissues. The preservation of teeth in ancient human relics buried for centuries attests to this fact. The adult dentition is comprised of 32 teeth, each tooth has five surfaces. The innumerable combinations of missing teeth, filling materials, carious lesions, restorative work and prosthesis form the basis of dental identification. Considering additional identifying features incorporated within the root canal, periapical, and surrounding bone and soft tissue, it may be realised how specific the oral structures can be in terms of identification. The concept that no two dentitions are alike is the basic premise of dental identification.

Three organizations are dedicated to the field of forensic Odontology. These organizations include: The Bureau of Legal Dentistry (BOLD), The American Board of Forensic Odontology (ABFO) and the International Organization for Forensic Odontostomatology (IOFOS). In 1996, BOLD was created at the University of British Columbia to develop new technology and techniques in forensic Odontology. The

University of British Columbia Programme is the only one in North America that provides graduate training in Forensic Odontology<sup>1</sup>. The Bureau of Legal Dentistry encourages the use of multiple dental impressions to create a "dental line up", similar to a suspect line up used to identify/alleged perpetrators of crime. The dental impressions collected as evidence are compared only to those collected from a given suspect, which may bias the resulting outcome. Using multiple dental impressions in a lineup may enable forensic odontologists to significantly decrease the current bias in matching bite marks to the teeth of a suspect.

The organization BOLD also supports the creation of a database of dental records, which could help in verifying dental uniqueness<sup>2</sup>. This database could be created using criminal records or possibly all dental patients. In 1984, the ABFO began making an attempt to diminish the discrepancies and increase the validity of bite mark analysis by creating bite mark methodology guidelines. The guidelines attempt to establish standard terminology in describing bite marks and that reduces the risk of biased results. The ABFO also provides advice on how to effectively collect and preserve evidence. For example they recommend that the collection of DNA evidence and detailed photography of bites be taken together at the crime scene. The guidelines also outline how and what a forensic odontologist should record such as the location, contours, shape, and size of a bite mark.

They also provide a system of scoring to assess the degree to which a suspect's dental profile and bite mark match i.e.

1. Positive identification - The ante mortem and postmortem data match in sufficient detail, with no unexplainable discrepancies, to establish that they are from the same individual.
2. Possible identification - The ante mortem and postmortem data have consistent features but, because of the quality of either the postmortem remains or the ante mortem evidence, it is not possible to establish identity positively.
3. Insufficient evidence - The available information is insufficient to form the basis for a conclusion.
4. Exclusion - The ante mortem and postmortem data are clearly inconsistent.

In an attempt to improve guidelines used to collect dental evidence IOFOS developed one of the most recognized system for collection of forensic dental evidence<sup>3,4</sup>

Ante mortem loss or fracture of tooth in assault cases is a criminal act U/S 320 of Indian Penal Code (IPC) clause 7<sup>5</sup>. If such cases are to be examined medicolegally, then determination of nature and age of injury (loss or fracture of tooth) is very important to co-relate the history with the occurrence of crime from medical and dental facts. It is not only the examination of injured tooth which is important, but associated injuries to the surrounding structures and on the face should be recorded along with the examination of the stump/root or empty socket. The X-ray examination of the jaw is equally important to find associated fracture of the thin bony plate surrounding the alveolus which is usually seen in local trauma thereby ruling out natural fall of diseased tooth.

## The Dentist's Role

Generally three types of cases are referred to dental surgeons.

1. Age determination-the dentist opinion is sought in age verification of victim or accused in cases of rape or kidnapping to determine

if victim or accused is minor or major. Sometimes age determination is required for purpose of marriage or job.

2. Medicolegal injury cases-the dental surgeons opinion is sought on the details of the dental injury and the nature of injury to the victim in a fight or an accident.
3. Dental jurisprudence-dental surgeons help is sought in identifying dead bodies or matching the impression of teeth or victim to bitemarks. In medicolegal cases the case is first attended by the casualty medical officer and then referred to the dental surgeon for dental opinion .In age verification ,the case can be directly referred to the dental surgeon by the concerned authority .In above mentioned cases the dental surgeon is required to attend the court and give evidence whenever he is called for it.

Dental opinion should be given on such a performa that is self explanatory and non controversial that require minimum cross examination from defence lawyer.

There should be a uniform approach and standard parameters for all dental surgeons when making a dental report for medicolegal cases. The role of teeth in providing age estimation, sex determination, race and misidentification is undisputedly well documented. Recently cheiloscopy and rugoscopy have established their unique role in identification just like superimposition technique.

## Conclusion

To further substantiate the role of dentists with above considerations, the Dental Council of India (DCI) has formulated

regulations in which provision regarding teaching of forensic dentistry has been made in the final year of BDS (Bachelor of Dental Surgery) course <sup>6</sup>.

The dental fraternity too along with the medical fraternity can play a pivotal role in the criminal investigation system. The dentists can take forensic dentistry to such heights in the society that it may become a very useful tool for the investigating agencies in solving the disputed cases and the courts should not hesitate to base their verdict on the undisputed dental evidence rendered by Forensic dentist in the Court of law.

An aware needs to be made among the masses that forensic medicine and dentistry can be a boon in providing medico legal information and identification.

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# Fatal Uterine Perforation by Intrauterine Contraceptive Device- A Case Report and Review of Literature

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## Abstract

Intrauterine devices (IUDs) remain one of the main methods of choice for birth control in the world, especially in developing countries. Uterine perforation by an IUD is a rare but important complication of IUD use. Here a case was reported in which a 25 yrs old female, having a history of IUD insertion 3 months after delivery suddenly collapsed and the PM examination revealed the perforation of the uterus with the IUD lying in the adjacent region.

## Key Words

Uterine perforation; intrauterine contraceptive device; death.

## Introduction

Intrauterine device (IUD) is a safe and cost-effective means of contraception.<sup>1</sup> However, since its application, many complications including dysmenorrhea, hypermenorrhea, pelvic infections, pregnancy, spontaneous abortion, uterine rupture, and migration into the neighboring organs have been reported.<sup>2,3</sup> For dislodged IUDs the removal is recommended because of the potential inflammatory responses that may cause obstruction or perforation.<sup>4</sup>

## Case Report

A 25 yrs old female suddenly collapsed at her home while doing some household work. She was taken to the emergency wing of nearby hospital where she was declared dead on arrival. Her past obstetric history revealed of giving birth to a live child by normal vaginal delivery 5 months back. Her entire pregnancy period was uneventful. She had a history of Cu-T insertion three months back and was complaining of lower abdominal pain and discomfort since one week prior to the her death. Other past medical and family history was non significant. The dead body was sent to the mortuary for autopsy to determine the cause of death.

The Autopsy was performed on the next day. During autopsy, no external injuries were present over the body surface. On opening the abdomen about 1 liter of clotted blood was found to be present inside the peritoneal cavity. All internal organs were pale.

On examination of the uterus a single oval perforation, 0.2cmX0.3cm, was present on the superior aspect of fundus (Fig 1). The uterine cavity contains clotted blood and there was no evidence of Cu-T inside its lumen.

Fig. 1: Showing uterine perforation



On further exploration of the abdominal viscera the Cu-T was found to be lying freely inside the peritoneal cavity, in close approximation to the wall of the jejunum.

The cause of death given in this case was hemorrhagic shock consequent to uterine perforation caused by intrauterine contraceptive device.

## Discussion

There are many potential complications of IUD insertion, and they are usually classified as immediate or delayed.<sup>1</sup> Immediate complications include perforation of the uterus, vagal reaction, vaginal bleeding, and lower abdominal pain. Delayed ones include menometrorrhagia, often accompanied by dysmenorrhea, lost IUD, total or partial expulsion of the IUD, ectopic pregnancy, and pelvic infections (pelvic inflammatory disease). The International Planned Parenthood Federation in 1991 reported the incidence of uterine perforation by IUD to be 0.3–0.6 per 1,000 insertions.<sup>2</sup> According to recent studies, this adverse event occurs in 0.87 per 1,000 cases, but the statistics generally seem to fluctuate between 0.05 and 13 per 1,000 insertions.<sup>3</sup> Perforation of the uterus by an IUD is supposed to happen mostly during or soon after IUD insertion rather than as a delayed event. Therefore, IUDs be inserted after proper case selection by trained medical professionals.<sup>4</sup> Sonography, whether performed transabdominally or transvaginally, can be an additional tool in case selection. It also plays a crucial role in the evaluation of post-insertion IUD position.<sup>5</sup> There have been many case reports concerning IUD migration in the literature, and almost every kind of IUD including the latest frameless IUD Gynefix, which is characterized by having a streak-like rather than well framed T-shaped design,<sup>6</sup> have been involved in this type of adverse event. Furthermore, the site of migration has been reported as being almost everywhere in the pelvic and intra-abdominal cavity. Regardless of whether IUD migration is caused by direct perforation of tissue or by transportation through fallopian tubes, gynecologic tissues other than endometrial cavity are the most affected targets. Secondary perforation of the uterine cervix,<sup>7</sup> implantation in the broad ligament,<sup>8</sup> implantation in an ovary,<sup>9</sup> and implantation in a submucosal uterine myoma with growth of the myoma around the apparatus favored<sup>10</sup> have been widely reported. After the gynecologic system, the urinary system and rectosigmoid colon have been found to be the next most commonly involved. The associated problems include uterovesical fistula,<sup>11</sup> lower urinary tract symptoms caused by bladder perforation and calculus formation around the IUD,<sup>12</sup> and stricture of the sigmoid colon.<sup>13</sup> Gastrointestinal tract organs other than the rectosigmoid colon are seldom affected, but there have been reports involving IUD appendicitis<sup>14</sup> and small intestine gangrene.<sup>15</sup>

## Conclusion

In view of the importance of misplaced IUDs and their related problems, there should be a high index of suspicion and a careful survey of the potential condition in patients with a history of a “lost” IUD and possibly associated discomfort. Although an abdominal plain film may be sufficient for diagnosis, other modalities such as HSG, ultrasound, CT and even MRI can help determine the exact position of an IUD and any complication caused by its translocation. Once the diagnosis is made, surgical removal of the apparatus is necessary, even in an asymptomatic patient.



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# Epidemiology of Burn Deaths in North Karnataka

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## Abstract

## Background

Despite many medical advances, burns continue to remain a challenging problem due to lack of infrastructure and trained professionals as well as increased cost of treatment, all of which have an impact on the outcome.

## Research Question

What is the incidence of burn deaths in Belgaum, Karnataka? What are the various factors influencing it?

## Methods

All burn deaths autopsied at mortuary, District Hospital, under the forensic medicine department, BIMS, Belgaum from March 2010 to February 2011 form the material for the study.

## Results

During this period, out of 735 cases, 112 were deaths due to burns. The commonest age group of victims was between 21-30 years with female preponderance. Most of the victims sustained injury from flames. Majority of victims had burns more than 80% of the total body surface area. Maximum survival period of the victims was between 3-7 days. 66.1% deaths were accidental deaths and septicemia was the main cause of death.

## Conclusion

Burn injuries is a major public health concern and is associated with significantly high mortality. Majority of the burns were caused by domestic accidents and are therefore preventable by adequate safety measures and health education.

## Key Words

Burns, Deaths, Autopsy, Accidents, Septicemia.

## Introduction

Fire is a necessary evil. Even before a primitive man learned to use fire, he has been a victim of it. Burns are a common injury in the developing world and associated with significant mortality and morbidity. Burn is an injury caused by heat or by chemical or physical agent having an effect similar to heat. Burns are produced by dry heat or moist heat (scald).<sup>[1]</sup>

Despite many medical advances, burns continue to remain a challenging problem due to lack of infrastructure and trained professionals as well as increased cost of treatment, all of which have an impact on the outcome. The WHO estimates indicate that globally there were more than 7.1 million fire-related unintentional burns giving an overall incidence rate of 110 per 100,000 per year and the highest incidence in South East Asia which was 243 per 100,000 per year.<sup>[2,3]</sup> The WHO estimates that 310,000 people died in fires in 2004 across the world, the great majority being in low-income and middle-income

countries with global mortality rate amounting to 4.8 per 100,000 per year.<sup>[2,4]</sup>

Burn deaths are a very common scenario in North Karnataka where the culture of dowry has very strong roots. Majority of burn deaths are a result of greed for dowry where either the female is killed by her husband and in-laws for want of more dowry or she is compelled to commit suicide. In different communities the etiology of burn death varies considerably, hence a careful analysis of epidemiological factors is needed before the planning and implementation of a sound prevention program. Considering the magnitude of the problem, this study was conducted to know the incidence rate as well as influence of various factors on burn cases in this part of the country.

## Material and Methods

All burn deaths autopsied at mortuary, district hospital, under the forensic medicine department, BIMS, Belgaum from March 2010 to February 2011 form the material for the study.

During this period, out of 735 cases, 112 were death due to burns. Data was obtained from hospital case records and police records.

## Results

During study period a total of 735 autopsies were conducted at the mortuary in district hospital, Belgaum. Out of which 112(15.2%) were death due to burns. There was no regular pattern in the incidence of burn deaths over the study period. The commonest age group of victims was between 21-30 years (43.8%) with female preponderance (70.5%). Most of the victims sustained injury from flames (76.7%). Majority (47.4%) of victims had burns more than 80% of the total body surface area. Maximum survival period of the victims was between 3-7 days (33.9%). 66.1% deaths were accidental deaths and septicemia was the main cause of death (59.8%).

## Discussion

Burn injuries constitute a major health concern with respect to morbidity and mortality, as well as cost of management particularly in a developing country like India, where few specialized units exist in the public health sector. The incidence of death due to burns is 15.2% in the present study. This finding is lower compared with other series<sup>[5,6,7,8]</sup> which shows incidence between 21 to 37%, but higher than the study conducted by Memchoubi Ph et al<sup>[9]</sup> in which the incidence was only 0.9%.

In this study, the highest incidence of burn death was in the age group of 21-30 years (43.8%) which is similar to other series<sup>[7-12]</sup> but, in contrast with the study conducted by Rooh-ul-Muquim et al<sup>[13]</sup> which shows maximum incidence in the age group of 1-10 years. Female predominated male in the ratio of 2.4:1 in this study which is similar to many other studies<sup>[5-8,10-18]</sup> but in contrast with the other series which shows male preponderance.<sup>[9,19,20,21]</sup>

In the present study, flame was responsible for most of the burn

deaths (76.7%) and majority of burn deaths were accidental (66.1%) which is in accordance with most of the studies<sup>[6-11,15,16,17]</sup> The major factors include gross ignorance of fire prevention and the persistence of age old traditional way of cooking in most rural areas i.e. mud stove with wood fire. Majority of the burns were domestic. Married women in the Indian scenario spend most of their time in the kitchen and because of inadequate precautions during cooking and wearing of loose Indian sari, they are more susceptible to burns. Also cases of bride burning are prevalent in most parts of our country.

Maximum survival period was between 3-7 days in the present

**Table 1. INCIDENCE OF BURN DEATHS**

Total No. of autopsies conducted	Total no. of burn deaths	Percentage
735	112	15.2

**Table 2. DEMOGRAPHIC CHARACTERISTICS OF BURN DEATHS**

Characteristics	No. of Burn Deaths	Percentage
<b>Age</b> 1-10 years	12	10.7
11-20 years	11	9.8
21-30 years	49	43.8
31-40 years	26	23.2
41-50 years	02	1.8
>50 years	12	10.7
Total	112	100
<b>Sex</b> Male	33	29.5
Female	79	70.5
Total	112	100

**Table 3. TYPE OF BURN**

Type of burn	No. of Burn Deaths	Percentage
Flame	86	76.7
Scald	12	10.7
Electric	04	3.7
Chemical	10	8.9
Total	112	100

**Table 4. ESTIMATION OF BODY SURFACE AREA**

Body surface area	No. of Burn Deaths	Percentage
< 30 %	00	00
31 – 40 %	03	2.7
41 – 50 %	16	14.3
51 – 60 %	10	8.9
61 – 70 %	11	9.8
71 – 80 %	19	16.9
>80 %	53	47.4
Total	112	100

**Table 5. PERIOD OF SURVIVAL**

Survival Period	No. of Burn Deaths	Percentage
< 1 hour	06	5.3
1 – 24 hours	24	21.5
24 – 48 hours	13	11.6
2 – 3 days	03	2.7
3 – 7 days	38	33.9
> 1 week	28	25
Total	112	100

**Table 6. MANNER OF BURN DEATHS**

Manner	No. of Burn Deaths	Percentage
Suicidal	30	26.8
Accidental	74	66.1
Homicidal	08	7.1
Total	112	100

**Table 7. CAUSE OF DEATH**

Cause	No. of Burn Deaths	Percentage
Septicemia	67	59.8
Neurogenic Shock	16	14.4
Hypovolumic shock	21	18.7
Toxemia	08	7.1
Total	112	100

study which is similar with other series finding<sup>[6,7,10,16]</sup> but, in contrast with the finding of the study conducted by Shetty AK et al<sup>[8]</sup> and Memchoubi Ph et al<sup>[9]</sup> which showed that the maximum survival period was more than 7 days and less than 1 hour respectively. The present study revealed that, septicemia was the commonest cause of burn death (59.8%) which is similar to the results of other series.<sup>[6,7,8,10,11,14,16]</sup> The study conducted by Memchoubi Ph et al<sup>[9]</sup> showed that the burn shock was the most common cause of burn death (67.7%) which is in contrast with the finding of the present study.

## Conclusion

Burn injuries have been a major cause of concern since prehistoric days to the present era of modern medicine. However, the general belief that burns usually occur at the two extremes of age does not hold true in the present Indian setup where the majority of the reported cases belongs to second or third decade of life with female preponderance. Most of the burns were caused by domestic accidents and are therefore preventable. The approach to prevention may be accomplished by: Education and awareness campaigns in risk groups i.e. housewives, children, elderly, passing legislation for proper safeguards in household appliances, legislation for electric theft and use of less flammable garments.

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# Erectile Dysfunction-A Demographic Study in North Bengal Medical College

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## Abstract

In the present chaotic and stressful life, increased medical problems, coupled with changes in our social and cultural ethos, cases of Erectile Dysfunction are steadily increasing and being reported. Though it may be just the tip of the iceberg, the female partner has started complaining of inadequate sexual gratification by her male partner. In the present study, the subjects were connected with various sexual crimes, brought by the Police for Certification of Potency as per the order of the Ld. Courts. Though it may not be an ideal random sampling of the population, the finding on initial examination, that 9.20% of the subjects were being suspected to be Impotent, was alarming none the less, thus what encouraged us to go for a detail study with laboratory evaluation. After detailed evaluation, only 3.34% was declared to be suffering from Erectile Dysfunction, which is still in contrast to studies abroad by various authors where the prevalence is higher (> 10%).

## Key Words

Impotence, Erectile dysfunction

## Introduction

Impotence is defined as inability to perform sexual intercourse and failure to consummate marriage.

Sexual Intercourse for consummation of marriage consists of full erection of penis, its full and sustained penetration into the vagina and complete ejaculation in Males, and in Females it consists of allowing full penetration into vagina supported by rhythmic manipulation by both partners till ejaculation by male and vaginal secretion by female in the form of orgasm.

Legally, one single act of full penetration will constitute potency resulting in consummation of marriage even without mutual orgasm or emission of semen.

Frigidity is the failure on the part of the subject to respond to sexual stimulation, in its initiation or maintenance of sexual performance.

Sterility signifies inability to procreate. In case of male, sterility will indicate failure to impregnate, in females it indicates failure to conceive.

The term Erectile Dysfunction [ED] replaced the old term Impotency and more has been learned about ED during the eighties than was known during the rest of the last century combined. Prior to about 1985, most information on ED was based on clinical impressions and studies of convenience samples of atypical patients.<sup>1</sup>

The medicolegal significance of Erectile dysfunction is envisaged in the Hindu Marriage Act, 1955<sup>2</sup> where any marriage solemnized can be annulled by a decree of nullity if the respondent was impotent at the time of the marriage and continued to do so until the institution of the proceedings.

### Pathophysiology of Erectile Dysfunction

The development of an erection is a complex event involving integration of psychological, neurologic, endocrine, vascular, and local anatomic systems. Positron emission tomography (PET) scanning studies, have suggested that sexual arousal is activated in higher cortical centers, which then stimulate the medial preoptic and paraventricular nuclei of the hypothalamus. These signals ultimately

descend through a complex neural network involving the parasympathetic nervous system and eventually activate parasympathetic nerves in the sacral area (S2 to S4). The neurovascular events that ultimately occur result in the inhibition of adrenergic tone and release of the nonadrenergic, noncholinergic neurotransmitter nitric oxide. Nitric oxide is believed to be released from nonadrenergic noncholinergic (NANC) nerves and endothelial cells. Nitric oxide stimulates the guanylate cyclase enzyme system in penile smooth muscle. This results in increased levels of cyclic guanosine monophosphate (GMP) and ultimately in smooth muscle relaxation, enhancement of arterial inflow, and veno-occlusion, producing adequate firmness for sexual activity. Abnormalities in any of these systems may produce erectile dysfunction. For example, cerebral vascular accidents, multiple sclerosis, Parkinson's disease, and spinal cord injury may result in neurogenic erectile dysfunction. More commonly, vascular disease and diabetes may produce neurovascular abnormalities resulting in erectile dysfunction. Surgery for cancers of the prostate, bladder, and colon may also produce neurovascular abnormalities resulting in erectile dysfunction. Diseases such as Peyronie's disease, in which patches or strands of dense tissue surround the cavernous body of the penis, and traumatic perineal and penile injuries may also interfere with neurovascular and anatomic structures, producing erectile dysfunction.<sup>3</sup>

## Material and Methods

Our study is based on male accused subjects brought by the Police to the Department of Forensic Medicine, North Bengal Medical College, for certification of Potency in cases of sexual assault, in the year 2010. After routine history taking including mental status, psychological status, marital status and genital examination, cases were referred to the Department of Urology, North Bengal Medical College & Hospital for further evaluation. In the Department of Urology, examination of obvious neurological deficit like weakness of any limb, bulbocavernosal reflex, anocutaneous reflex, cremasteric reflex were done along with examination of genital organ – phallus, testis. Routine haemogram and biochemical parameters like Blood Sugar, Lipid profile, Urea, Creatinine, ECG in hypertensive patients, Papaverine Induced Penile Erection Test (PIPE); Ultrasonography of the Phallus with Duplex Doppler Study after intracavernosal injection of papaverine (0.5 – 1ml.)

## Results

A total of 87 males were examined in the Department for Potency in the Year 2010. The age distribution being categorized in decades from 11 years above (Table 1) showed most subjects were of the second decade (11-20 yrs) – 32.18%. while above 61 years was only 4.60%. The total cases suspected to be suffering from Erectile dysfunction by initial examination at the Deptt. of Forensic Medicine by self masturbatory technique with visual sexual stimulation and prostatic massage was 8 out of the total 87 subjects (9.20%) and their age distribution is as given in Table 2., with the maximum cases (37.5%) in the age group 51-60 yrs.

On the basis of detailed history, the cases were categorized age wise, if suffering from any medical conditions like diabetes, hypertension, psychiatric problems like depression, urogenital

problems like hydrocele, hypospadias with chordee, any history of local injury or surgical intervention, habits like smoking and alcoholism, history of medications like antipsychotic and antidepressants ( Table 3 ). It is seen that cases of suspected erectile dysfunction with history of Diabetes Mellitus ( Type II ) and hypertension, history of psychiatric problems, smoking and alcoholic habits was very common, with 5 cases ( 62.50%) having all the associated problems and habits.

The 8 suspected cases on referral to the Deptt. Of Urology, NBMC&H, were clinically evaluated and advised necessary investigations. The findings were tabulated as given below (Table.4). It was seen that there was no neurological deficits, the bulbocavernosal, anocutaneous, cremasteric reflexes were normal except for one case ( >60 yrs.). Their routine haemogram showed abnormality in the form of anaemia with increased monocyte count in 5 cases, which was also closely linked with abnormal blood glucose, serum cholesterol, serum VLDL, urea and creatinine. and ischemic changes in their ECG. The PIPE conducted on them showed rigid erection in 5 cases terming them potent with 1 case of temporary ED, no erection in 2 cases, terming them to be suffering from ED, while 1 case showed soft erection, which was interpreted as a Borderline ED Case. In the present study we have included the Borderline ED case with the ED cases, making the cases of ED after evaluation, 3 out of the 8 suspected cases ( 3.44%).

## Discussion

The prevalence of ED varies in different surveys and countries (10-20%).<sup>4</sup> In the present study the prevalence was 9.20% on initial survey, which came down to 3.45% (3 cases of ED) after further laboratory tests . In a study based in rural New York State, the prevalence of ED among men 50-76 years old in rural Central New York State was at least 21.3% . Age, perceived state of health and socio-economic status were found to be important determinants of erectile dysfunction among this population.<sup>5</sup> In the present study, though only 4.60% of the sample was above 60 yrs., the incidence of ED was high as 25%, while in the 51-60 yrs group it came down to 20%, 41-50 yrs group further down to 12.5%.

In our study, there has been a close relationship between the predisposing medical conditions like hypertension with ECH changes, **Table 1.** Table showing Age-wise distribution of cases examined for potency

Sl.No.	Age Group (yrs.)	No. of cases Examined	Percentage(%)
01.	11-20	28	31.18
02.	21-30	26	29.89
03.	31-40	16	18.39
04.	41-50	08	09.20
05.	51-60	05	05.75
06.	> 60	04	04.60
	Total	87	

**Table 3.** Table showing relationship between cases of suspected erectile dysfunction and normal subjects with disposing factors.

Sl.No.	Age Group (yrs.)	No. of cases with H/O of Diabetes		No. of cases with H/O Hypertension		No of cases with H/O Depression/ Psychiatric problem		No. of cases with Urogenital surgical ailment e.g. Hydrocele		No. of cases with H/O Injury /Surgicalln tervention		No. of cases with Smoking habit		No. of cases with Alcoholic habit		No. of cases with H/O of medications Antipsychotic/ Antidepressant	
		-ve	+ve	-ve	+ve	-ve	+ve	-ve	+ve	-ve	+ve	-ve	+ve	-ve	+ve	-ve	+ve
01.	11-20	-	-	-	-	-	-	-	-	-	-	13	-	11	-	-	
02.	21-30	-	-	-	-	01	-	-	-	-	-	09	-	14	01	-	
03.	31-40	01	03	01	02	-	02	-	-	-	-	01	08	01	08	-	02
04.	41-50	01	02	01	02	-	-	-	-	-	01	05	01	04	-	01	
05.	51-60	03	-	03	01	02	01	01	-	-	-	03	02	03	02	01	01
06.	>60	01	02	01	02	01	02	-	-	-	-	01	02	01	02	-	-
	Total	06	07	06	07	04	05	01	-	-	01	06	39	06	41	02	02

-ve : No rigid erection (Suspected case of erectile dysfunction)

+ve: Rigid erection (Normal)

abnormal blood glucose , cholesterol, urea, creatinine levels and ED, to the extent that 62.5% of the cases of suspected ED and 100% of the true ED cases had correlation with them all. The Massachusetts Male Aging Study showed the combined prevalence of minimal, moderate and complete impotence was 52%. The prevalence of complete impotence tripled from 5 to 15% between subject ages 40 and 70 years. Subject age was the variable most strongly associated with impotence. After adjustment for age, a higher probability of impotence was directly correlated with heart disease, hypertension, diabetes, associated medications, and indexes of anger and depression, and inversely correlated with serum dehydroepiandrosterone, high density lipoprotein cholesterol and an index of dominant personality. Cigarette smoking was associated with a greater probability of complete impotence in men with heart disease and hypertension. They concluded that impotence was a major health concern in light of the high prevalence, was strongly associated with age, had multiple determinants, including some risk factors for vascular disease, and may be due partly to modifiable para-ageing phenomena.<sup>6</sup>

In a survey of 541 diabetic males in Scotland, England, aged 20-59 years, 190 (35%) had erectile dysfunction.<sup>7</sup> A correlation was found in patients with severe microangiopathy, along with ischaemic heart disease and diabetic impotence.<sup>7</sup> which was also perceived in the present study.

## Conclusion

Impotency is a mere definition in legal terms where there needs to be a rigid phallus for coitus, whether lawful or unlawful. There is no scope for discussion as to the causes, whether it was due to any associated medical condition which one cannot be blamed for, or was it due to the sexual partner being frigid and cold. The mere rigidity or flaccidity of the phallus cannot be the only testimony for potency or

**Table 2.** Table showing Age-wise distribution of cases examined and cases suspected of erectile dysfunction.

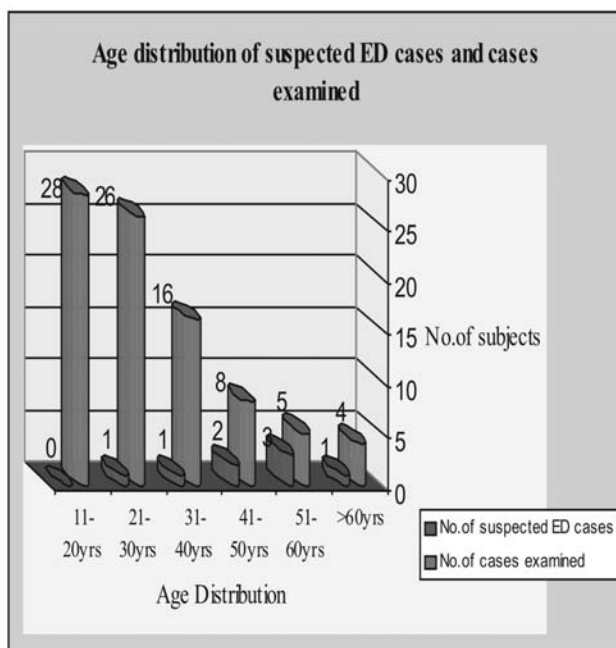
Sl.	Age Group (yrs.)	No. of cases examined	No. of cases Suspected to be suffering from Erectile dysfunction	Percentage (%)	Total Percentage (%)
01.	11-20	28	-	-	-
02.	21-30	26	01	12.50	01.15
03.	31-40	16	01	12.50	01.15
04.	41-50	08	02	25.00	02.30
05.	51-60	05	03	37.50	03.44
06.	>60	04	01	12.50	01.15
	Total	37	08		

**Table 4.** Table showing Clinical and Laboratory Evaluation of individual cases of suspected Erectile Dysfunction (ED) and their interpretation.

Sl.No.	Age Group Yrs.(1)	Neurological deficit (2)	Reflexes (3)			Haemogram (4)	Blood Sugar (5)	Lipid Profile (6) (7)	Urea Creatinine	ECG (8)	USG (9)	Final Opinion
			Bulbo (i)	Anocutaneous (ii)	Cremasteric (iii)							
01.	21-30	A	N	N	N	N	N	N	N	R	Potent	
02.	31-40	A	N	N	N	N	A	A	N	N	R	Potent
03.	41-50	A	N	N	N	N	N	N	N	N	R	Potent
04.	41-50	A	N	N	N	A	A	A	A	A	S	Bordeline ED
05.	51-60	A	N	N	N	A	A	A	A	A	R	Potent
06.	51-60	A	N	N	N	A	A	A	A	A	R	Temporary ED (Hydrocele)
07.	51-60	A	N	N	N	A	A	A	A	A	A	ED
08.	>60	P	S	S	S	A	A	A	A	A	A	ED

- (2) Neurological deficit : weakness of limbs, muscle wasting : ( A)= Absent (P)= Present  
 (3) (i) Bulbocavernosus Reflex: ( N) = Normal, ( S)= Subnormal (A)= Absent  
 (ii) Anocutaneous Reflex : ( N) = Normal, ( S)= Subnormal (A)= Absent  
 (iii) Cremasteric Reflex: ( N) = Normal, ( S)= Subnormal (A)= Absent  
 (4) Routine Haemogram : (N) = Within Normal Limits (A)= Out of Normal Limits  
 (5) Serum Glucose (Fasting/ Post Prandial) : (N)= Within Normal Limits (A) = Above Normal Limits  
 (6) Serum Lipid Profile : (N)=Within Normal Limits (A) = Above Normal Limits  
 (7) Serum Urea Creatinine: (N) Within Normal Limits (A)=Above Normal Limits  
 (8)ECG: (N) Normal Study (A) Abnormal Study  
 (9)Papeverine Induced Penile Erection (PIPE) Test :  
 USG of Phallus with Duplex Doppler Study after Intercavernosal Papaverine Injection (0.5-1ml.) :  
 (R) =Rigid Erection, (S) = Soft Erection (A) = No Erection.

Graph showing age distribution of the subjects examined and suspected ED cases.



impotency. The mechanism of penile erection is a complex neurochemical process involving the higher centres of the brain and ending at the cavernosal venous plexus of the penis, fuelled by a sexual impulse which may be visual, tactile, olfactory, or even gustatory, along with the proper ambience for sustainability and satisfaction. This intricacy cannot be like a two stage phenomenon, erection and flaccidity. The need for further study into ED can only open the web further, so that we can term true cases of ED from the ones of decreased libido and sexual fervor.

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# Epidemiology of Intentional Self Poisoning

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## Abstract

Intentional self-poisoning is one of the most common methods of suicide worldwide. A three year retrospective hospital record-based research conducted in a tertiary care hospital attached to a medical institution in Karnataka to record the incidence, age, gender, religion, type of poisoning, outcome and circumstance of poisoning. Of the total 1,49,454 patients admitted in the hospital for treatment during this three year research period, 592 patients were for acute poisoning, among which 377 are of intentional self poisoning. Of these 57.5% were males and 42.5% females. The majority (36.6%) cases were from age group of 21–30 years. Majority (96.8%) of the intentional self poisoning victims were Hindus. The commonest poisons ingested were Organophosphorous insecticides. The mortality outcome was 60 out of 377 cases. Psychiatric illness was seen in 182 (48.3%) intentional self poisoning victims.

## Key Words

Poisoning; Intentional self poisoning; Mortality; Organophosphorous poison.

## Introduction

Acute poisoning is an important clinical emergency and contributor to morbidity and mortality. Nearly one million people are affected globally every year.<sup>1</sup> Self inflicted violence accounts for around half of the 1.6 million violent deaths that occur every year worldwide.<sup>2</sup> About 63% of global deaths from self harm occur in the Asia Pacific region. Most of these deaths occur in rural areas, where easy access to highly toxic pesticides turns many impulsive acts of self poisoning into suicide.<sup>3</sup> Self-poisoning is one of the most common methods of suicide. In developed countries, it predominantly occurs in young people impulsively responding to stressful events who have little desire to die. Deaths are rare, since the medicines ingested are of low toxicity or easily treated. The situation is different in the developing world, where pesticides are the most popular means of self-poisoning and cause an estimated 300 000 deaths each year.<sup>4</sup> Suicide by intentional ingestion of pesticides: a continuing tragedy in developing countries<sup>4-6</sup>, including India.<sup>7-11</sup> An estimated 3 million people are hospitalized for pesticide poisoning each year throughout the world, resulting in 7.3% mortality.<sup>12</sup> Most of this morbidity and mortality is due to intentional self poisoning. The present study attempts to gather epidemiological information regarding intentional self poisoning in a tertiary care hospital attached to a medical institution in Karnataka hospital through a record-based research to record incidence, age, gender, religion, type of poisoning, outcome and circumstance of poisoning, so as to formulate recommendations that could probably help to reduce the morbidity and mortality due to intentional self poisoning, a preventable health hazard.

## Material and Methods

This is a retrospective hospital record-based study conducted in a tertiary care hospital attached to a medical institution in Karnataka, situated in coastal Karnataka, South India, for a period of 3 years (January 2006 to December 2008). The study included 377 cases of intentional self poisoning and data regarding incidence, age, gender,

religion, type of poisoning, circumstance of poisoning and outcome were collected in the pre-structured proforma. The nature of poisonous substance involved was determined from the circumstantial evidence, reliable history, presentation of remaining stuff/container from which the poison had been consumed, suggestive clinical features and laboratory investigation reports. The poisons/drugs classified in different groups based on their characteristics. The data collected using the proforma was entered in the computer in data base and analyzed using SPSS 11.0 software.

## Results and Observations

One lakh forty nine thousand four hundred fifty four patients were admitted in the hospital during the period of 3 years (January 2006 to December 2008). Of these, 592 patients admitted with acute poisoning, among which 377 are of intentional self poisoning as depicted in the Table No. 1. This was less than 1% of the total admission and 63.68% of the total acute poisoning cases.

Maximum numbers of intentional self poisoning cases were found to be in the age group of 21 to 30 years, followed by the age group of 11 to 20 years, and 31 to 40 years respectively, as depicted in the Table No. 2. In our study, we observed that males outnumbered females, as depicted in the Table No. 3. 96.8% of the victims were Hindus, followed by Christians and Muslims, as depicted in the Table No.4.

The most common substance used for intentional self poisoning was organophosphorous insecticide followed by therapeutic medications as depicted in the Table No. 5. It was observed in our study that, 84% of intentional self poisoning cases reported to our hospital had survived while 16% cases had expired, as depicted in the Table No.6.

The most of the intentional self poisoning victims had psychiatric illness as the precipitating factor followed by personal problems, as depicted in the Table No.7.

**Table 1.** Year wise distribution of cases of poisoning

Year	Total admissions	Poisoning cases	Suicidal poisoning
2006	44,966	188	120
2007	51,320	201	122
2008	53,168	203	135

**Table 2.** Age incidence (n=377)

Age group in years	No of cases	Percentage (%)
< 10	0	0
11-20	82	21.7
21-30	138	36.6
31-40	60	15.9
41-50	47	12.5
51-60	31	8.3
>61	19	5.0

**Table 3.** Gender distribution (n=377)

Sex	No. of cases	Percentage (%)
Male	217	57.5
Female	160	42.5



**Table 4.** Religion-wise distribution of poisoning victims (n=377)

Religion	No. of cases	Percentage (%)
Hindu	365	96.8
Muslim	2	0.5
Christian	10	2.7

**Table 5.** Type of poisoning (n= 377)

Nature of poison	No. of cases	Percentage (%)
Organophosphorous insecticides	191	50.7
Carbamates	14	3.7
Rodenticides	44	11.7
Chlorinated hydrocarbons	8	2.1
Therapeutic drugs	66	17.5
Irritants	16	4.2
Plant poisons	12	3.2
Corrosives	10	2.7
Miscellaneous	16	4.2

**Table 6.** Outcome (n=377)

Outcome	No. of cases	Percentage (%)
Survival	317	84
Expired	60	16

**Table 7.** Reason for suicide (n=377)

Reason	No. of cases	Percentage (%)
Psychiatric illness	182	48.3
Personal problem	75	19.9
Fight with family members	50	13.3
Alcohol	35	9.3
Financial loss	19	5.0
Exam failures	16	4.2

## Discussion

Morbidity and mortality due to acute poisoning is a worldwide phenomenon and has enormous medical, legal and social significance. Nearly one million people are affected by poisoning globally every year.<sup>1</sup> The mortality worldwide is estimated to be 0.6% of all deaths per year as per WHO. In India deaths due to poisoning accounts for more than 50,000 people every year.<sup>13</sup> Self poisoning is one of the oldest methods tried for intentional self harm (suicide). A self-poisoning episode may be defined as the self exposure of an individual (by ingestion or inhalation) to an amount of substance associated with the significant potential to cause harm. Self-poisoning episodes may be accidental or deliberate/intentional, fatal or nonfatal. Accidental self-poisoning may occur when an individual unintentionally experiences more of an effect from a substance than planned.<sup>14</sup> Intentional self-poisoning, when it is nonfatal, and particularly when it is grouped together with self-injury, is also called deliberate self-harm (DSH), attempted suicide or parasuicide.<sup>15</sup> If death occurs consequent to an episode of deliberate self-poisoning or self-harm then the diagnosis becomes one of suicide.<sup>14</sup> There are reports available from different parts of the world highlighting various substances abused for acute poisoning and their toxicity. From Western countries, drugs have reported as the commonest substances abused with mortality rates varying between 0.4% and 2.0%.<sup>16</sup> Reports available from certain Asian (Sri Lanka) and African countries (Uganda) describe organophosphates and drugs as the commonly abused toxic substances with reported mortality rates varying from 2.0% to 2.1%.<sup>17, 18</sup>

Suicidal poisoning forms a bulk of the total acute poisoning victims, which is not only a phenomenon restricted to India but also a global one.<sup>16, 19, 20</sup> This greater incidence of suicide by poisoning is linked to a widespread belief that poisoning kills without significant suffering. Human life is full of mental as well as physical stress. Physiological stress factors such as hormonal variations etc., peer pressure, self-esteem, confusion, self-doubt, expectations, pressure to succeed, academic responsibilities, maladjustment, financial uncertainty and physical

diseases are some of the factors contributing to this stress during different age groups. Suicide is often a spontaneous act resulting from the inability to cope with their environment and adjust with the stress they are exposed to. If the emotional support and understanding is not provided, one may resort to suicide as a easy way out to ones problem and stress. Psychiatric illness was the major driving force behind victims resorting to intentional self poisoning in concurrence with other studies on suicide victims.<sup>21, 22</sup> The mortality rate in intentional self poisoning victims was 16%, where as the mortality rate ranged from 2 to 15% in various other studies.<sup>16, 23, 24</sup>

The age group with maximum incidence of intentional self poisoning was between 21 - 30 years and showed significant decrease in the extremes of age. The high incidence in the above age group is in accordance with the trends observed nationally and globally.<sup>25, 26, 27, 28</sup> It is obviously due to the fact that this age group is the determining factor of the life in terms of studies, service, marriage and other life settlement factors. Therefore, they are subjected to substantial amount of mental stress and strain during this period. Prevalence of males was more in our study when compared to females, corroborating with other studies.<sup>19, 20</sup> Male preponderance in this study could be accounted to the fact that males are more often exposed to the stress and strain of day to day life, as well as to the occupational hazards than the females in this part of the world. However, studies from the some parts of India, United Kingdom, Iran, Turkey, and Tokyo reported more cases of poisoning in females, indicating the varying trends at different places.<sup>29, 30-33</sup>

Majority of the poisoning victims belong to the Hindu faith reflecting the distribution of population following different religion.<sup>34</sup> Hindus are predominantly engaged in agriculture related occupations. The fact that farming community is more prone to poisoning may be responsible for this high rate of poisoning among Hindu community. Harming ones own life is considered 'haram' and strictly forbidden in Islam, the Muslim religion. This may be the reason for low incidence of poisoning among Muslims as such.<sup>34</sup>

Bulk of the poisoning cases were due to Organophosphorous insecticide poisons and was in accordance with studies conducted at national and international levels.<sup>20, 35, 36</sup> The use of poison agent depends on the availability and accessibility of the agent to an individual. Organophosphates continue to be the most commonly used agrochemicals in southern and western part of the country because of its easy availability and low cost.<sup>37</sup> However, the pattern of poisoning observed in the western studies revealed, prescription related drugs to be the most preferred poison.<sup>30, 38</sup>

## Conclusions and Recommendations

- Poisoning constitutes less than 1% of the total hospital admissions.
- Males are affected more often than the females; male to female ratio being 1.4:1.
- Seventy four percent of poisoning victims were in the 2<sup>nd</sup> to 4<sup>th</sup> decade of life.
- Organophosphorous insecticide poison was the most common type of poison that was observed in 51% of the cases.
- Most of the poisoning victims belong to Hindu faith.
- The mortality rate in our study is 16%.
- The most common reason of intentional self poisoning revealed to be underlying psychiatric illness.

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# Study of Pattern of Suicidal Deaths in Aurangabad, Maharashtra

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## Abstract

The "Medicolegal Study of Suicidal Deaths" was carried out in the Department of Forensic Medicine, Govt. Medical College, Aurangabad, for a period of 6 months. 200 Cases were included. As all were medico-legal cases, details of these cases are available in the Department. These cases were studied and analyzed on the basis of age, sex, marital status, residence, occupation, methods and causes of suicide. Methods of suicide were also noted like hangings, drowning, burns, poisoning, injury, electrocution.

## Key Words

Poisoning, burns, adults, rural, suicide, death.

## Introduction

"Life is a stage with one entrance but with many exits" remarked by Will Durant (1964) [1] and suicide, an important exit, has a long history and philosophy. The French Nobel Laureate Campous A. (1969) [2] said, "That there is but one serious philosophical problem and this is suicide."

Suicidal deaths are attracting increasingly more attention from the medical profession and public health agencies. Suicide is defined by Beck 'a willful self inflicted life threatening act, which has resulted in death [3].

Methods of suicide in Indians are generally poisoning, burns, hanging and drowning. Previously drowning used to occupy the first position of all the modes of committing suicide in India reported by Franklin (1982) [4]. In India, it is believed, the tendency to commit suicide is growing due to increasing pressure in social and personal lives. The common reasons are poverty, indebtedness, dowry demand, family conflicts and sometimes, failure to realize an ambition or to pass an examination. After the publication of the results of the secondary

and higher secondary examinations in West Bengal, a spate of suicides took place. Students not only take their own lives for failure, but also for not having done well enough.

In present study an attempt is made to review the known suicide with reference to age, sex, marital status, methods, cause of suicide and area wise distribution.

## Material and Methods

The "Medicolegal Study of suicidal death" was carried out in the department of Forensic Medicine, Govt. Medical College, Aurangabad, for a period of 6 months during Jan 1997—June 1997. 200 Cases are included. As all are medico-legal cases, details of these cases are available in the Department. The preliminary data related to name, age, sex, address, brought by whom, time of admission, treatment given and time of death was noted. The inquest report was carefully read before starting postmortem examination; detailed history on various aspects was obtained from the medico-legal documents of each case and by interrogating relatives. Urban and rural individuals were also included as per the occupation and dwelling. Rural individuals were defined as persons coming from village whose dependence was mainly upon agriculture. Urban individuals were those not from rural area. The pre-designed proforma was used knowing the Name, Age, sex, marital status, residence—urban / rural, cause of suicide like dowry, chronic illness, mental illness, illicit relationship, bankrupt, sad demise and unknown.

Methods of suicide were also noted like hangings, drowning, burns, poisoning, injury, electrocution.

## Observations

The findings were carefully noted, analysed and presented in tables as follows.

**Table 1.** Causes of suicide as per age of the victim

Age Group	Methods						Total No (%)
	Hanging No (%)	Drowning No (%)	Burns No (%)	Poisoning No (%)	Injuries No (%)	Electrocution No (%)	
Below 18	3(1.5)	0(0)	2(1)	3(1.5)	0(0)	0(0)	7(3.5)
19-25	13(6.5)	9(4.5)	31(15.5)	42(21)	1(0.5)	1(0.5)	97(48.5)
26-32	14(7)	9(4.5)	13(6.5)	19(9.5)	3(1.5)	0(0)	58(29)
33-39	0(0)	2(1)	7(3.5)	16(8)	1(0.5)	0(0)	26(13)
40-46	0(0)	1(0.5)	5(2.5)	1(0.5)	0(0)	0(0)	7(3.5)
47-53	0(0)	0(0)	0(0)	1(0.5)	0(0)	0(0)	1(0.5)
54-60	0(0)	0(0)	0(0)	1(0.5)	0(0)	0(0)	1(0.5)
Above 60	0(0)	1(0.5)	0(0)	1(0.5)	0(0)	0(0)	2(1)
Total	30(15)	22(11)	58(29)	84(42)	5(2.5)	1(0.5)	200(100)

As found in Table No. 1, it is clear that poisoning (42.0%) was the most common cause of suicide in all age groups, followed by burns (29.0%), hanging (15.0%), drowning (11%), injuries (2.5%), electrocution (0.5%).

Table No. 2 shows that among married males poisoning (24.5%) was the most common method used to commit suicide followed by hanging (10.5%), burns (7.5%), drowning (4.5%), injuries (0.5%) and electrocution (0.5%) each. While in married females burns (17%) was most common method used to commit suicide followed by poisoning (6.5%), drowning (5.0%), hanging (3.0%), injuries (0.5%).

The most common methods used to commit suicide by unmarried males were poisoning (9.0%), burns (2.0%), hanging and drowning (1.5%), injuries (1.0%). While in unmarried females most common method used to commit suicide was burns (2.5%) followed by poisoning (1.5%), drowning and injuries (0.5%).

Table No. 2 also clears that irrespective of marital status poisoning (33.5%) among the males and burns (19.5%) among the females was the most common method of suicide. Hanging (12%) was other common method used by males to commit suicide as compared to females (3%).

**Table 2.** Methods of suicide as per sex and marital status

Methods of Suicide	Married				Unmarried				Total	
	Male		Female		Male		Female		No	%
	No	%	No	%	No	%	No	%		
Hanging	21	10.5	6	3	3	1.5	0	0	30	15
Drowning	9	4.5	10	5	3	1.5	1	0.5	23	12.5
Burns	15	7.5	34	17	4	2	5	2.5	58	29
Poisoning	49	24.5	13	6.5	18	9	3	1.5	83	41.5
Injuries	1	0.5	1	0.5	2	1	1	0.5	5	2.5
Electrocution	1	0.5	0	0	0	0	0	0	1	0.5
Total	96	48	64	32	30	15	10	5	200	100

**Table 3.** Methods, sex, marital status and region

Methods	urban				Rural			
	Married		Unmarried		Married		Unmarried	
	Male(%)	Female(%)	Male(%)	Female(%)	Male(%)	Female(%)	Male(%)	Female(%)
Hanging	8(4)	2(1)	1(0.5)	0(0)	13(6.5)	4(2)	2(1)	0(0)
Drowning	3(1.5)	2(1)	1(0.5)	0(0)	6(3)	8(4)	2(1)	1(0.5)
Burns	5(2.5)	13(6.5)	1(0.5)	2(1)	10(5)	21(10.5)	3(1.5)	3(1.5)
Poisoning	15(7.5)	4(2)	6(3)	0(0)	34(17)	9(4.5)	12(6)	3(1.5)
Injuries	0(0)	0(0)	2(1)	0(0)	1(0.5)	1(0.5)	0(0)	1(0.5)
Electrocution	1(0.5)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
total	32(16)	22(11)	11(5.5)	2(1)	64(32)	42(21)	19(9.5)	8(4)

In the present study as found in Table No. 3 it is obvious that most of the suicidal deaths were by poisoning in both married and unmarried as well as in urban and rural region. In urban region among the married males most common method used commit suicide was poisoning (7.5%) and in married females most common method used was burns (7%).

In the unmarried males in urban region the most commonly method used to commit suicide was poisoning (3%) and in unmarried females it was burns (1%).

In the rural region most common method used to commit suicide was poisoning by the married males (17%) and burns by married females (10.5%).

In unmarried male also the commonest method to commit suicide was poisoning followed by burns (1.5%), hanging (1%), drowning (1%), and injuries (0.5%).

In unmarried females most common method used to commit suicide was poisoning (1.5%) and burns (1.5%) followed by hanging and injuries 0.5% each.

**Table 4.** Region wise Distribution of Cases as per sex and marital status

Region	Male				Female				Total	
	Married		Unmarried		Married		Unmarried		No	%
	No	%	No	%	No	%	No	%		
Urban	32	16	11	5.5	21	10.5	2	1	66	33
Rural	64	32	19	9.5	43	21.5	8	4	134	67
Total	96	48	30	15	64	32	10	5	200	100

As found in the Table No. 4, maximum numbers of suicidal deaths were found in rural region i.e. 67.00% as compared to urban region (33.0%). Among the married males 16% of the cases are in the urban region and 32% in rural region. In married females 21.5% were from rural region and 10.5% from urban region. Among the unmarried males 9.5% of cases were from rural region and 5.5% from urban region. In unmarried females also maximum number of cases i.e. 4% are from rural region and 1.0% from urban region.

## Discussion

As found in Table No. 1, poisoning (42%) was the most common method of choice in all the victims of suicide in all age groups followed by burns (29%), hanging (15%), drowning (11%), injuries (2.5%), electrocution (0.5%). These findings are consistent with the findings of Dhatarwal S.K. (1997) [5] hanging is preferred to drowning as hanging can be done in the closed chamber.

Poisoning was the commonest method to commit suicide because it is easily available in rural region. The category of poison found was insecticide. We did not found a single case of suicide by consumption of any other poison or drugs or overdose of any drugs particularly antidepressant and salicylates.

Table no. 4 reveals that the poisoning was the most common

method to commit suicide in married males. This finding correlates with the findings of Mcloone p et al (1996) [6]. This may be due to the fact that there is an easy access to various insecticides in rural region as farmers stores them in their homes, farms and hence higher rate.

In married females burns (17%) was the commonest method to commit suicide. In cases of deaths due to burns the element of uniform monotonous history provided in majority of cases such as stove burst while cooking, pouring kerosene oil to the burning stove, both of which were found to be rather not true on personal interrogation of blood relatives accompanied the deceased to the mortuary. Considering the marital history and age of the victim it is true that most of them are married and between 18 to 32 years of age.

Death of the married female due to burns are clear pointer to the fact that deaths are mostly deliberate, intentional giving credence to dowry deaths rather than plea usually taken by the defense [7].

Other methods used to commit suicide by the married females were poisoning (6.5%), drowning (5%), hanging (3%), and injuries (0.5%).

Amongst the unmarried males most common method to commit suicide was poisoning 9% and in unmarried females burns 2.5%.

In the present study Table No. 3 reveals that most of the suicidal deaths were in rural region thereby 67% as compared to urban region

33%. This may be because of illiteracy and socioeconomic crises.

Zacharakis C.A. (1998)[8] and et al in their study of patterns and social factors of suicide concluded that rural suicides death were twice as urban deaths and this is in accordance with the findings of present study.

Among the married male 32% of cases are from rural region and 16% from urban region. In married female 21.5% are from rural region and 10.5% are from urban region. Amongst the unmarried male 9.5% are from rural region and 5% cases are from urban region. In unmarried females also maximum numbers of cases are from rural region, thereby 4% as compared to urban region 1%.

In the present study as found in table No. 3 it is obvious that most of the suicidal deaths were by poisoning in both married and unmarried as well as in urban and rural region. In urban region among the married males most common method used commit suicide was poisoning (7.5%) and in married females most common method used was burns (7%). In the unmarried males in urban region the most commonly method used to commit suicide was poisoning (3%) and in unmarried females it was burns (1%).

In the rural region most common method used to commit suicide was poisoning by the married males (17%) and burns by married females (10.5%). In unmarried male also the commonest method to commit suicide was poisoning(6%) followed by burns (2%), hanging (1%), drowning (1%) and injuries (0.5%). In unmarried females most common method used to commit suicide was burns (1.5%), poisoning (1.5%) followed by drowning (0.5%) and injuries (0.5%) each.

## Suggestions

1. There is need of strengthening of inbuilt system of value education in schools in special reference to value of life as a precious gift to human being.
2. The local Government should initiate and promote the community

based recreational activities to meet the emotional, intellectual, social and cultural needs of the individuals.

3. The Govt. should emphasize the availability of employment opportunities to married men on emergency basis to avoid untoward incidences to maintain social and individual integrity as a part of psycho-behavioral therapy.
4. Counseling centres to prevent suicides need to be initiated on the basis of computerized as complying helpline system in high risk areas preferably at Grampanchayat areas.
5. Marriage counseling through family courts with the help of non-governmental organizational needs to be strengthened to bridge the gap in the adjustments of couples in their marital relationship.

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# Detection of Thiophanate Methyl and Cartap by Spot Test Method

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## Abstract

A spot test for detection of two carbamate pesticides namely thiophanate methyl and cartap is described. Thiophanate methyl and cartap produced crimson coloured spots when treated with copper hexacyanoferrate reagent on silica gel-G spot test plate. The sensitivity of this spot test for detection of thiophanate methyl and cartap was found to be 5µg. The reagent did not respond positively with other carbamates namely carbaryl, carbosulfan, methomyl and propoxur. The described method is simple, sensitive, quick, and reliable for detection of these carbamates in different matrices including biological samples.

## Key Words

Spot test, Thiophanate methyl, Cartap, Copper hexacyanoferrate, Carbamate Silica gel-G.

## Introduction

Thiophanate Methyl [Dimethyl 4, 4'- (O-phenylene) bis (3-thioallophanate)] and Cartap [S, S'-(2'-dimethyl-amino trimethylene) bis (thiocarbamate)] pesticides used largely against a variety of pests on cereal, fruit and vegetable crops. <sup>1-2</sup> Easy availability and low price of carbamate pesticides has resulted in misuse for poisoning purpose. Therefore, their detection and identification is important in frequently encountered biological samples in the forensic science laboratories.

Some researchers carried out HPLC method <sup>3-5</sup> for determination of thiophanate methyl and oscillopolarographic and gas chromatographic methods<sup>6</sup>; colorimetric and fluorometric methods<sup>7</sup>; HPLC method<sup>8</sup>; GC-MS Method <sup>9</sup>; GC/micro-ECD Method <sup>10</sup> for determination of cartap. The above methods for determination of thiophanate methyl and cartap were applied on non forensic samples where generally no interfering materials are present. Though GC and HPLC are highly sensitive techniques but these are not considered good for initial detection and rapid screening of forensic samples where interfering materials ie protein, fats etc, encountered and therefore need proper clean up procedure before application of such techniques. On the contrary the spot test, chemical test and TLC method are the method of choice for initial detection and rapid screening of samples hence the present work. The present paper describes a highly efficient spot test for detection of thiophanate methyl and cartap.

## Material and Method

All chemicals of analytical grades were used.

**Preparation of standard carbamate solution:** A standard solution of 1 mg/ml strength of each of commonly available carbamates namely carbaryl, carbosulfan methomyl, propoxur, thiophanate methyl and cartap (thiocarbamate) were prepared separately in methanol for spot test examination as well as for evaluating specificity of the reagent.

**Preparation of chromatographic plates for spot tests:** Thin layer glass plates coated with 250 mm thin layer silica gel-G were activated at 110°C for 30 minutes just before use.

### Preparation of reagents for spot test

- i. 3% aqueous copper sulphate solution: 3g of copper sulphate (CuSO<sub>4</sub>) dissolved in 100 ml of distilled water. Colour of the

solution is blue.

- ii. 3% aqueous potassium hexacyanoferrate solution: 3g of potassium hexacyanoferrate (K<sub>3</sub>FeCN<sub>6</sub>) dissolved in 100 ml of distilled water. Colour of the solution is yellow.
- iii. Copper hexacyanoferrate reagent: - To 50 ml of copper sulphate solution, 50 ml of potassium hexacyanoferrate solution added and the resultant yellowish-brown solution is used as chromogenic reagent during the spot test method.

## Method

5ml of standard solutions of six carbamates namely carbaryl, carbosulfan, methomyl, propoxur, thiophanate methyl and cartap were applied on the activated silica gel-G chromatographic plates. A drop of copper hexacyanoferrate was applied over each spot of standard carbamate solutions. Crimson coloured spots were developed instantaneously with thiophanate methyl and cartap and rest of the carbamates did not respond. In an alternate procedure, a drop of copper sulphate solution and of potassium hexacyanoferrate solution were applied one after another over the spots of the standard solutions and it is observed that on addition of copper sulphate solution, the thiophanate methyl gave green coloured spot and then changed into crimson coloured spot on addition of potassium hexacyanoferrate solution. Cartap did not show this trend with copper sulphate solution but developed crimson coloured spot on addition of potassium hexacyanoferrate reagent. The method may also be used in a different way ie after spotting of standard solutions on silica gel-G coated spot plate; spray of copper hexacyanoferrate reagent or copper sulphate solution and potassium hexacyanoferrate solution one after another. The blank test was also carried out to differentiate the colour so obtained by the thiophanate methyl and cartap and reagent reaction.

## Results and Discussion

A spot test for detection of thiophanate methyl and cartap is developed. Crimson (red-orange) coloured spots were obtained when thiophanate methyl and cartap treated with copper hexacyanoferrate reagent on silica gel-G coated spot test plate. The sensitivity of the reagent for detection of thiophanate methyl and cartap was found to be 5mg. Silica gel-G layers were preferred for carrying out spot tests because silica gel-G is highly un-reactive in nature and can withstand the use of chemicals.

Standard solutions of some other carbamates namely carbaryl, carbosulfan, methomyl and propoxur were also prepared to determine the specificity of the suggested reagent. The reagent instantaneously produced crimson coloured spots only with thiophanate methyl and cartap and failed to react in a similar way with other described carbamate pesticides. However, after passage of some time other carbamates also started to respond with the reagent but the instant response with the reagent is only given by the thiophanate methyl and cartap. The suggested reagent also found suitable for detection of thiophanate methyl and cartap when extracted from spiked biological samples.

The spot test method has many advantages, which include economy of material, time, space, and labour. It is sensitive, as micro amount can easily be detected. The most remarkable advantage of spot test analysis is its simplicity. The adsorption and localized fixation of the reaction product(s) in the reaction surface (gel layer) makes it

a convenient screening method.

In forensic toxicology the prime object is identification of a substance in biological samples. The amount of targeted substance is very low in such samples and after the extraction from suitable methods it remains left in micro amount in the extract. Therefore, the technique besides speed and reliability should make use of minimal quantity of suspected material to establish the presence of a substance. To meet the above challenges of forensic toxicology, the spot test can be a method of choice.

The suggested spot test method is simple, sensitive, quick and reliable further it makes use of readily available reagents hence suitable for routine laboratory analysis for initial detection and identification of thiophanate methyl and cartap. Their further confirmation can be made through the instrumental methods.

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# Study of Decapitation Injuries in Railway Accidents

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## Abstract

Decapitation or complete severance of head from the body is imminently a fatal condition and is commonly encountered in railway accidents<sup>1</sup>. Suicide on railway tracks is a public health challenge and has been reported in urban/semi urban centers worldwide<sup>2</sup>. Those attempting suicide on the railway lines are usually affected by various social problems viz unemployment, love affairs and sexual offences etc. Railway tracks are easily available plat forms to commit suicide reach their goal of death and also used for masquerading the manner of death.

## Key Words

Railway Accident; Decapitation; Autopsy

## Introduction

Indian railways are largest public sector enterprise in the world and it is the major means of transportation for lakhs of people everyday across India .For Efficient and safe transportation , infrastructure is vital and this contributes to the economic growth in any developing countries, maintenance and safety of railways as well as security of passengers have always been a herculean task ever since its inception.

Railways are the major mode of transportation of the passengers and goods world wide , consequently the incidences of railway fatalities and mishaps are also high.

The injuries and deaths due to accidents are inescapable in the modern way of living. The accidental deaths are mostly due to the road traffic accidents but the deaths due to railway fatalities are also not negligible, especially in the areas where railway traffic is high<sup>3</sup>.

Cases of accidents at road rail crossings, slipping during entraining and detraining the moving train are frequently encountered. Similarly instances of jumping in front of moving train or lying on the railway track to commit suicide are also not uncommon. Most of the reported cases of railway deaths are brought to the mortuary that either the victim was directly hit by the train or died due to some other reason ,but the body was recovered in the vicinity of the railway platforms.

Few cases have also been reported where person have been killed and later thrown on railway track to simulate suicide or accident.

## Material and Methods

The present study "Pattern of injuries in fatal railway accidents" has been carried out in department of forensic medicine M. S. Ramaiah Medical College and hospital, Bangalore during the period October 2005 to October 2006, of all the cases of railway related deaths subjected for medico legal autopsy. A total number of 75 cases were selected for this prospective study. Detailed information regarding the deceased and the circumstances of death was collected from railway police, eyewitness, relatives and friends. In some of the instances information was supplemented by either visit to scene of occurrence or from photographs of scene of occurrence.

## Sample Size of Determination

All cases of railway related deaths with injuries brought by railway police for postmortem examination as railway accidents were studied from October 2005– October 2006.

## Inclusion Criteria

All railway related deaths cases with injuries brought by railway police to M. S. Ramaiah Medical College hospital mortuary.

## Exclusion Criteria

Natural deaths occurring in trains and platforms.  
Highly decomposed bodies.

## Results

The present study "Pattern of injuries in fatal railway accidents" has been carried out in department of forensic medicine M. S. Ramaiah Medical College and hospital, Bangalore during the period October 2005 to October 2006, of all the cases of railway related deaths subjected for medico legal autopsy. Out of total 763 cases of postmortem, railway related deaths constituted 75 cases. (9.82%)and decapitation deaths amounted to 35 cases.

In present study it is observed that maximum incidence of fatalities occurred in the age group of 21-30 years, may be attributed to unemployment, un successful romantic deeds, academic failure, family conflicts, marital disharmony in proper judgement of problems, dowry harassment and diseases. It was noticed that stress did not spare the professionals and engineers to use railway tracks to end their lives.

In present study it was observed that males forms the major chunk of passengers commuting the trains and hence more prone for accidents, and also because of lack of care, recklessness and don't care behaviour of males. Usually males use violent form to commit suicide whereas females usually resort for less violent form to commit suicide like hanging, drowning etc. These are the reasons for the wide differences. Simple decapitation was commonly seen in suicidal cases, soft tissue injuries were absent in most of the decapitated victims. Some cases had decapitation along with traumatic amputation of limbs. Extensive injuries to neck was common in accidental cases

## Discussion

In the beginning of nineteenth century, the symbol of a steam engine running upon a railway reflected not only the economic, social and industrial importance of the railway but also its significance as an expression of a characteristic Victorian ideology in which engineering achievement was identified with economic expansion and social progress. However from the point of view of the modern historian and particularly the historian of trauma a steam engine running *off* a railway and dragging its train to destruction behind might serve equally well.

The railway accident was as much a product of the industrial revolution of nineteenth century and it and embodies and symbolizes many of the age's apprehensions about progress and technological development .The railway accident constituted a uniquely sensational and public demonstration of the price which that triumph demanded -violence, destruction, terror and trauma.<sup>4</sup>

Railway injuries may be suicidal or accidental. Simple decapitation is commonly indication of suicide and rarely of accident. Traumatic amputation of limbs or fractures are common in accidents or rarely when a person throwing himself in front of moving train. Burns or charging may be found and the extent of which will depend on duration



of contact. Accidental injuries occurs while trying to board a moving train or falling from it and while walking on rails etc.<sup>5</sup>

Decapitation is an imminently fatal entity. Cases are on record where person have been killed by decapitation or else their head have been severed post-mortem i.e after being killed. <sup>1</sup>Decapitation in vehicle assisted suicides and complete hanging have also been reported. <sup>6</sup> Decapitation can result when a suicidee lies down on the railway track and expects a train or when an unconscious person is laid on the track or when a person accidentally falls or intentionally jumps or is pushed down from a running train or railway track. If the head or a body part is extended out of a running train through a window or door and strikes a pillar or any structure, then gross damage occur to that part due to force full impact and when the head is extended out of door or window of a running train.<sup>7</sup>

Dead body llaid on the track with an intention to obliterate the cause of death by a running train, . Ex;w hen a person is strangled to death and dead body is subjected to be run over with in a short period, by placing it on the track, with the neck on one side rail then very important findings on the neck in the support of strangulation will be lost. When the victims falls accidentally or jumps down intentionally they sustain mechanical injuries like bruise, abrasion, laceration and fracture of bones, these bodies may not get run over.

Decapitation can be inflicted postmortem after killing the victim, Common motives for decapitation can be considered as defensive, aggressive, and a possible combination of the two .Decapitation a vital injury and accounted for death in any grossly mutilated body. The combination of death scene findings and autopsy results will in most cases distinguish between homicidal and other modes of death.<sup>8</sup>

## Conclusion

Deaths due to railway injuries are Increasing in number and there is always a question of doubt ,regarding the manner of death, meticulous post mortem examination of external and internal injuries ,the irregular wound margins with under lying crushed tissues and stains of grease and oil from train parts can distinguish between railway injuries and other blunt trauma and also the manner of decapitation and death



1. Photograph showing the decapitation



2. Photograph showing the decapitation



3. Photograph showing the irregular margins of neck after decapitation

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# Study of Postprandial Variation of Routine Haematological Parameters in Healthy Subjects

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## Abstract

## Introduction

Routine hematological investigations are one of the most important parameters in reaching to the proper clinical diagnosis. Patient-related variables, such as physical exercise, stress and fasting status are important sources of variability in laboratory testing. However, no clear indications about fasting requirements exist for routine haematological tests.

## Methods

We studied 40 healthy volunteers who consumed a light meal containing a standardized amount of carbohydrates, protein and lipids. Blood was taken for routine haematological tests pre prandially and 1, 2 and 4 hours postprandially.

## Results

After one hour and two hours of the meal, total leucocyte count and neutrophil count increased significantly, whereas lymphocyte counts, red blood cell count, haematocrit, and haemoglobin decreased significantly. A clinically significant variation was observed for all the above. Four hours after the meal, WBCs, neutrophils, lymphocytes, showed significant increase while RBCs, haemoglobin and haematocrit were significantly decreased.

## Conclusion

The significant variation of several haematological parameters after a light meal demonstrates that the fasting time needs to be carefully considered in order to interpret the results of haematological tests correctly.

## Keywords

Pre prandial, post prandial, haematological tests.

## Introduction

Routine haematological testing is probably the most common laboratory endeavour. Thus it becomes an important investigation to reach to clinical conclusions in all the fields of healthcare. At the same time, it is also most prone to errors, manual, technical, pre-analytical and patient related.

Patient-related variables, such as physical exercise, stress and fasting status are important sources of variability in laboratory testing. However, no clear indications about fasting requirements exist for routine haematological tests, nor has the influence of meals been assessed.<sup>6</sup>

Laboratory diagnostics is often delivered in a high-pressure, fast-moving environment, involving a vast array of innovative and complex technologies<sup>2,3</sup>. The bulk of errors belong to the manually intensive pre-analytical phase, comprising of improper labeling, poor sample collection techniques, poor standardization and calibration.

Routine haematological testing plays a significant role in reaching to the correct diagnosis.

The external and internal quality control measures are essential prerequisites to help in the patient treatment.

Modern automated haematology counters provide quick results characterized by a high degree of precision and accuracy<sup>10</sup>. Spurious results may occasionally be observed in some circumstances, such as agglutination in the presence of ethylenediamine tetra-acetic acid (EDTA), cryoglobulins, lipids, insufficiently lysed red blood cells (RBC), erythroblasts and platelet aggregates<sup>11,12</sup>. Pre-analytical variability is another important source of errors in haematological testing, accounting for 0.36%<sup>7</sup> to 0.45%<sup>9</sup> of all unsuitable specimens referred for routine haematological testing.

Current data on pre-analytical errors in routine haematological testing indicate that undue clotting, samples collected into unsuitable containers or at an inappropriate volume (either insufficient volume for testing or suboptimal blood to anticoagulant ratio) are the prevailing causes of unsuitable specimens<sup>7</sup>.

Patient-related variables, such as fasting status, physical exercise, stress and the like can be major influencing factors causing errors in laboratory testing

The fasting requirement of at least 9 hours is specified for lipid profile according to the National Cholesterol Education Program (NCEP),<sup>14</sup>. For glucose alone, a fast of 8 hours is sufficient. Nevertheless, no clear indications about fasting requirements exist for routine haematological tests, nor has the influence of meal ingestion been previously assessed. The present study was done for the evaluation of the effect of an average Indian breakfast meal (comprising of 510 kcal) on the various haematological parameters. This will help us to sometimes cope up with the spurious results obtained due to different sample collection timings in the same patient, as in the oncology wards and emergency conditions.

Also, the acquaintance with the variation in the postprandial samples will help the clinicians to analyse the spurious variations and interpret the results correctly.

## Material and Methods

The study population consisted of 40 healthy males; between the age of 22 and 35 years, who were enrolled among the laboratory staff and students and gave written consent to testing.

Blood samples were collected by a four, expert phlebotomists, using a 22 G straight needle, directly into 2.0 mL siliconised vacuum

**Table 1.** Nutritional composition of light meal

Nutritional composition	Slice of cheese	Slice of bread	Biscuit Flavoured	Milk	Total
Number (overall weight)	1(20g)	2(54g)	4(25.7g)	1(200g)	301.1g
Kcal	55	132.6	142.8	178	508.4
Protein(g)	2.4	3.7	2.4	6.4	14.9
Carbohydrate(g)	0.4	25.4	20.8	24	70.6
Sugar(g)	0.8	1.8	8.0	16	26.6
Total lipids (g)	4.6	2.4	11.2	6.2	24.4
Saturated lipids(g)	3.4	0.8	5.6	3.8	13.6
Fibre(g)	0	0.9	1.2	N/A	2.1
Sodium (g)	0.2	0.286	N/A	0.1	0.586
Calcium (g)	0.1	N/A	N/A	0.24	0.34

tubes containing 5.9 mg K<sub>3</sub> EDTA . First blood sample was collected between 8:30 and 9:00 a.m. after an overnight fast. Immediately after blood collection, the volunteers consumed a light meal, containing standardised amounts of carbohydrates, protein and lipids (Table I). The meal included one slice of cheese, two slices of bread, four biscuits and a bottle of packed flavoured milk. The precise composition of the meal is shown in table I. Subsequent blood samples were collected 1, 2 and 4 hours after the end of the meal. Each phase of sample collection was carefully standardised, including the use of needles and vacuum tubes from the same lot. No specimen needed to be discarded due to unsatisfactory attempts, difficulty in locating a suitable venous access or missing the vein.

All samples were processed for routine haematological testing immediately after collection (<15 min) on the same Transasia haematology analyser . The parameters tested included haemoglobin, haematocrit, RBC count, mean corpuscular haemoglobin (MHC), mean

corpuscular volume (MCV), Mean Corpuscular Haemoglobin concentration (MCHC), Red cell distribution width (RDW), platelet count, mean platelet volume, platelet distribution width (PDW), total white blood cell (WBC) count and White blood cell differential count, including neutrophils, lymphocytes and other cells. The instrument was calibrated against appropriate proprietary reference standard material and verified with the use of proprietary controls. Results are shown as mean and standard error of the mean (SEM).

The significance of differences between samples was assessed by paired Student's t-test. The level of statistical significance was set at P < 0.05.

## Results

The results are shown in table II.

**Table 2.** Post-prandial variation of the routine haematological profile after a 510 kcal meal

	WBC	NEU	LYM	OTH	RBC	HGB	HCT	MCV	MCH	MCHC	RDW	PLT	MPV	PDW
<b>BASELINE SPECIMEN</b>														
MEAN VALUE	5.51	3.13	1.7	0.67	4.86	14.97	43.1	87.68	30.2	34.48	45.06	177	12.87	17.58
(SEM)	(0.21)	(0.14)	(0.06)	(0.43)	(0.06)	(0.15)	(0.39)	(0.9)	(0.41)	(0.18)	(0.62)	(0.09)	(0.30)	(0.71)
<b>1 hr AFTER MEAL</b>														
MEAN VALUE	5.9	3.71	1.55	0.63	4.63	14.37	41.54	88	30.29	34.37	45.13	177	12.28	17.2
(SEM)	(0.24)	(0.19)	(.07)	(.04)	(0.06)	(0.15)	(0.36)	(0.93)	(0.45)	(0.20)	(0.63)	(0.08)	(0.30)	(0.81)
MEAN % DIFF.	20%	18.5%	-8.8%	-6%	-4.8%	-4.2%	-3.5%	0.36%	0.3%	-0.32%	0.15%	0	-4.58%	-2.16%
p	.0001	.0001	.026	.373	.0001	.0001	.0001	.477	.486	.463	.507	.5	.359	.466
<b>2 hrs AFTER MEAL</b>														
MEAN VALUE	6.34	3.9	1.77	0.69	4.53	14.12	40.71	88.7	30.34	34.37	45.2	178	12.2	17.08
(SEM)	(0.24)	(0.22)	(.08)	(.04)	(.06)	(0.15)	(0.38)	(0.92)	(0.44)	(0.19)	(0.63)	(0.09)	(0.27)	(0.7)
MEAN % DIFF.	16.4%	24.6%	0	3%	-6.8%	-5.9%	-5.5%	0.1.2%	0.46%	-0.32%	0.31%	0.56%	-5.2%	-2.84%
p	.0001	.0001	.377	.765	.0001	.0001	.0001	.424	.478	.461	.485	.507	.334	.448
<b>4 hrs AFTER MEAL</b>														
MEAN VALUE	6.81	4.15	1.9	0.76	4.56	14.13	40.9	87.9	30.2	34.33	44.83	182	12.22	17.45
(SEM)	(0.26)	(0.21)	(.08)	(.06)	(.06)	(0.15)	(0.34)	(0.94)	(0.46)	(0.19)	(0.61)	(0.09)	(0.29)	(0.77)
MEAN % DIFF.	23%	31.6%	11.8%	18%	-15.4%	-5.8%	-5.1%	0.19%	0	-0.44%	0.5%	2.8%	-5%	-0.74%
p	.0001	.0001	.022	.224	.0001	.0001	.0001	.488	.5	.446	.475	.537	.348	.479

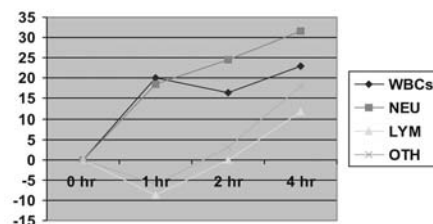
WBC: white blood cell count; NEU: neutrophils; LYM: lymphocytes ; OTH: other cells (eosinophils,basophils and monocytes)RBC: red blood cell count; HGB: haemoglobin; HCT: haematocrit; MCV: mean corpuscular volume; MCH: mean corpuscular haemoglobin; MCHC : mean corpuscular haemoglobin concentration; RDW: RBC distribution width; PLT: platelet count; MPV: mean platelet volume;PDW :platelet distribution width ;SEM: standard error of mean ;p: p value

One hour after the ingestion of the meal, significant increases were observed in total WBC count and neutrophil count, whereas lymphocytes and other white blood cells, haematocrit and haemoglobin were significantly decreased (Figures 1 and 2).

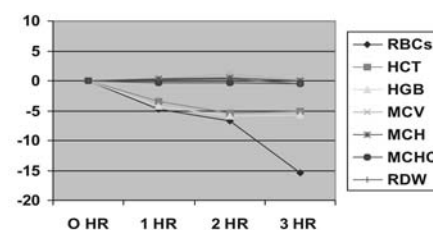
Two hours after the ingestion of the meal, the total white cell and neutrophil counts remained significantly increased, whereas lymphocyte counts were seen to be the same as baseline. RBC count, haemoglobin and haematocrit remained significantly decreased (Figures 1 and 2).

Four hours after the ingestion of the meal a significant increase was recorded for WBCs,neutrophils,lymphocytes as well as other white cells and platelets. RBC count, haemoglobin, haematocrit, mean platelet volume were significantly decreased. (Figures 1 and 2).

**Figure 1.** Percentage post-prandial variations of white blood cell (WBC) count, neutrophils (NEU), lymphocytes (LYMP) and other cells after a light meal.



**Figure 2.** Percentage post-prandial variation of red blood cell count (RBC), haemoglobin concentration (HGB), haematocrit (HCT), mean corpuscular haemoglobin (MHC), mean corpuscular volume (MCV) and RBC distribution width (RDW) after a light meal.



## Discussion

The health care system is incomplete and indeed unreliable without the diagnostic support. It needs a high degree of precision and accuracy to standardize the various laboratory parameters and thereby provide accurate and beneficial results to the clinicians in order to create an efficient health care system.

As in other areas of laboratory diagnostics, however, pre-analytical variability can affect haematological tests, thereby producing spurious results that can jeopardise patients' safety.<sup>2,1,5,8.</sup>

The fasting status which can be a crucial variable causing significant alterations in results, is not specified in the case of routine haematological tests. This may not be important in the cases wherein the sample is taken in the morning from fasting bed ridden patients in the hospital set up. However, the outdoor patient inflow in the hospitals as well as in the independent laboratories is unguarded and thus, the post prandial variations should be well specified in order to make the clinicians interpret the results correctly and troubleshoot spurious variations.

Patients suffering from urgent clinical conditions that require stat testing might undergo compromising situations due to these post prandial variations. An adequate knowledge of these factors can help the clinicians to interpret test results correctly, especially in the longitudinal monitoring of patients' data.

The results of the above study clearly state that even a 510 kcal breakfast administered in this investigation, can induce significant variations in the routine haematological profile in healthy subjects. This might prove to be important in the patients coming with haematological disorders and also in the emergency conditions wherein the course of the treatment totally depends on the laboratory results.

We observed a clinically significant increase in total WBC counts (upto 23%), neutrophils (upto 31.6%), lymphocyte (upto 18%) and other WBCs, mainly eosinophils (upto 18%) after 4 hours of the meal. A drop of 8.8% in lymphocyte counts was seen 1 hour after ingestion of meal which came to the baseline level after 2 hrs and then shows an increase of 11.8% after 4 hours. (Figure 1)

Hansen et al also noted an increase in neutrophil and platelet counts and a reduction in lymphocyte counts 2.5 hours after the intake of meal.<sup>15</sup> Van Oostrom *et al.* found a significant post-prandial increase in WBC in healthy subjects after an 8-hour oral fat load. However, while observing a substantial increase in neutrophils in the first 2 hours (142% higher than baseline), which did not return to baseline by the end of the test, they also recorded a substantial increase in lymphocytes (142% higher than baseline)<sup>16</sup>.

Lippi et al<sup>6</sup> also noted an increase in total WBC count and neutrophils after the ingestion of meal. They however, gave a reduction in lymphocytes even after 4 hours, contrary to our results. No plausible explanation can be found in the literature for this divergent result.

The increase in the various WBC counts show that the food intake represents a marked intestinal exposure to antigens, requiring host defences. Besides local immune activation, this defence includes a co-ordinated systemic immune response, which may serve to support local immunity.

The initial drop in lymphocytes indicate that the food antigen exposure is an acute antigen presentation that calls for neutrophil mobilization from the bone marrow and demarginalisation of neutrophils.<sup>15</sup> along with emigration of lymphocytes, probably into extravascular abdominal tissues, where they may serve to support local immune defences.<sup>6</sup>

After 4 hrs, the other White blood cells also participate in the immune response and gear up the host defences with the neutrophils.

The RBC count, hematocrit and haemoglobin concentration show a gradual decrease from around 4% each after 1 hour to 15.4%, 5.12%

and 5.8% respectively after 4 hours. This is probably due to hemodilution following ingestion of food and fluids.<sup>1</sup>

## Conclusion

The above study clearly shows that there is a significant variation in the postprandial evaluation of routine haematological parameters.

Therefore, we recommend that all the samples for hematological tests should be taken in fasting state and in cases of emergency, the pathologist should clearly indicate the timing of sample collection, so that the spurious results are coped up with, leading to better patient care.

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# Lasers in Oral Pathology-A Review

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## Abstract

Lasers were introduced into the field of dentistry with the hope of overcoming some of the drawbacks posed by conventional methods of dental procedures. Since the first experiment for applications in 1960s, the use of laser has increased rapidly in the last couple of decades. At present wide varieties of procedures are carried out using lasers. The aim of this review is to describe the application of lasers, the advantages and disadvantages of different wavelength lasers used for oral soft tissue biopsies.

## Key Words

Lasers, Oral Soft Tissue Biopsy

## Introduction

LASER is an acronym for light amplification by stimulated emission of radiation. It is an electro-optical device which upon stimulation, can convert jumbles of light waves into an intense, concentrated, uniform, narrow beam of monochromatic light with an energy source of great intensity and exceptional flexibility. The radiation may be continuous or modulated or the emission may occur in short pulses. This high intensity radiation can be focused on an extremely small area, approximately one micron in diameter, because of small angle of divergence and coherency of the beam. Light photons of characteristic wavelength are produced, amplified and filtered to produce the laser beam.<sup>[1]</sup>

After the development of first laser, a ruby laser in 1960 by Theodore Maiman,<sup>[2]</sup> it became a viable intra oral surgical tool only after Patel developed in 1964 the first continuous wave carbon-dioxide (CO<sub>2</sub>) device.<sup>[3,4]</sup> In 1970, Polanyi premiered the incision of living tissue with a carbon-dioxide (CO<sub>2</sub>) laser.<sup>[4]</sup> The use of lasers in dentistry has increased over the past few decades. Since then this science has progressed in fields of endodontics, periodontics, operative dentistry and oral surgery. Because of the many advantages, lasers are indicated for wide variety of procedures. After early experiences with ruby laser,<sup>[5]</sup> dentists began to use lasers to produce other wavelengths, such as argon (Ar),<sup>[6]</sup> carbon-dioxide (CO<sub>2</sub>),<sup>[7]</sup> neodymium : yttrium-aluminum-garnet (Nd: YAG),<sup>[8]</sup> diode,<sup>[9]</sup> erbium (Er:YAG and Er, Cr: YSGG)<sup>[10,11]</sup> and potassium titanium phosphate (KTP)<sup>[12]</sup> lasers.

Lasers have been effectively used for the treatment of pathologic condition of the oral mucosa.

## Biopsy

Biopsy is a surgical procedure performed to establish a clear diagnosis of a lesion, and to confirm a suspected clinical diagnosis.

The biopsy may be incisional or excisional. Incisional biopsy is a process of removal of one or more tissue samples to establish an effective therapy based on a histological diagnosis.

Excisional biopsy is a process of complete removal of the lesion, so it is a diagnostic and therapeutic procedure.

In oral pathology, it is essential that the whole specimen be clear and readable in order to make an unequivocal histological diagnosis, especially in potentially dysplastic lesions. During the biopsy it is essential to maintain safe and readable cut margins, to allow a histological examination for possible marginal infiltrations or malignant transformation of a lesion.<sup>[13]</sup>

The peripheral cellular layers of specimens are extremely important for the evaluation of the infiltrating potential of a lesion, so any surgical device that creates thermal or mechanical damage in the tissue to be examined is not suitable for performing biopsies. Moreover, it is well known by now that a partial excision of a dysplastic lesion enhances its degree of dysplasia.<sup>[14,15]</sup> Because of these potential problems, a long debate on the feasibility of carrying out laser biopsies took place in recent years.

According to the presence of dysplasia, oral soft tissue lesions can be categorised into two groups:

- Benign or clinically non-suspicious lesions (e.g. fibroma, hemangioma, gingival hyperplasia, mucocele, nevus, etc), where laser provides optimal treatment.
- Suspected dysplastic or malignant neoplastic lesions (e.g., leukoplakia, lichen planus, cancer, melanoma, etc.), where it is necessary to enlarge the surgical incision, at least 0.5 mm in circumference, in order to make a histological diagnosis free from doubt or uncertainty.<sup>[13]</sup>

Several benign oral lesions were treated with Diode GaAsAl, Nd:YAG and KTP lasers (Fig:4,5). Although these lasers have unusual characteristics and wavelengths, they are all absorbed by hemoglobin and oxy-hemoglobin and are very useful.

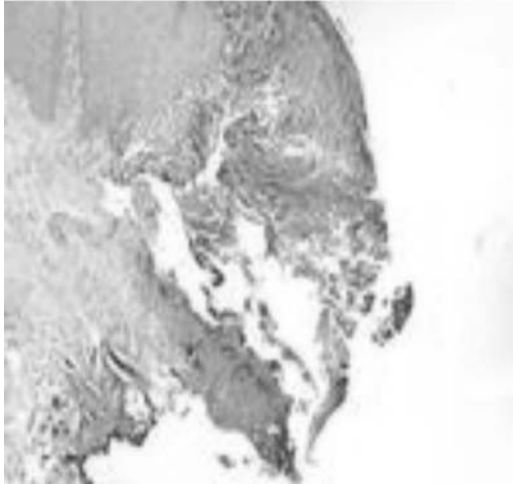
Fig. 1: Denture induced gingival hyperplasia



Fig. 2: Excised area showing almost complete healing



**Fig. 3:** 40x (H&E) Photomicrograph showing fibrous hyperplasia



**Fig. 4:** Fibroma of the cheek



**Fig. 5:** Excised area showing almost complete healing



#### The surgical protocol consists of following steps

- Anamnesic session to find and eliminate possible focuses of infection (surgical, restorative and endodontic therapy).
- Periodontal session (oral hygiene) about 10 days before surgery.
- Routine blood investigation.
- An x-ray examination, if required.

- A local infiltrative perilesional anesthesia is used without adrenaline to assure a good blood supply to the surgical area for correct energy absorption.
- Lesion is immobilized with a suture or by an anatomical Ellis forceps, without closing the blood supply, in order to preserve the tissue architecture.
- Lesion is removed by laser.
- Various lasers like Carbon-dioxide (CO<sub>2</sub>), Diode, Nd: YAG, KTP can be used in continuous wave or pulsed wave to carry out biopsy safely.
- Washing of surgical area with sterile physiological saline solution and topical application of 0.2% Chlorhexidine gel or spray.
- To allow an uneventful healing 0.2% Chlorhexidine spray is prescribed.

The sample of the lesional tissue is stored in 10% formalin and sent for histological examination.

#### Discussion

Initially Carbon-dioxide (CO<sub>2</sub>) laser was used as an alternative to conventional procedures (Fig: 1, 2 & 3). But the use of this laser has shown some limitation. Local discomfort and pain were the most common complaints. Sometimes trismus, numbness and early signs of infection were observed after surgery.<sup>[16]</sup> Carbonisation and charring were untoward effects of continuous wave of Carbon-dioxide (CO<sub>2</sub>) laser. Charring occurs when the tissue absorbs heat faster than it can release it via conduction or circulation.<sup>[17]</sup> Post operative bleeding has been reported in some studies.<sup>[18]</sup>

In order to overcome these limitations, lasers like Diode; Nd: YAG and KTP are being used successfully.<sup>[13]</sup> They provide a haemostatic effect. There is formation of denatured clot acting as a haemostatic wound dressing and barrier against possible secondary infection, particularly in the management of patients with infectious diseases (HIV; HBC; HCV).

There is reduction in the use of sutures, as healing is good by secondary intention and low propensity for postoperative scarring particularly in cases of denture-induced fibrous hyperplasia and also in critical anatomic site like soft palate.

It is a relatively easy and rapid operation as it gives sterilisation effect, need for anesthesia is reduced and an almost complete absence of postoperative pain and swelling which always present with conventional techniques.<sup>[19]</sup>

#### Conclusion

Laser has a wide range of indications encompassing simple cases like fibroma, where it can be employed without anesthesia and more complex situations like hemangiomas, where the superior haemostatic capabilities make it an indispensable element, especially in locations with extensive vascularisation (gums, tongue, cheeks) and in patients with hemorrhagic diathesis. In addition, a laser should not be applied on lesions with doubtful clinical diagnosis, because a correct and an accurate bioptic examination is partly compromised, since borderlines are usually altered by thermo coagulation process.

In cases with suspected dysplasia or malignancy it is imperative to enlarge the surgical incision in circumference to make a histological diagnosis free from doubt or uncertainty.

It should be recognised that despite being a simple procedure, the technique requires a particular set of skills to be mastered. If not used properly it can cause thermal damage to the tissue.

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# Analysis of Fatal Road Traffic Accidents in Nagpur (Maharashtra)

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## Abstract

A two year retrospective study has been carried out in the Department of Forensic Medicine and Toxicology, Indira Gandhi Government Medical College, Nagpur. Total 460 cases of road traffic accident fatalities were observed, accounted for the 22.24 % of the total unnatural death autopsies. Maximum numbers of road traffic victims were males (87.61 %) and maximum fatalities in the age group of 20–39 (55.43 %) with a clear male dominance in all age groups. Pedestrians were victimized in most of the cases (43.91 %). Most of the victims died on the spot at the accidental site in 60 % cases and that of 84.58 % victims died within the 24 hours following the accident. Most of the deaths were caused by injuries to the vital organs (49.13 %), followed by head injury, hemorrhage & shock in 37.17 % and 10.65 % cases respectively.

## Key Words

Road traffic accident, Injury, Autopsy, RTA

## Introduction

Accident is an event, occurring suddenly, unexpectedly and inadvertently under unforeseen circumstances. Amongst all traffic accidents, road traffic accidents claim largest toll of human life and tend to be the most serious problem world over. Worldwide, people killed in road traffic accident (RTA) each year is estimated at almost 1.2 million, while the number of injured could be as high as 50 million [1]. Nearly three quarter of deaths occurs in developing country [2] and the incidences are on the rise.

India is undergoing major economic and demographic transition coupled with increasing urbanization and motorization. Among the top ten causes of mortality in the country, RTA was the tenth cause two decades back, but with the increasing urban expanse and lifestyle changes, it is projected that RTA will occupy the fifth position in the list of major killers and third position among causes of disease burden in 2020. According to latest report of National Crime Records Bureau, the total annual death due to road traffic accidents has crossed 1.18 lakh [3]. In India rate of RTA is 7.5 accidents per 1000 vehicles [4].

The causation of road traffic accidents remains multi-factorial. Some of the factors that increases the risk in India are poor road infrastructure, encroachments on road, lack of safety engineering measures, heavy traffic and an increasing number of motorized vehicles, unsafe driving behavior, unsafe traffic environment and lack of knowledge regarding traffic rules.

In spite of recent advancement of technology and medical sciences, death and deformities following road-traffic accident is yet to be controlled successfully. Lives lost in the productive age group, money spent on hospitalization and rehabilitation remains a burden on any economy and yet we seem to be unable to stop this very stoppable mortality and morbidity. So the present study is smallest attempt to analyse the magnitude of problem of road traffic fatalities in the central part of India.

## Material and Methods

The present retrospective study of total 460 cases of road traffic accidents (RTA) has been carried out in the Department of Forensic

Medicine and Toxicology, Indira Gandhi Government Medical College, Nagpur for a period of two years from January 2001 to December 2002. The data is collected from police papers (Requisition and inquest panchnama), relevant history, hospital and postmortem examination reports. The study includes all those fatal cases which are due to direct involvement of any kind of the moving vehicle on road and excludes those cases where death occurs without involvement of a vehicle or caused due to stationary vehicle.

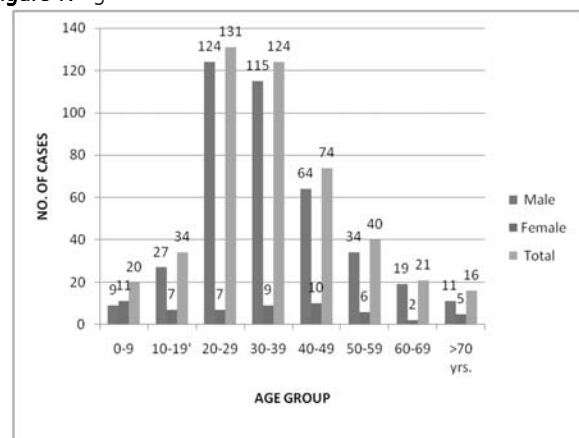
## Observations

Out of total 2888 medicolegal autopsies, 2068 cases were due to unnatural deaths, of which 460 fatal cases of road traffic accidents (RTA) were observed.

**Table 1.** Distribution of fatal road traffic accident.

YEAR	2001	2002	Total
No. of fatal RTA	234	226	460

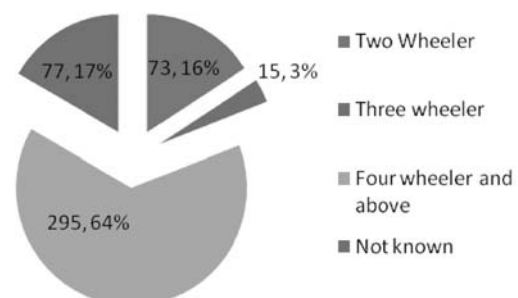
**Figure 1:** Age and sex wise distribution of road traffic fatalities



**Table 2.** Type of victims in road traffic accident.

Victims	Number of fatal cases	%
Pedestrian	202	43.91
Drivers	92	20.00
Occupant	166	36.09
Total	460	100

**Figure 2:** Fatal cases and type of vehicles involved in RTA





**Table 3.** Site of incidence of road traffic accidents.

Area	No. of fatal cases	%
Urban	246	53.47
Rural	214	46.53
Total	460	100

**Table 4.** Road traffic accident victims brought from

Victims	No. of fatal cases	%
Spot	276	60
Ward/ casualty	184	40
Total	460	

**Table 5.** Period of survival of road traffic accident victims.

Period of survival	No of victim survived for the period	Total No of fatal cases (%)
1- 24 hrs	113	389 (84.57)
2-3 days	46	435 (94.56)
> 3 days	25	460 (100)

**Table 6.** Cause of death in road traffic accidents.

Cause of Death	No. of fatal cases	Percentage
Injuries to the Vital organs	226	49.13
Head injury alone	171	37.17
Hemorrhage and shock	49	10.65
Septicemia	14	3.05
Total	460	100

## Discussion

Road Traffic accident is defined as "An accident, which took place on the road between two or more objects, one of which must be any kind of moving vehicle."

Total 460 cases of RTA victims were analyzed during the studied period, accounted for 15.93 % of the total medicolegal autopsies (n=2888), and 22.24 % of the unnatural deaths (n=2068). Findings are fairly consistent with [5-8] and absolutely consistent with Satyasi P, Shaikh K, Mohanty NK [9] but it differs with the Sharma BR and others [10] who reported road traffic accident accounted for 48.92 % of total deaths (1096/2240).

Maximum numbers of road traffic victims were males, 403 cases (87.61 %) compared to females, 57 cases (12.39 %); with male: female ratio 7.07:1. This is consistent with the observation of others [6, 7, 9, 11-18]. The reasons for male preponderance are the social structure of the Indian society that most of the outside work usually carried out by the male while a woman usually stays indoor, male preponderance in driving the vehicles actively or passively, The maximum deaths were noted in age group 20-29 (131) and 30-39 (124) means age group 20-39 years sharing 55.43 % of all RTA with a clear male dominance. The increase fatalities in this age group are due to the maximum participation in social and cultural activities, earning age as well as more travelling. In females, maximum deaths were between age group 30-49 (19 cases) i.e. 33.34% of total female victims. In this age group, females are more active in social gatherings and hence expose more to transportation. No traffic senses, playing on the roads are the commonest reason for deaths in children. Our findings are corroborating with others [6-9, 11- 23].

Pedestrians were the commonest group of victims, 202 cases (43.91 %); followed by occupants in 166 cases (36.08%) then the drivers of vehicles, 92 cases (20 %). Because large number of pedestrian shares the roadways with fast-moving and slow-moving vehicles and no segregation of pedestrian from wheeled traffic; also the widespread disregard to the traffic rules by the pedestrians themselves result in accidents. Drivers gets victimized due to defective roads, poor street lighting, low driving standards, physical and mental tiredness, vision problem, night blindness, fatigue, faulty judgment capacity due to consumption of alcohol resulting for reckless driving accounting to death. Similar findings were observed in most studies [6- 8, 10, 14-16,

19-25].

In fatal RTA; four wheelers were involved in majority of cases, 295 cases (64.14 %); followed by unknown vehicle and two wheelers in 16.73 % and 15.86 % cases respectively. Reason behind that Nagpur is situated in the center of India and many national highways passes, hence, most of the domestic as well as the commercial transportation took place through the city by the buses, minibuses, jeep, trucks, lorries, matador etc. accounting for the majority of RTA. It was followed by unknown vehicle in 77 cases (16.73 %) due to habit of hit and run by the vehicular drivers. Two-wheelers involved in the 73 cases (15.86 %) because majority of people makes their domestic transport by the two wheeler which is having less safety measures and the peoples not following the traffic rules. These findings are vary with some observers (15, 16, 17) but it is consistence with the majority of studies [7, 10, 11, 14, 18, 20-23, 25].

The incidences of RTA were higher in the urban population as compared to rural. There were 246 cases (53.47%) from urban areas while 214 (46.53 %) cases from rural area. Many people are visiting Nagpur city for various purposes such as education, employment, business, medical treatment, sightseeing, attending religious and social functions, legislative assembly etc, hence increases the burden on traffic resulting into more accidents. Increase in vehicles and road users with mixed nature of traffic, inadequate infrastructure and road space, inadequate width of pedestrian sidewalks and their use by hawkers, lack of road sense, encroachment of the road for business and other purposes all these factors are specially occur in the urban areas leading to higher incidences. This is consistence with the observation of Mackay GM [24] and Singh YN, Bairagi K, Das KC [7].

In the study, 84.57 % victims of RTA cases died within 24 hours, 94.56 % cases died within 2-3 days. 60 % RTA victims died on the spot because majority of victims got severe injuries to the vital parts of the body resulting in immediate deaths. Similar findings are noted by others [6, 10, 14, 20, 23, 25].

Injuries to vital organs were the leading cause of death (49.13 %) in fatal RTA cases. Head injury alone comprised 171 cases (37.17 %). Involvement of head injury was seen in majority of fatal cases either alone or in combination with other vital organs. Such findings are observed by most of the observant. Since the cranial cavity contains the brain with its all vital centers for the life, trauma to this region challenges the integrity and viability of the individual. Because of its size and anatomical position, it is a major site of trauma in road accidents. Other causes for the fatalities are hemorrhage and shock in 10.65 % and septicemia in 3.05 % cases due to the infected wounds resulting into death of the person.

## Conclusions and Recommendations

Road traffic accident is the third major cause of all deaths and is a growing menace, causing heavy loss of valuable man-power and human resources. Most incidences are caused by human errors and are therefore preventable. There is a need for road safety education and it should be directed towards all the road users. Some recommendations are listed below to bring down the incidences

1. Education to the general public, beginning from the school level regarding traffic rules, safety precautions and risk factors.
2. Proper maintenance of vehicles and safe driving. Improvement in the roads, street lights and various signs should be displayed at proper places.
3. Enforcement of laws strictly to driving tests, license, medical fitness for driving, maintaining the speed limits, wearing of crash helmets and seat belts, regular inspection of vehicles.
4. Prompt and adequate ambulance service should be provided to the victims with the help of government and other voluntary agencies.
5. Set up of proper national reporting system of road traffic accidents so that an overall picture can be drawn for proper traffic management planning.

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# Fatal Childhood Injuries in Shimla Hills

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## Abstract

Childhood injuries has been a neglected issue so far even though injury and violence are a major killer of children throughout the world. Due to paucity of data on child hood injuries from our country it becomes difficult to establish a baseline of such injuries so that preventive interventions can be instituted at the right time and the right place. Availability of such data can therefore significantly play an important in reducing mortality and morbidity of children due to fatal and non fatal childhood injuries,

## Key Words

Fatal childhood injuries, homicidal injuries, violence.

## Introduction

Child injuries are a major public health issue. Injury and violence is a major killer of children throughout the world. Unintentional injuries account for almost 90% of these injuries and they are among the top three causes of death among children aged 5-19 years. According to WHO UNICEF 2004 Report-RTA accounts for-720death/day, drowning -480death/ day, burns -260death/day, falls -130 death/day and poisoning-125 death/day amongst children<sup>1</sup>.

Globally, around 950 000 children under the age of 18 years die due to injury and violence each year<sup>2</sup>. Injury is a major cause of death in children over one year of age in the South-East Asia (SEA) Region. In 2004, the Region had the second highest rate of unintentional child injuries (49/100 000 children per year) globally, following the African Region. In the South-East Asia Region, road traffic injuries, drowning, burns and self-inflicted injuries are the leading causes of death among children<sup>3</sup>.

Injuries disproportionately affect the poor. About 95% of all global child deaths from injury occur in low- and middle-income countries. Children over one year are most vulnerable to injuries. In general, boys are far more likely to get injured than girls.

However, burns are the only type of fatal injury that occur more frequently among girls than boys in South-East Asia and in low- and middle-income countries in the Eastern Mediterranean and Western Pacific Regions.

In India, injuries are the second leading cause of death in 5-14 year-old children and fourth leading cause of death in children under 15 years old<sup>4</sup>.

## Aims and objectives

- To ascertain the various aspects of unnatural deaths,
- To find remedial measures to bring down the incidence

## Material and Methods

The present retrospective observational study was carried out in the Department of Forensic Medicine, IGMSC Shimla. Records of all the autopsies conducted in the Department of Forensic Medicine from the months of June to December during the years 2000 & 2008 were procured and closely scrutinised. Records of autopsies conducted on children aged 0-18 years during these 2 years were segregated and the detailed data of these cases was collected and analysed. The results

obtained there of for these two years were then compared and tabulated.

## Observations

In the year 2000 out of total 197 autopsies conducted in the Department of Forensic Medicine from the months of June to December 13(6.59%) were cases of fatal childhood injuries. In the year

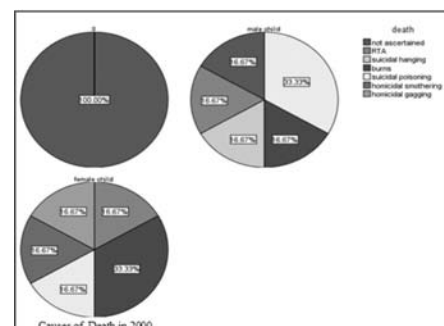
sex	Mean age in years	Total no.	S.D
Male child	12.17	6	8.28
Female child	8.17	6	7.25
total	9.38	13	7.90

### Age Distribution of cases in Year2008

sex	Mean age in years	Total no.	S.D
Male child	4.62	13	4.68
Female child	6.14	7	6.23
total	5.15	20	5.16

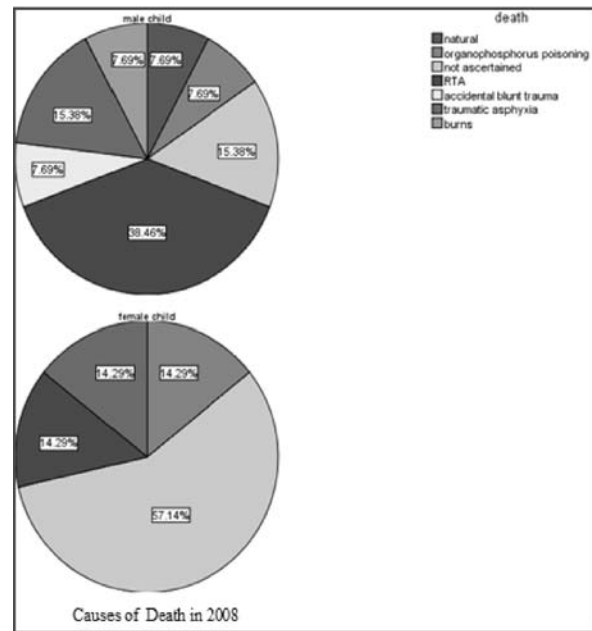
### Causes of death in cases in year2000

	death	N	% of Total N
0	not ascertained	1	7.7%
	Total	1	7.7%
male child	not ascertained	1	7.7%
	RTA	1	7.7%
	suicidal hanging	1	7.7%
	burns	1	7.7%
	suicidal poisoning	2	15.4%
	Total	6	46.2%
female child	RTA	1	7.7%
	burns	2	15.4%
	suicidal poisoning	1	7.7%
	homicidal smothering	1	7.7%
	homicidal gagging	1	7.7%
	Total	6	46.2%
Total	not ascertained	2	15.4%
	RTA	2	15.4%
	suicidal hanging	1	7.7%
	burns	3	23.1%
	suicidal poisoning	3	23.1%
	homicidal smothering	1	7.7%
	homicidal gagging	1	7.7%
Total	13	100.0%	



Causes of death in children in year 2008

	death	N	% of Total N
male child	natural	1	5.0%
	organophosphorus poisoning	1	5.0%
	not ascertained	2	10.0%
	RTA	5	25.0%
	accidental blunt trauma	1	5.0%
	traumatic asphyxia	2	10.0%
	burns	1	5.0%
	Total	13	65.0%
female child	organophosphorus poisoning	1	5.0%
	not ascertained	4	20.0%
	RTA	1	5.0%
	traumatic asphyxia	1	5.0%
	Total	7	35.0%
Total	natural	1	5.0%
	organophosphorus poisoning	2	10.0%
	not ascertained	6	30.0%
	RTA	6	30.0%
	accidental blunt trauma	1	5.0%
	traumatic asphyxia	3	15.0%
	burns	1	5.0%
	Total	20	100.0%



2008 out of total 211 autopsies conducted in the Department of Forensic Medicine from the months of June to December 20(9.5%) were cases of fatal childhood injuries.

### Approaches

There is a need for multisectoral and multipronged approaches to prevent child injuries. High-income countries have been able to reduce child injury deaths by up to 50% over the past three decades<sup>5</sup>. The following approaches are recommended to prevent such casualties

1. There is a need for focusing on strict legislation, regulation and enforcement.
2. There should be a provision for supportive home visits.
3. There is a dire need of modification of the environment.
4. We should ensure promotion of the use of safety devices such as safety belts and helmets along with product modification, especially standardizing helmets.
5. Develop strategies for education, life skills development and behavioral change.
6. Community-based projects for further research on this topic.
7. We have to ensure pre-hospital care, acute trauma care and rehabilitation that reach rural communities.
8. Further research is required to examine the epidemiology of injuries, effectiveness and cost-effective interventions.

### Conclusions

Research on child injuries is too limited. Most countries around the world have limited human resources to prevent the epidemic of

child injuries and provide care and rehabilitation services for those injured. This problem is particularly acute in low-income countries where the burden of child injury is the greatest. Reductions in child injury mortality have been achieved in some countries as a result of the application of evidence-based programmes based on rigorous research and priority-setting. Research into the whole spectrum of child injuries – from primary prevention through to rehabilitation – needs much higher levels of funding. Such research will not only benefit developing countries enormously, but has the potential to uncover solutions not yet found in high-income countries.

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# Stem Cells in Dentistry-A Revolution in Regeneration

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## Introduction

Stem cells are primitive, unspecialized cells that can regenerate themselves and give birth to specialized cells with the unique ability to differentiate into a variety of cells. When a stem cell divides, each new cell has the potential to either remain a stem cell or become another type of cell with a more specialized function - such as a muscle cell, a red blood cell or a nerve cell. In present day scenario stem cells have proven to be the mainstay of regenerative medicine and there is a great interest in developing techniques for manipulating stem cells in order to introduce restorative treatments to tissues and organs. For bioengineering to be effective, it is necessary the presence of three factors: the stem cells themselves, an extracellular matrix and growth factors<sup>1</sup>. Recently dental tissues such as periodontal ligament, dental papilla and dental follicles have been identified as easily accessible sources of undifferentiated cells. This study is aimed to conduct a literature review of current trends in stem cell research in dentistry, and discuss the factors involved for the successful practical use of these cells and their role in combating diseases.

## History

The term stem cell was proposed for scientific use by Russian histologist Alexander Maksimov in 1908. While research on stem cells grew out of findings by Canadian scientists in the 1960s<sup>2,3</sup>. In general there are two broad types of stem cells which are: Embryonic stem cells, and Adult stem cells. Embryonic stem cells were harvested from embryos, they are cells derived from the inner cell mass of the blastocyst (early stage embryo, 4-5 days old, consist of 50-150 cells) of earlier morula stage embryo.<sup>4</sup> In other words these are the cells that form the three germ layers, and are capable of developing more than 200 cell types. In 1998 the first human embryonic stem cell line was derived at university of Wisconsin-Madison.<sup>5</sup>

The history of stem cell research had a benign, embryonic beginning in the mid 1800's with the discovery that some cells could generate other cells. In the early 1900's real stem cells were discovered and it was found that some cells generate blood cells. The history of stem cell research includes work with both animal and human stem cells. Stem cells can be classified into three broad categories, based on their ability to differentiate. Totipotent stem cells are found only in early embryos. Each cell can form a complete organism (e.g., identical twins). Pluripotent stem cells exist in the undifferentiated inner cell mass of the blastocyst and can form any of the over 200 different cell types found in the body. Multipotent stem cells are derived from fetal tissue, cord blood, and adult stem cells. Although their ability to differentiate is more limited than pluripotent stem cells, they already have a track record of success in cell-based therapies. A prominent application of stem cell research has been bone marrow transplants using adult stem cells. In the early 1900's physicians administered bone marrow by mouth to patients with anemia and leukemia. Although such therapy was unsuccessful, laboratory experiments eventually demonstrated that mice with defective marrow could be restored to health with infusions into the blood stream of marrow taken from other mice. This caused physicians to speculate whether it was feasible to transplant bone marrow from one human to another (allogenic transplant). Among early attempts to do this were several transplants carried out in France following a radiation accident in the late 1950's. Performing

marrow transplants in humans was not attempted on a larger scale until a French medical researcher made a critical medical discovery about the human immune system. In 1958 Jean Dausset identified the first of many human histocompatibility antigens. These proteins, found on the surface of most cells in the body, are called human leukocyte antigens, or HLA antigens. These HLA antigens give the body's immune system the ability to determine what belongs in the body and what does not belong. Whenever the body does not recognize the series of antigens on the cell walls, it creates antibodies and other substances to destroy the cell.

It was not until the 1960's that physicians knew enough about HLA compatibility to perform transplants between siblings who were not identical twins. The 1990's saw rapid expansion and success of the bone marrow program with more than 16,000 transplants to date for the treatment of immunodeficiencies and leukemia. Adult stem cells also have shown great promise in other areas. These cells have shown the potential to form many different kinds of cell types and tissues, including functional hepatocyte-like (liver) cells. Such cells might be useful in repairing organs ravaged by diseases. In 1998, James Thompson (University of Wisconsin - Madison) isolated cells from the inner cell mass of early embryos, and developed the first embryonic stem cell lines. In the same year, John Gearhart (Johns Hopkins University) derived germ cells from cells in fetal gonadal tissue (primordial germ cells). Pluripotent stem cell "lines" were developed from both sources. Ongoing researches are now focused on transplanting stem cells of non-self origin.

Stem cell therapy is a procedure by which damaged, diseased, or malfunctioning cells anywhere in the body are replaced by introducing healthy stem cells to that area of the body. Stem cell therapy is a promising treatment for all kinds of degenerative diseases because of the stem cells' regenerative abilities. Thereby offering the possibility of a renewable source of replacement cells and tissues - to treat diseases such as Parkinson's & Alzheimer's diseases, spinal cord injury, stroke, burns, heart disease, diabetes, osteoarthritis and rheumatoid arthritis. One of the major advantages one gets from harvesting stem cells from his own body and then using them later in his tissue regeneration if he has an illness is that there will be no refusal of these cells as they are autogenous body parts.

## Stem Cells in Human Body

Bone Marrow was the earliest source of stem cells due to its rich supply of somatic stem cells with main function of differentiating into blood cells. The other rich source of stem cells is the blood left over in the umbilical cord and placenta of a newborn child. Till recently, this blood was (and continues to be) often discarded as medical waste. However, umbilical cord blood is known to be a rich source of stem cells thus more parents are choosing to bank these cells for its potential future use. Exciting new research on a new type of stem cell called "mesenchymal stem cell" has now enhanced the scope of diseases that can potentially be treated with stem cell therapy<sup>6</sup>. Embryonic (Or Fetal) Germ Cells (EGCS) are pluripotent stem cells derived from primordial germ cells, which give rise to the gametes (sperm & eggs) in adults. They are found in a 5 to 9 week old embryo/fetus in the area that is destined to become either the testicles or the ovaries. Deriving stem cells through this process is controversial since the embryo or the fetuses from which the germ cells are obtained are destroyed. The

embryo or the fetuses, even though not fully formed, are considered 'human' in many cultures and hence their destruction leads to ethical dilemmas. Menstrual fluid contains self-renewing stem cells. A woman's menstrual blood includes tissue shed from the endometrial lining of the uterus which potentially contains hundreds of millions of rich and abundant stem cells which could possibly serve as a source for a wide range of regenerative therapies. These menstrual stem cells are unique because they have many properties and characteristics similar to both bone marrow and embryonic stem cells; they multiply rapidly and can differentiate into many other types of stem cells such as neural, cardiac, bone, fat, cartilage and possibly others; demonstrating great promise for future use in clinical regenerative medical therapies<sup>7</sup>. Stem cells, in limited quantities, can also be found in the peripheral blood circulation. Peripheral blood stem cells are easier to obtain than bone marrow as they can be drawn from blood. Some studies have shown that these stem cells engraft faster than bone marrow stem cells.<sup>6,7</sup>

## Stem Cells in Dentistry

There are two major categories of stem cells, which are discussed for dentistry: (1) Embryonic stem cells; (2) Somatic or adult stem cells. Isolation and use of human embryonic stem cells is ethically controversial. Somatic stem cells have a limitation in their potentials of differentiation. However, somatic or adult stem cells are a better option for dentistry, as these cells are easily accessible, and their use does not bring up ethical concerns. Embryonic (Or Fetal) Germ Cells (EGCs) are pluripotent stem cells derived from primordial germ cells, which give rise to the gametes (sperm & eggs) in adults. They are found in a 5 to 9 week old embryo/fetus in the area that is destined to become either the testicles or the ovaries. Deriving stem cells through this process is controversial since the embryo or the fetuses from which the germ cells are obtained are destroyed. The main differentiation potential of dental stem cells lies within the formation of dentin or periodontium-associated tissues, whether these cells are derived from pulp, PDL or dental follicle. It is obvious that dental ectomesenchymal stem cells can be classified in two different groups with respect to their major differentiation potential. The first group is associated with the dental pulp, consisting of DPSCs, SHEDs and SCAPs; the second group contains PDL stem cells and dental follicle progenitor cells and is related to the periodontium. Periodontal ligament stem cells (PDLSCs) and dental follicle progenitor cells (DFPCs) are post-natal populations having mesenchymal stem cell-like (MSC) qualities, including the capacity for self-renewal and multilineage differentiation potential. MSCs derived from bone marrow (BMMSCs) are capable of giving rise to various lineages of cells, such as osteogenic, chondrogenic, adipogenic, myogenic, and neurogenic cells. The dental-tissue-derived stem cells are isolated from specialized tissue with potent capacities to differentiate into odontogenic cells. Among stem cells of mesenchymal origin, BMMSCs or BM-derived stromal stem cells (BMSSCs) are the most studied stromal stem cell populations (Caplan, 1991; Prockop, 1997; Pittenger *et al.*, 1999).<sup>8</sup>

## Dental MSCs

Dental tissues are specialized tissues that do not undergo continuous remodeling as shown in bony tissue therefore, dental-tissue derived stem/progenitor cells may be more committed or restricted in their differentiation potency in comparison with BMMSCs. Additionally, dental mesenchyme is termed 'ectomesenchyme' due to its earlier interaction with the neural crest. From this perspective, ectomesenchyme-derived dental stem cells may possess different characteristics akin to those of neural crest cells.<sup>5,6</sup>

## Dental Pulp Stem Cells (DPSCs)

One important feature of pulp cells is their odontoblastic differentiation potential. Human pulp cells can be induced *in vitro* to differentiate into cells of odontoblastic phenotype, characterized by polarized cell bodies and accumulation of mineralized nodules

(Tsukamoto *et al.*, 1992; About *et al.*, 2000; Couble *et al.*, 2000). In addition to their dentinogenic potential, subpopulations of hDPSCs also possess adipogenic and neurogenic differentiation capacities by exhibiting adipocyte- and neuronal-like cell morphologies and expressing respective gene markers (Gronthos *et al.*, 2002). More recently, DPSCs were also found to undergo osteogenic, chondrogenic and myogenic differentiation *in vitro* (Laino *et al.*, 2005; Zhang *et al.*, 2006; d'Aquino *et al.*, 2007).<sup>9,10,11,12</sup> A further class of dental ectomesenchymal stem cells is PDL stem cells, which were isolated from the root surface of extracted teeth, but display a low potential for osteogenic differentiation under *in vitro* conditions. The human dental follicle is a tissue of the tooth germ, which can easily be isolated after wisdom tooth extraction. Likewise, bovine dental follicles, cells of the human dental sac develop into the mature periodontium consisting of alveolar bone, the PDL and cementum. The dental follicle contains ectomesenchymal cells which are derived from the neural crest. DFPCs, like BMMSCs, are plastic adherent and colony forming cells, and they can differentiate into osteoblast like cells under *in vitro* conditions. Similar to PDL stem cells, DFPCs can also differentiate, form robust connective tissues and produce clusters of mineralized tissue.<sup>13</sup>

Furthermore, ectomesenchymal stem cells of human exfoliated deciduous teeth (SHEDs) were isolated from the dental pulp of exfoliated incisors<sup>14</sup>. These cells could be cultivated either as fibroblast-like, adherent cells, or like neural stem cells as neurospheres. SHEDs are capable of differentiation into odontoblast, adipocytes and neural cells. They induced bone formation and produced dentin under *in vivo* conditions; and they were able to survive and migrate in murine brain after transplantation into immunocompromised animals<sup>14</sup>.

## Application of Stem Cells in Successfully Treating Diseases

Scientists have been able to do experiments with human embryonic stem cells (hESC) only since 1998, when a group led by Dr. James Thomson at the University of Wisconsin developed a technique to isolate and grow the cells. Although hESCs are thought to offer potential cures and therapies for many devastating diseases, research using them is still in its early stages. Since then, biotechnology companies have built upon those basic foundations to begin developing stem cell-based human therapies. In July 2010, the FDA notified the biotechnology company Geron that could begin enrolling patients in the first clinical trial of a hESC-derived therapy. This trial has been designed to test the safety of using hESCs to achieve restoration of spinal cord function: oligodendrocyte progenitor cells derived from hESCs will be injected directly into the lesion site of the patient's injured spinal cord.<sup>10,15,16</sup>

## Future Scope and Perspectives

There will be continuous advancement in stem cell research and dental cells applied to clinical therapies. Stem cells are being applied to dental implants and they have shown ligamentous attachment between implant surface and bone. Regeneration or regrowing pulp tissue is all set to reform the specialty of endodontics within next five years. Dental stem cells and other stem cells from craniofacial origin develop from material that is created during development of nervous system. These stem cells can therefore help in regeneration of cells of orofacial origin. Mesenchymal stem cells, found in dental pulp these cells have been helpful in treating diseases such as Parkinson's disease, heart disease, diabetes, management of spinal cord and brain injuries, cranial bone repair and root formation. The research is relatively new therefore it is yet not been proven that stem cells can be used for other people different from donors; however in future with further research and review these cells can be matched without the risk of rejection.<sup>17,18</sup>

## Conclusion

Dental schools should consider the addition of stem cells and tissue engineering courses to the existing curriculum. Several textbooks

are now available in the area of stem cells, tissue engineering and regenerative medicine (e.g. Mao et al, 2007) along with a number of articles in literature. Without these and similar measures, dental students, postgraduate students and dental practitioners are likely to be ill-prepared for the upcoming era of stem cell based technologies. Stem cell therapy promises to treat diseases such as Parkinson's & Alzheimer's diseases, spinal cord injury, stroke, burns, heart disease, diabetes, osteoarthritis and rheumatoid arthritis. In dental application regeneration of dental pulp is right around the corner. Very soon periodontal ligament repair and regeneration will be possible preventing loss of tooth. Stem cell therapy will also aid in implant treatment for bone defects or compromised residual ridges. Dentistry is about to change with the possible implications of stem cell therapy.

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# A study of Determination of Personal Height from Foot Dimensions

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## Abstract

This study was carried out to estimate the relationship between foot dimensions and stature using simple linear regression analysis based on a sample of male and female of Kolhapur district. Measurements of the foot length, foot breadth and stature were taken from 1200 subjects (600 male, 600 female). Obtained data was analysed and attempt was made to find out correlation between the foot dimensions and stature of an individual. A good correlation of height was observed with foot dimensions and it was statistically significant. The results of the present study would be useful for anthropologists and forensic medicine experts.

## Key Words

Stature, foot length, foot breadth

## Introduction

Stature of an individual came into discussion when primitive mammal changed its posture from pronograde to orthograde.

The study of human evolution, racial differences, inheritance of body traits, growth and decay of human organism is called physical anthropology. These informations are of interest to an anatomist and also helpful in medico-legal works. The foot has been extensively studied to provide valuable information about an individual when an individual foot is recovered and brought for forensic examination. The problem is encountered in cases of mass disasters, explosions, and assault cases where the body is dismembered to conceal the identity of the victim. Stature has been estimated from foot prints, and various measurements of the foot such as foot length and foot breadth<sup>1,2,3,4,5,6,7,8,9,10,11</sup>, based on the statistical equations and formulae.

Morphology of human feet is influenced by combined effects of heredity and life style. Telkka (1950)<sup>12</sup> opined that each racial group will need a different formula, and regional studies of the subjects are very much needed.

The purpose of the present study is to analyze the anthropometric relationship between dimensions of the foot with stature and to devise regression formulae to estimate height from foot length and foot breadth of known sex from residents of Kolhapur district as it is essential to build a context of reference for a given population.

## Methodology

Present study has been carried out on 1200 residents of Kolhapur district (600 male; 600 female) aged between 12 to 30 yrs for males and 11 to 30 yrs for females. All the subjects were healthy and free from any apparent symptomatic deformity of foot and spine. They will be divided into 3 groups.

Prepubescent:

11-12 yr (female)

12-14 yr (male)

Pubescent:

12-14 yr (female)

14-16 yr (male)

Post pubescent:

Above 14 yr for female

Above 16 yr for male

## Measurement Technique

- Stature:** is measured as the vertical distance between the vertex and the floor. The subject was made to stand bare foot in an erect posture against a wall with both feet kept close together, buttocks & occiput touching the wall and hands hanging down on the sides.
- Foot length:** is the distance between the most backward and prominent part of the heel (pternion) and the most distal part of the longest toe of the foot (acropodian). The foot length of each individual was measured with a sliding caliper.
- Foot breadth:** is the distance between the most prominent point on inner side of the foot and the most prominent point on the outer side of foot. Obtained data was analysed by linear regression analysis and results were tabulated.

## Results

**Table 1.** Mean of height and foot dimensions in all age groups

Group	Mean height (cm.)		Mean foot dimension (cm.)	
	Male	Female	male	Female
Pre pubescent	149.7	148.83	23.35(R.F.L.)	22.35 (R.F.L.)
			23.25(L.F.L.)	22.20(L.F.L.)
			8.95(R.F.B.)	8.67(R.F.B.)
			8.93(L.F.B.)	8.64(L.F.B.)
Pubescent	161.9	154.49	24.78(R.F.L.)	23.51(R.F.L.)
			24.64(L.F.L.)	23.43(L.F.L.)
			9.48(R.F.B.)	8.9(R.F.B.)
			9.45(L.F.B.)	8.84(L.F.B.)
Post pubescent	172.4	157.85	25.47(R.F.L.)	23.52(R.F.L.)
			25.39 (L.F.L.)	23.44(L.F.L.)
			9.84(R.F.B.)	8.91(R.F.B.)
			9.82(L.F.B.)	8.84(L.F.B.)

R.F.L.:Right foot length, L.F.L.:Left foot length,

R.F.B.:Right foot breadth, L.F.B.:Left foot breadth

Linear regression equations for stature estimation in prepubescent male and female

	Male(n=200)		Female (n=200)	
	Equation	r	Equation	r
R.FL	=69.33+3.4(RFL)	0.6	=110.74+1.70(RFL)	0.4
L.F.L	=70.47+3.4(LFL)	0.6	=112.07+1.66(LFL)	0.4
R.FB	=102.2+5.3(RFB)	0.4	=133.79+1.73(RFB)	0.1
L.FB	=107.7+4.7(LFB)	0.3	=142.5+142.5(LFB)	0.1

r: Correlation coefficient

Linear regression equations for stature estimation in pubescent male and female

	Male(n=200)		Female (n=200)	
	Equation	r	Equation	r
R.FL	=124.9+1.5(RFL)	0.2	=124.99+1.2(RFL)	0.4
L.F.L	=125.9+1.5(LFL)	0.2	=123.03+1.3(LFL)	0.4
R.FB	=126.5+3.7(RFB)	0.3	=149.20+0.6(RFB)	0.1
L.FB	=125.1+3.9(LFB)	0.3	=146.47+0.9(LFB)	0.1



Linear regression equations for stature estimation in post pubescent male and female

	Male (n=200)		Female (n=200)	
	Equation	r	Equation	R
<b>RFL</b>	=83.37+3.5(R.FL)	0.7	=83.9+3.14(RFL)	0.5
<b>L.FL</b>	=79.22+3.7(L.FL)	0.7	=84.65+3.1(L.FL)	0.5
<b>RFB</b>	=144+2.9(R.FB.)	0.2	=155.2+0.3(RFB)	0.1
<b>LFB</b>	=142.4+3.1(L.FB.)	0.2	=136.4+2.4(L.FB)	0.3

## Discussion

Higher values of all the studied parameters (stature and foot dimensions) in case of males in the present work are in conformity with other researchers<sup>13</sup>.

Stature is an inherent characteristic and males are constitutionally taller than females. An association of Y chromosome with stature has been documented<sup>14</sup>.

Correlation value (r) is relatively high for F.L. than for F.B. for both males and females of each age group suggesting that F.L. provides a more reliable estimate of stature than F.B.

## Conclusion

Height can be estimated from foot length and foot breadth. Stature estimation from foot breadth may not be as reliable as obtained through foot length. Our study is useful for anthropologist and medico legal person by knowing the height of a person from foot length and foot breadth in Kolhapur district.

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# A Study of Epiphyseal Union of Base of First Metacarpal Bone Radiologically for Estimation of Age

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## Abstract

Determination of age is the common problem that demands forensic expertise. Studies conducted in India and abroad by various research workers have shown that there exists no uniform pattern for epiphyseal union of bones for estimation of age. The pattern is also different in different regions of the same country. The present study was conducted to estimate age from epiphyseal union of base of first metacarpal bone radiologically.

Radiographs (PA View) of left hand including wrist joint of 120 subjects (60 boys and 60 girls) of age ranging from 15-19 years were studied among subjects in Davangere district of central Karnataka. Stevensons classification of epiphyseal union was used to study the radiographs.

The results of the study showed that the average age of fusion of base of first metacarpal bone is 15-16 years in females and 16-17 years in males. It was concluded from the study that the exact and precise age of an individual cannot be stated, but a range can be given by radiological examination. Females show early union of epiphysis by 1-3 years when compared to males. The results of present study also show appreciable variation in time of union of epiphysis when compared with the observation made by previous workers.

## Key Words

Age estimation, epiphyseal union, radiographs, wrist joint, metacarpal bone.

## Introduction

Estimation of age of a person is a common problem that demands forensic expertise and is an important criterion in the establishment of identity of an individual. In addition to identification of a person, age is an important feature in day to day legal system, in both civil as well as criminal cases.<sup>1</sup> Age estimation in civil cases is required in situations like making of will, attainment of majority, marriage, voting rights, employment etc. In criminal cases age estimation becomes important in cases of rape, kidnapping, prostitution, criminal abortion and criminal responsibility etc. The gravity of offence depends upon particular age and also certain rights are given to the persons only at certain age. Thus the estimation of age is a task of considerable importance from the view point of administration of justice.<sup>2</sup>

There are various means by which medical personnel can arrive at a fairly accurate opinion about age of a person. Of the various means, the principal means accepted globally are the eruption of teeth and progress of skeletal ossification. The most common age involved in civil and criminal cases are 16 and 18 yr. Such a study by radiological observation of the period of appearance and fusion of ossification centers of various bones is matter of great medicolegal importance.<sup>3</sup>

Adequate data for each geographical area based on sufficient research is not available at present. Hence the present study was taken up in Davangere district of central Karnataka, to estimate the age of individuals from the epiphyseal union of base of first metacarpal bone at wrist joint and prepare a data of its population. The data obtained from this study should be of great help to the medical experts, law enforcing authorities and judiciary of this region concerned with legal matters, in arriving at a fairly accurate opinion regarding the age of a person.

## Material & Methodology

The study comprised of 120 subjects from Davangere district of central Karnataka, India. Out of these 60 were boys and 60 were girls. The age group of study ranged from 15-19 years. The subjects were chosen from different schools and colleges of Davangere and also among the subjects visiting the outpatient department of Bapuji and Chigateri General Hospital, Davangere, Karnataka, India. Apparently healthy subjects, having age proof in the form of either birth certificate or school / college admission register and a domicile of Davangere district were selected for the study.

The subjects were categorized into four age groups at an interval of 12 months. Thus among the total of 120 subjects, 30 (25%) of them were selected in each of the four different age groups.

**Table 1.** Provides the age and sex wise breakdown analysis of the study population

Age group (in years)	No. of case		Total (n)
	Males	Females	
15.1 – 16	15	15	30
16.1 – 17	15	15	30
17.1 – 18	15	15	30
18.1 – 19	15	15	30
Total	60	60	120

Informed consent was taken from every individual, prior to examination in the prescribed consent form.

Radiograph of left hand including wrist joint was taken by a single exposure, which included the lower end of radius and ulna, all the carpal bones, metacarpal bones and the phalanges. Stevensons<sup>2,4,5</sup> classification of epiphyseal union was adopted as follows to interpret the radiographs of our study.

**Stage I :** No union-a clear gap or space is seen between the epiphysis and diaphysis.

**Stage II:** Beginning union-partial closure of gap or space between epiphysis and diaphysis.

**Stage III:** Recent union-the active process of bony union is over but there is retention of thin line of demarcation at the epiphyseo-diaphyseal junction.

**Stage IV:** Complete union-completion of process of union and epiphyseal space is bony in architecture.

However for our study purpose, the stage I and II was considered as not fused while stage III and IV as fused.<sup>2,3</sup>

## Observation and Results

In the present study, a total of 120 the radiographs (PA view) of left hand including wrist joint were studied and following observations were made. The age interval at which, 75% of the cases showing fusion was taken as the average age of epiphyseal union for the corresponding centre.

In case of males, 53% showed fusion of base of 1<sup>st</sup> metacarpal bone between 15-16 years of age. There is gradual increase in the number of subjects showing fusion as the age advances. Between 16-17 years of age 80% showed fusion, between 17-18 years of age 93% and between 18-19 years of age 100% of the subjects showed fusion of base of 1<sup>st</sup> metacarpal bone. Hence average age of fusion was taken as 16-17 years as 80% of them showed fusion.

In case of female subjects, 93% of them showed fusion of base of 1<sup>st</sup> metacarpal bone in the age group 15-16 years, while 100% of them showed fusion in rest of the age groups involved in the study i.e., 16-17, 17-18 and 18-19 years. Therefore average age of fusion was considered to be 15-16 years as 93% of them showed fusion.

**Table 2.** Showing fusion and non fusion of base of 1<sup>st</sup> metacarpal.

Sex	Age in years	Total No	Not fused		Fused	
			No	%	No	%
Male (n=60)	15-16	15	7	47	8	53
	16-17	15	3	20	12	80
	17-18	15	1	7	14	93
	18-19	15	-	-	15	100
Female (n=60)	15-16	15	1	7	14	93
	16-17	15	-	-	15	100
	17-18	15	-	-	15	100
	18-19	15	-	-	15	100

It was also observed from the study that the average age of fusion of base of first metacarpal bone is much earlier in females than that of males indicating, the epiphyseal union occurs much earlier in females compared to that in males

**Table 3.** Showing statistical analysis of mean age of fusion of base of first metacarpal bone between boys and girls.

	Sex	Base of 1 <sup>st</sup> metacarpal
Mean Age + SD	M	16.9 + 1.1 (n = 49)
	F	16.6 + 1.2 (n = 59)
	M/F	t = 0.90
		p > 0.05 NS

The mean age at which the females show fusion of base of 1<sup>st</sup> metacarpal is 16.6 + 1.2 years and in case of males it is 16.9 + 1.1. The t value is 0.90 and p > 0.05 indicating that there is no significant age difference in male and female with reference to fusion of base of 1<sup>st</sup> metacarpal.

## Discussion

A Forensic expert or doctor is often required to give opinion about the age of a person involved in various civil and criminal cases. The important ages with legal implications are 7, 10, 12, 14, 16, 18 and 21 years. In India, 16 years of age is significant for a girl as for as consent for sex is concerned, in alleged cases of rape. Similarly in number of cases false representation of age is made, particularly with respect to the age 18 years. In India 18 years is the age for attainment of majority. At this age the individual enjoys a number of privileges like entry into a government job, making a valid will, voting power and in case of females it is the minimum age for marriage.

Various parameters like height, weight, pubertal changes, eruption and root calcification of teeth etc have been used for estimating age before 25 years. But all these parameters are variable in both sexes, hence the study of epiphyseal union of bones is considered universally as a reasonable, scientific and accepted method for estimation of age by the court of law.<sup>6</sup>

Research workers in India and abroad have conducted the studies and recorded an appreciable variation in the time of union of epiphysis with their respective diaphysis. It was also observed by them, that the age at which epiphyseal union in bones occurs is influenced by climatic condition, hereditary, nutritional, socioeconomic factors and geographical location.<sup>7</sup> India is a vast country with diversity of afore mentioned factors, hence it is not possible to make uniform standards for the entire country.

Keeping in view all the above mentioned factors an attempt is being made in the present study to estimate the age among the

subjects in Davangere district by the fusion of epiphysis around wrist joint. In the present study, epiphyseal union of base of 1<sup>st</sup> metacarpal bone is studied and the results compared with that of the previous workers (table 4).

**Table 4.** Comparative study of fusion of base of 1<sup>st</sup> metacarpal bone.

Sl. No.	Research worker	Population studied	Age in years	
			Males	Females
1.	Present study (2007)	Central Karnataka	16-17	15-16
2.	Galastaun (1937) <sup>8</sup>	Bengal	16-18	14-16
3.	Dasgupta SM(1974) <sup>10</sup>	Uttar Pradesh	20-21	20-21
4.	Patil DT (1994) <sup>11</sup>	North Karnataka	15-16	14-15
5.	Kangne (1999) <sup>2</sup>	Maharashtra	-	15-16
6.	Sheetal Jain (1999) <sup>12</sup>	Rajasthan	17-18	17-18
7.	Flecker (1932) <sup>9</sup>	Australian	17	15

The study conducted by Dasgupta SM<sup>10</sup> showed delayed fusion of base of 1<sup>st</sup> metacarpal bone by 4-5 years in both sexes compared with that of the present study. The study conducted by Sheetal Jain<sup>12</sup> also showed delayed fusion of base of first metacarpal bone by about 1-2 years in both sexes, when compared to that of present study. Similarly delayed fusion was observed by Flecker<sup>9</sup> in his study on Australian population. But the study done by Kangne<sup>2</sup> on female population showed that the average age of fusion of base of 1<sup>st</sup> metacarpal bone is the same as that observed in the present study. However study done by Patil DT<sup>11</sup> showed that the base of 1<sup>st</sup> metacarpal bone fuses one year early in both sexes when compared with the present study. Galastaun<sup>8</sup> observed an average age range of two years for fusion of base of first metacarpal bone in his study on Bengali subjects, but in the present study we observed only one year age range. All the previous workers observed that the fusion of base of 1<sup>st</sup> metacarpal bone occurs earlier in females compared to that in males, which is similar to that observed in present study.

## Conclusion

Though exact and precise age of the individual cannot be stated, a reasonable age range can be assessed by the timings of the epiphyseal union of bones. Radiological examination plays an important role in visualizing the epiphyseal union of the bones and has become a reasonable and accepted method.

The fusion of epiphysis is subjected to variabilities as it occurs at different age in different countries and in same country at different regions. Fusion of ossification centres occurs 1-3 years earlier in case of females compared to that of males and is consistent with the observations made universally. It was also observed that appreciable variation with respect to time of union of epiphysis occurs within the country and also within same state of the country.

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# A Study of Biophysical Properties of Various Amino Acids in Different Aqueous Solutions of Potassium Nitrate at Different Temperatures

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## Abstract

Potassium ions have played an important role in biological processes like sodium-potassium ion pump in our body. Apparent molar volumes,  $V_{2,f}$  of glycine, DL- $\alpha$ -alanine, DL- $\alpha$ -amino-*n*-butyric acid, L-valine and L-leucine in water and in (0.25, 0.5, 0.75, 1.0, 1.5, 2.0) mol  $\times$  kg<sup>-1</sup> aqueous potassium nitrate solutions have been determined from densities measurements at various temperatures (288.15, 298.15, 308.15 and 318.15) K. The standard partial molar volumes,  $V_{2,f}^o$  obtained from  $V_{2,f}$  have been used to calculate the corresponding volume of transfer at infinite dilution,  $V_{2,f}$  from water to aqueous potassium nitrate. The structure making / breaking capacities of these amino acids in water and also in aqueous potassium nitrate investigated have been discussed.

## Key Words

Amino acids; Potassium nitrate; Partial molar volume; Transfer volumes; Hydration numbers; Interaction coefficients; Partial molar expansibilities.

## Introduction

Proteins are large complex molecules. The detailed three-dimensional structure of proteins and nucleic acids provides critical information about the molecules but they provide no information about the stability of a molecule or the energetic of its interactions.<sup>1</sup> The interactions of water with the various functional groups of proteins play crucial role in determining the conformational stability of proteins.<sup>2-5</sup> The other important aim of such studies lies in the understanding of solute-solvent interactions and about the effects of amino acids on the structure of water. There are strong evidences of the controlling influence of aqueous solvent in membrane permeability, intercellular structure, function and molecular biology of proteins.<sup>6</sup> The side chain groups are involved in a wide range of interactions. These interactions are affected by the surrounding solutes and solvent of macromolecules; for this reason, the physicochemical behaviors of proteins are strongly influenced by the presence of solutes.<sup>7</sup> Salt induced electrostatic forces are known to play an important role in modifying the protein structure by affecting the properties like solubility, denaturation, and activity of enzymes.<sup>2, 8</sup> Remarkable experimental work has been reported on thermodynamics of amino acids in aqueous alkali metal salts.<sup>8-15</sup> The role of K<sup>+</sup> ions as components of all body fluids are indispensable, among others (Ca<sup>2+</sup>, Mg<sup>2+</sup>, Na<sup>+</sup>) for a correct functioning of the nervous system<sup>16</sup>. Therefore, in continuation of our work<sup>17-19</sup> we have undertaken a systematic study on the volumes of some amino acids in aqueous potassium nitrate solutions at different temperatures. These properties are sensitive to specific interactive changes in solutions. Consequently, in the present paper, the apparent molar volumes,  $V_{2,f}$  of glycine, DL- $\alpha$ -alanine, DL- $\alpha$ -amino-*n*-butyric acid, L-valine and L-leucine in water and in aqueous potassium nitrate (0.25, 0.5, 0.75, 1.0, 1.5, 2.0) mol  $\times$  kg<sup>-1</sup> have been determined by measuring the densities using a vibrating-tube digital densimeter at various temperatures (288.15, 298.15, 308.15 and 318.15) K.

## Experimental Section

The amino acids selected for the present study glycine (G-7126), DL- $\alpha$ -alanine (A-7502), DL- $\alpha$ -amino-*n*-butyric acid (A-1754), L-valine

(V-0500) and L-leucine (L-8000) were obtained from sigma chemicals co. these along with potassium nitrate (AR, S.d. fine chemicals Ltd., India), were used without further purification and dried over anhydrous CaCl<sub>2</sub> in a vacuum desiccator before use. Densities function was checked by measuring the densities of aqueous sodium chloride solutions, which agreed well with the literature values<sup>20</sup>.

## Result and Discussion

The apparent molar volumes,  $V_{2,f}$  of amino acids in water and ion aqueous potassium nitrate solutions of various molalities ( $m$ , molality of potassium nitrate solutions, mol  $\times$  kg<sup>-1</sup>) at (288.15, 298.15, 308.15 and 318.15) K are calculated. Apparent molar volumes of amino acids have been calculated as follows:

$$V_{2,f} = M / -(r - r^o) 1000 / m r r^o \quad (1)$$

Where M is the molar mass of amino acid,  $m$  (mol  $\times$  kg<sup>-1</sup>) is the molality of amino acid, and  $r$ ,  $r^o$  are the densities of solution and solvent, respectively. At infinite dilution, the apparent molar volumes, and partial molar volumes, are identical ( $V_{2,f}^o = V_{2,f}^o$ ).  $V_{2,f}^o$  was determined by least-squares fitting of the data using the following equation:

$$V_{2,f} = V_{2,f}^o + S_y m \quad (2)$$

Where  $V_{2,f}^o$  is the infinite dilution apparent molar volume and has the same meaning as the standard partial molar volume, and  $S_y$  is the experimental slope. The  $V_{2,f}^o$  values along with their standard deviations are summarized in Table 1 at (288.15, 298.15, 308.15 and 318.15) K. The experimental values of amino acids in water agreed well with those reported in the literature.<sup>21-25</sup>

From the  $V_{2,f}^o$  data, the standard partial molar volumes of transfer,  $\Delta_t V^o$ , at infinite dilution from water to aqueous potassium nitrate solutions have been evaluated as follows:  $\Delta_t V^o = V_{2,f}^o$  (in aqueous potassium nitrate) -  $V_{2,f}^o$  (in water)  $\quad (3)$

The  $\Delta_t V^o$  values for the studied amino acids are positive and increase almost linearly with the increase in concentration of aqueous potassium nitrate solutions. The cosphere model<sup>26</sup> can be utilized to rationalize the  $\Delta_t V^o$  values in terms of solute-cosolute interactions. Franks et al.<sup>27</sup> have shown that the partial molar volume of non-electrolyte is a combination of two types of contributions given by the following equation:

$$V_2^o = V_{int} + V_s \quad (4)$$

where,  $V_{int}$  is the intrinsic volume of non-electrolyte and  $V_s$  volume due to its interactions with the solvent. It has been considered<sup>28-29</sup> that  $V_{int}$  is made up of two types of contributions.

$$V_{int} = V_{ww} + V_{void} \quad (5)$$

Where,  $V_{ww}$  is the van der Waals volume<sup>30-31</sup> and  $V_{void}$  is the associated void or empty volume.<sup>32</sup> Shahidi et al.<sup>28</sup> further modified above equation to include the contribution of interactions of a non-electrolyte solute with the solvent.

$$V_2^o = V_{ww} + V_{void} + n s_s \quad (6)$$

Where  $s_s$  is the shrinkage in volume produced by the interactions of hydrogen.

$$V_2^o = V_{ww} + V_{void} - V_{shrinkage} \quad (7)$$

This also gets support from the volumetric and compressibility studies of glycine and DL- $\alpha$ -alanine in aqueous sodium sulfate solutions by Wadi and Ramasami<sup>32-34</sup>, who reported that the hydration number of amino acids decreases with increasing temperature and concentration of sodium sulfate. Kozak et al.<sup>35</sup> have proposed formalism on the basis of McMillan-Mayer<sup>36</sup> theory of solutions which permits the formal

**Table 1.** Solutions densities,  $\rho$ , and apparent molar volumes,  $V_{2,f}$  for the  $\alpha$ -amino acids in aqueous solutions of  $\text{KNO}_3$  at different concentrations and at various temperatures.

Amino acids	Water	0.25 m	0.5 m	0.75 m	1.0 m	1.5 m	2.0 m
T=288.15K							
Glycine	42.82±0.05 <sup>b</sup> (11.31) 42.84 <sup>c</sup> 42.40 <sup>d</sup>	43.42 ± 0.06 (6.23)	43.67±0.08 (3.48)	44.21±0.06 (2.61)	44.91 ±0.07 (2.46)	45.04±0.07 (2.94)	45.99±0.06 (4.19)
DL- $\alpha$ -alanine	59.90±0.05 <sup>b</sup> (7.95) 59.67 <sup>c</sup> 59.90 <sup>d</sup>	60.20 ± 0.07 <sup>b</sup> (4.19)	60.32±0.08 (2.55)	60.53±0.03 (2.12)	61.29 ± 0.23 (4.82)	61.61±0.05 (2.18)	62.11±0.03 (1.93)
DL- $\alpha$ -amino- <i>n</i> -butyric acid	75.62±0.09 (3.51)74.67 <sup>e</sup>	75.82 ± 0.06 (1.46)	75.94±0.05 (2.18)	76.18±0.05 (2.05)	77.05±0.05 (1.14)	77.23±0.03 (2.79)	77.60±0.05 (5.64)
L-valine	90.02±0.05 (5.05)90.08 <sup>c</sup>	90.15 ± 0.04 (2.24)	90.19±0.04 (2.05)	90.31±0.02 (3.98)	90.81±0.06 (1.49)	91.14±0.03 (3.39)	91.35±0.03 (2.98)
L-leucine	107.09±0.09 (2.0)106.81 <sup>f</sup>	107.19±0.07 (1.96)	107.28±0.10 (2.76)	107.37±0.02 (2.79)	107.66±0.03 (4.77)	107.83±0.03 (4.01)	108.03±0.02 (4.63)
T=298.15K							
Glycine	43.17±0.02 <sup>b</sup> (1.66) 43.26 <sup>c</sup> 43.30 <sup>d</sup> 43.24 <sup>g</sup>	43.55 ± 0.09 (2.29)	44.08±0.03 (1.08)	44.44±0.02 (1.76)	45.10±0.01 (2.45)	45.48±0.04 (3.29)	45.63±0.11 (1.56)
DL- $\alpha$ -alanine	60.40±0.02 <sup>b</sup> (0.95) 60.47 <sup>c</sup> 60.49 <sup>g</sup>	60.68±0.03 <sup>b</sup> (2.07)	60.99±0.03 (1.62)	61.30±0.05 (1.63)	62.07±0.03 (0.76)	62.12±0.12 (5.43)	62.87±0.10 (2.16)
DL- $\alpha$ -amino- <i>n</i> -butyric acid	75.98±0.03 (0.72)75.51 <sup>e</sup>	76.16 ± 0.03 (0.61)	76.42±0.02 (0.87)	76.68±0.02 (0.61)	77.02±0.03 (0.62)	77.67±0.04 (1.41)	78.05±0.03 (2.57)
L-valine	90.76±0.02 (0.92)90.80 <sup>f</sup>	90.90 ± 0.02 (0.63)	91.03±0.04 (0.83)	91.34±0.02 (1.09)	91.51±0.02 (1.37)	91.86±0.07 (2.99)	92.23±0.03 (3.31)
L-leucine	107.44±0.03 (1.77)107.73 <sup>f</sup> 107.77 <sup>g</sup>	107.51±0.05 (2.64)	107.64±0.04 (1.74)	107.73±0.02 (2.67)	107.88±0.03 (1.57)	108.22±0.05 (1.76)	108.70±0.06 (2.22)
T=308.15K							
Glycine	44.34±0.05 <sup>b</sup> (2.37) 43.80 <sup>d</sup> 44.90 <sup>g</sup>	44.63 ± 0.06 (3.10)	44.71±0.04 (4.12)	45.42±0.08 (7.43)	46.06±0.11 (10.69)	46.38±0.08 (4.90)	46.89 ± 0.07 (4.76)
DL- $\alpha$ -alanine	61.31±0.12 (3.68) 60.90 <sup>d</sup> 61.01 <sup>g</sup>	61.50±0.13 <sup>b</sup> (5.12)	61.70±0.08 (5.94)	62.05±0.08 (5.0)	62.45±0.05 (5.67)	63.32±0.13 (4.49)	63.56±0.21 (4.57)
DL- $\alpha$ -amino- <i>n</i> -butyric acid	76.47±0.12 (4.51)76.61 <sup>g</sup>	76.66±0.08 (3.23)	76.89±0.10 (4.54)	76.92±0.04 (5.40)	77.45±0.05 (3.63)	77.94±0.08 (6.35)	78.66±0.11 (2.95)
L-valine	91.22±0.07 (1.86)91.55 <sup>g</sup>	91.24±0.04 (4.05)	91.56±0.08 (5.78)	91.58±0.10 (5.97)	92.09±0.03 (1.64)	92.25±0.03 (5.79)	93.22±0.11 (4.33)
L-leucine	107.78±0.03 (1.19)108.41 <sup>g</sup>	107.94±0.14 (2.46)	108.02±0.09 (2.54)	108.07±0.07 (6.07)	108.58±0.04 (5.15)	108.94±0.03 (3.16)	109.55±0.06 (1.55)
T=318.15K							
Glycine	45.28±0.12 <sup>b</sup> (8.80)44.17 <sup>g</sup>	46.69±0.09 (5.86)	46.77 ± 0.09 (3.84)	46.97±0.12 (3.53)	47.80±0.09 (5.33)	48.06 ± 0.15 (8.96)	49.02±0.19 (7.81)
DL- $\alpha$ -alanine	62.20±0.24 (8.73)61.31 <sup>g</sup>	62.72±0.05 (5.40)	62.69±0.19 (5.10)	63.66±0.12 (4.78)	64.43±0.24 (8.82)	64.68±0.11 (8.95)	65.37±0.08 (5.79)
DL- $\alpha$ -amino- <i>n</i> -butyric acid	77.00±0.22 (8.68)76.82 <sup>g</sup>	77.04 ± 0.09 (4.57)	77.50 ± 0.12 (6.04)	78.26 ± 0.12 (7.27)	78.33 ± 0.14 (6.31)	78.99 ± 0.03 (7.66)	79.84 ± 0.08 (4.09)
L-valine	91.82±0.16 (14.04)91.93 <sup>g</sup>	92.12 ± 0.03 (4.96)	92.33 ± 0.09 (4.44)	92.94 ± 0.11 (5.25)	93.16 ± 0.19 (5.64)	93.51 ± 0.09 (6.13)	94.28 ± 0.12 (4.99)
L-leucine	108.19±0.17 (5.70)109.38 <sup>g</sup>	108.23±0.12 (2.94)	108.46±0.12 (6.37)	109.13±0.11 (4.27)	109.30±0.07 (5.45)	109.43±0.11 (7.20)	109.92±0.16 (9.41)

separation of the effects due to interactions between pairs of solute molecules and those due to interactions involving three or more solute molecules. Friedman and Krishnan<sup>37</sup> and Franks et al.<sup>38-40</sup> have further discussed this approach to include the solute-cosolute interactions in the solvation sphere.

$${}^tV^0 = 2V_{AB} \times m_s +$$

$$3 V_{ABB} \times m_s^2 + 4 V_{ABBB} m_s^3 \quad (8)$$

$$V_{2,f}^0 = V_{2,f}^0(\text{int}) + n_H (V_E^0 - V_B^0) \quad (9)$$

Where  $V_{2,f}^0(\text{int})$  is the intrinsic volume of a solute molecule,  $V_E^0$  and  $V_B^0$  are the partial molar volumes of water in the bulk state and in the hydration shell of a solution. Following the procedure described by

Millero et al.<sup>41</sup> ( $V_E^o - V_B^o$ ) = -2.9, -3.3, -4.0 cm<sup>3</sup> × mol<sup>-1</sup> at 288.15 K, 298.15 K and 308.15 K, respectively. Therefore, as an approximation, the hydration number  $n_H$  can be obtained by Eq. (9), and the results are listed in Table 3. The contribution of charged end groups (NH<sub>3</sub><sup>+</sup>, COO<sup>-</sup>) are positive, and those of CH<sub>2</sub> groups are negative. From these observations, the overall positive  $\Delta V^o$  values suggest that the effect of charged end groups dominates that of alkyl side chains. The temperature dependence of  $V_f^o$  for various amino acids in water and in aqueous potassium nitrate solutions, studied here can be expressed by the general equation as follows:

$$V_f^o = a + b \times T + c \times T^2 \quad (10)$$

Hepler<sup>48</sup> developed a technique of examining the sign of  $(\Delta^2 V_f^o / \Delta T^2)_p$

**Table 2.** Pair and Triplet Interactions coefficients for some amino acids in aqueous potassium nitrate solutions at 288.15, 298.15, 308.15 and 318.15K.

Amino acids	$V_{XY}^{a'} \times 10^6 / m^3 \times \text{mol}^{-2} \times \text{kg}^{-1}$	$V_{XYZ}^{a'} \times 10^6 / m^3 \times \text{mol}^{-3} \times \text{kg}^{-1}$
T=288.15 K		
Glycine	1.041 ± 0.136	-0.091 ± 0.054
DL-á-alanine	0.556 ± 0.114	0.002 ± 0.046
DL-á-amino- <i>n</i> -butyric acid	0.541 ± 0.154	-0.009 ± 0.062
L-valine	0.275 ± 0.092	0.026 ± 0.037
L-leucine	0.234 ± 0.041	0.002 ± 0.016
T=298.15 K		
Glycine	1.109 ± 0.089	-0.160 ± 0.036
DL-á-alanine	0.715 ± 0.131	-0.036 ± 0.052
DL-á-amino- <i>n</i> -butyric acid	0.482 ± 0.054	0.017 ± 0.022
L-valine	0.348 ± 0.033	0.007 ± 0.013
L-leucine	0.127 ± 0.011	0.062 ± 0.004
T=308.15 K		
Glycine	0.762 ± 0.149	-0.037 ± 0.060
DL-á-alanine	0.523 ± 0.111	0.025 ± 0.044
DL-á-amino- <i>n</i> -butyric acid	0.319 ± 0.061	0.077 ± 0.024
L-valine	0.183 ± 0.099	0.099 ± 0.040
L-leucine	0.207 ± 0.067	0.080 ± 0.027
T=318.15 K		
Glycine	1.528 ± 0.260	-0.214 ± 0.104
DL-á-alanine	1.038 ± 0.194	-0.080 ± 0.078
DL-á-amino- <i>n</i> -butyric acid	0.616 ± 0.129	0.031 ± 0.052
L-valine	0.660 ± 0.086	-0.020 ± 0.035
L-leucine	0.523 ± 0.130	-0.031 ± 0.052

for various solutes in terms of long-range structure making and breaking capacity of the solutes in aqueous solutions using the general thermodynamic expression;

$$(\Delta C_p / \Delta p)T = -(\Delta^2 V_f^o / \Delta T^2)_p \quad (17)$$

On the basis of this expression it has been deduced that structure making solutes should have positive values, whereas structure breaking solutes should have negative values. It has been suggested that for a structure breaking solute, the left side of the equation should be positive, and therefore  $(\Delta^2 V_f^o / \Delta T^2)_p$  values should be negative for structure breaking and positive for structure making solutes.

This equation is useful for making a distinction ionic or polar solutes and those for making a distinction between ionic or polar solutes and those for which hydrophobic hydration is dominant. The presently obtained  $(\Delta^2 V_f^o / \Delta T^2)_p$  values are positive for all amino acids which suggests that studied amino acids are structure maker in water as well as in aqueous KNO<sub>3</sub>.

## Conclusion

Partial molar volumes,  $V_{2,p}^o$  of glycine, DL-amino-*n*-butyric acid, L-valine, L-leucine in aqueous and in mixed aqueous solutions of KNO<sub>3</sub>

**Table 3.** Limiting Apparent Molar Expansibility  $f_E^o \times 10^{-6} / m^3 \times \text{mol}^{-1} \times \text{K}^{-1}$  and  $10^{-6} (\Delta^2 V_f^o / \Delta T^2)_p$  for amino acids in water and in aqueous potassium nitrate solutions at different temperatures.

	$f_E^o \times 10^{-6} / m^3 \times \text{mol}^{-1} \times \text{K}^{-1}$				$10^{-6} (\Delta^2 V_f^o / \Delta T^2)_p / m^3 \times \text{mol}^{-1} \times \text{K}^{-2}$
	288.15K	298.15K	308.15K	318.15K	
Glycine in water	0.038	0.068	0.097	0.127	0.0029
0.25 m <sub>s</sub>	0.054	0.051	0.047	0.044	-0.0003
0.5 m <sub>s</sub>	-0.022	0.061	0.144	0.226	0.0083
0.75 m <sub>s</sub>	-0.006	0.060	0.126	0.192	0.0066
1.0 m <sub>s</sub>	-0.022	0.055	0.132	0.209	0.0077
1.5 m <sub>s</sub>	0.007	0.069	0.131	0.193	0.0062
2.0 m <sub>s</sub>	-0.080	0.044	0.169	0.293	0.0125
DL-á-alanine in water	0.049	0.068	0.088	0.107	0.0019
0.25 m <sub>s</sub>	0.028	0.065	0.102	0.139	0.0037
0.5 m <sub>s</sub>	0.054	0.070	0.086	0.102	0.0016
0.75 m <sub>s</sub>	0.038	0.080	0.122	0.164	0.0042
1.0 m <sub>s</sub>	0.008	0.068	0.128	0.188	0.0060
1.5 m <sub>s</sub>	0.043	0.086	0.128	0.171	0.0043
2.0 m <sub>s</sub>	0.029	0.081	0.134	0.187	0.0053
DL-á-amino- <i>n</i> -butyric acid in water	0.033	0.042	0.050	0.059	0.0008
0.25 m <sub>s</sub>	0.039	0.041	0.043	0.045	0.0002
0.5 m <sub>s</sub>	0.042	0.048	0.055	0.061	0.0006
0.75 m <sub>s</sub>	0.002	0.044	0.086	0.128	0.0042
1.0 m <sub>s</sub>	-0.028	0.017	0.062	0.108	0.0045
1.5 m <sub>s</sub>	0.007	0.037	0.068	0.098	0.0030
2.0 m <sub>s</sub>	0.021	0.058	0.095	0.131	0.0037
L-valine in water	-0.016	0.027	0.070	0.113	0.0043
0.25 m <sub>s</sub>	0.053	0.059	0.066	0.072	0.0006
0.5 m <sub>s</sub>	0.075	0.071	0.068	0.064	-0.0003
0.75 m <sub>s</sub>	0.056	0.073	0.089	0.106	0.0016
1.0 m <sub>s</sub>	0.048	0.067	0.085	0.104	0.0018
1.5 m <sub>s</sub>	0.035	0.061	0.088	0.115	0.0027
2.0 m <sub>s</sub>	0.084	0.093	0.102	0.111	0.0009
L-leucine in water	0.032	0.035	0.038	0.041	0.0003
0.25 m <sub>s</sub>	0.038	0.036	0.035	0.033	-0.0001
0.5 m <sub>s</sub>	0.033	0.037	0.041	0.045	0.0004
0.75 m <sub>s</sub>	0.004	0.039	0.074	0.109	0.0035
1.0 m <sub>s</sub>	0.019	0.044	0.069	0.094	0.0025
1.5 m <sub>s</sub>	0.048	0.053	0.058	0.063	0.0005
2.0 m <sub>s</sub>	0.088	0.074	0.058	0.043	-0.0015

(0.25, 0.5, 0.75, 1.0, 1.5, 2.0) mol × kg<sup>-1</sup>, have been determined at T = (288.15 to 318.15)K. From these data, transfer volumes, hydration numbers, and side chain contributions have been determined. The  $D_t^o$  values are positive in all the cases, and these increase with an increase in the concentration of KNO<sub>3</sub> and temperature.  $V_{XY}$  values are positive, and  $V_{XYZ}$  values are negative in all cases, which suggest that interactions between amino acids and KNO<sub>3</sub> are mainly pair wise. The positive  $(\Delta^2 V_f^o / \Delta T^2)_p$  values for all amino acids in aqueous KNO<sub>3</sub> suggest that studied amino acids are structure breakers in aqueous KNO<sub>3</sub> solutions.

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# Identification from Dental Implants

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## Abstract

Forensic odontology has been with us since time immemorial, when, according to the Old Testament, Adam was convinced by Eve to take a bite of the forbidden apple, and left behind a bite mark.

The number of patients being treated with dental implants is increasing, thus the precise recognition of implants on radiographs is of increasing importance in victim identification. Identification of implants that have been inserted previously is only possible from radiographs; dentists have to be familiar with the detailed morphology of different products and types of fixtures.

In the present study, radiographic images of five common dental implants were analyzed. Images were studied using available radiographs placed implants, thus the radiographic image varied from patient to patient. The influences of surface structures, such as threads, cuts, holes, perforations, and flutes, are demonstrated. The objective of this article is to make easier the identification of the 'implant system used' from simple routine radiographs.

## Key Words

Forensic, implant, identification

## Introduction

The word forensic is derived from the latin word 'Forensis' meaning public. Forensic science refers to areas of endeavour that can be used in a judicial setting and accepted by court and the general scientific community to separate truth from untruth.

The youngest and the corner stone of forensic sciences is FORENSIC ODONTOLOGY; which is defined as the positive identification of the living or deceased persons using the unique traits and characteristics of teeth and jaws.

Forensic odontological examination is the primary means of identification in situations where exposure, time elapsed after death and destruction of body has made other means of identification impossible. Currently there are three types of personal identification that uses teeth, jaws and orofacial characteristics.(1,2)

Radiography can play an important role in forensic odontology. These are usually in the form of bitewing radiographs, periapical and occlusal views (3) and extraoral projections such as oblique views or panoramic views. The frontal sinus view is very useful as it is an established fact that it is a unique feature of every individual (4). Radiography may have to be carried out in the field or at the scene of autopsy which may require certain modifications in the normal procedures followed.

In the future, dentists will more frequently encounter patients who have dental implants. To use radiographs to identify implants, dentists have to be familiar with the detailed morphology of different products and types of fixtures including the principles for formation of their radiographic images.

## Review of Literature

Radiography is used in forensic pathology for human identification, especially in cases of decomposed, fragmented, or burned victims (5-11), and for assessment and documentation of dental status (12, 13, 14)

Ante-mortem and post-mortem radiographs can be compared concerning pathological changes to bones, old traumas, prostheses, or other orthopedic operations (5, 6, 7, 15, 16) and these should be available with the dentist,(17,18). Hame et al recommended use of orthopantomography in identification which enables visualization of the structures of the jaws and related areas as a single radiography. Such radiographs are of particular importance especially when bodies are fragmented. (19,20)

The earliest reported case was of Lollia Paulina in the year 49 A.D. who was identified by her teeth, which had certain distinctive characteristics.(21) In 1969, the Glasgow police confirmed the identity of a women who had died in a fire, by a characteristic unerrupted upper second premolars, after matching it with her dental records.(22)

Haines (1972) identified 50 out of 78 victims of plane crash by dental means. (23)

The President of Pakistan, General Zia-ul-Huq(1988), who died in a plane crash was identified from his dentition.(24)

Another application in forensic practice is in the determination and documentation of the existence, number, localization, and identification of foreign material inside victims (8, 25, 26, 27, 28, 29). A denture picked up on the beach, had the technicians identity etched on it. (19,30). In India there is a reported case of Raja Rathore, whose mutilated body was identified by his false anterior tooth.(31)

Sognaes and Strom (1973) (32, 33) reported that charred body of Adolf Hitler was identified from the antemortem radiographs of Hitler's skull which revealed characteristic dental restorations.

Paul Revere (1974), constructed a silver bridge for his friend, who was killed by a bullet, and was identified by the bridge work. (34,35, 36)

Evans and Knight (1981) stated the importance of comparison radiography in relation to dental therapy in which teeth or bony structures are exposed or modified. They further stated that restoration remain unchanged until either removed or lost, exception being silicate cement which has high-rate of solubility in saliva and also some of the lining materials. (8)

Implantology is recently gaining importance as the method of replacing teeth and play a very important role in identification, if records are maintained in a systematic manner. Human bones and teeth survive both natural and unnatural processes and therefore can nearly always be examined radiographically. (37)

Sewerin (1992) first described and analyzed radiographic images of dental implants from different viewing angles (38). Increased patient mobility, and the large number of implants systems with different designs, has determined the need for a radiographic catalogue of dental implant images (39, 40, 41) and also for the forensic odontologist while attempting the identification of an unknown cadaver (42,43).

Morphological features of dental implants depicted on radiographs may be used to develop a dental profile of the individual and provide information that can narrow the search to a smaller number of individuals, or eliminate certain candidates by taking into account the dental system employed (44, 45, 46, 47).The matching of two sets of radiographs is performed with post mortem periapical X-ray of the implants against the dental implants' images of the various implant systems stored in the archive. Some implant systems have peculiar characteristics making recognition easy, but others which share very similar characteristics, require the analysis of fine structures (48).

Michelinakis et al (49) from their study concluded that the Implant

Recognition Software (IRS) should simplify clinicians' and technicians' jobs when identifying any dental implant systems which a patient may present with as well as having potential uses in the field of forensic dentistry.

## Method and Materials

In the present study, radiographic images of five most common dental implants were analyzed. The radiographic images were obtained from some of the leading implantologists from the city of Mumbai. Images varied as they were sometimes as an IOPA, some as a digital image and some as OPG images. The angulation and the processing of each radiograph varied and as such a variety of images were obtained. The images were read carefully to study various structural characteristics of the implant system. The influences of surface structures, such as threads, cuts, holes, perforations, and flutes were recorded.

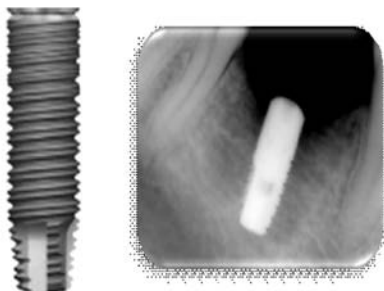
A survey of the most commonly used implants in India was done. The details of implants with regards to surface structure were noted on physical examination and compared with the literature supplied by the company.

About 4-5 radiographs each of all the 5 types of implants were collected from the respective implantologists and then scrutinized for their radiographic comparison and compared with the actual implant sample. As per variations in protocol, radiographs ranged from conventional IOPAs to digital periapical radiographs to OPGs.

A radiograph of the same implant was taken on an intra oral periapical film (Kodak E speed). The exposure parameters and the intra oral x-ray machine used was the same for all the different implants radiographed, the source to film distance was also kept constant, and processing was done on the automatic processor.

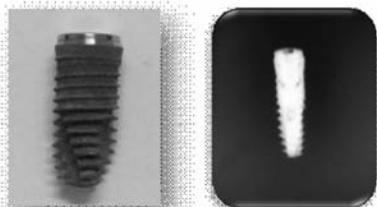
## Observations

### IMAGE OF OSSTEM GS II IMPLANT FIXTURE AND RADIOGRAPHIC IDENTIFICATION FEATURES: (Fig No. 1)



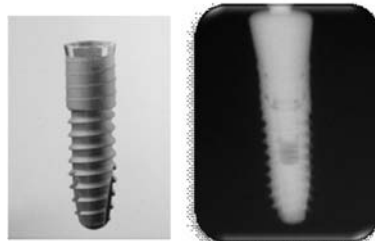
- Straight body structure
- Flat apical end
- Finer radio opaque ring outlines in the upper one third and well defined radio opaque serrations in the middle and apical third suggestive of dual combining micro and macro threads
- A radiolucent area in the middle third
- Reduced radio opacity along the borders of the fixture in the apical part due to blade of cutting edge

### IMAGE OF DENTSPLY XIVE IMPLANT FIXTURE AND RADIOGRAPHIC IDENTIFICATION FEATURES: (Fig. No 2)



- Gradually tapering body
- Rounded apical end
- Uniform thread thickness
- Radiolucency at the centre corresponding to the internal cylindrical perforation
- Apical vertical cuts causing reduced radio opacity along the borders in the apical one third

### IMAGE OF UNITI EQUINOX IMPLANT FIXTURE AND RADIOGRAPHIC IDENTIFICATION FEATURES: (Fig. No. 3)



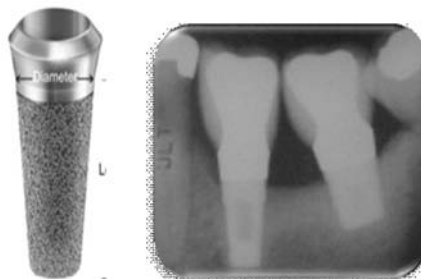
- Upper one third is parallel body without prominent thread units
- Well tapered lower two thirds with prominent thread pattern
- Rounded apical end
- A rectangular radiolucency at the junction of middle and lower one third
- Reduced radio opacity in the apical third due to vertical cuts

### IMAGE OF NOBEL BIOCARE IMPLANT FIXTURE AND RADIOGRAPHIC IDENTIFICATION FEATURES : (Fig. No. 4)



- Expanding tapered body
- Flattened end apically
- Radio opaque ring at the top
- Implant in implant appearance
- Rectangular radiolucent window in the upper half with a radio opaque bar passing through it
- Crescent shaped radiolucency in the lower one third area

### IMAGE OF LIFECARE ENDOPORE IMPLANT FIXTURE AND RADIOGRAPHIC IDENTIFICATION FEATURES: (Fig. No. 5)



- Truncated body
- Shorter length
- No radio opaque serrations due to lack of threaded units
- Straight cut flat apical end
- Rectangular radiolucency in the middle third
- No reduced radio opacity at apical borders due to lack of vertical cuts

## Results and Discussion

There is a lot of complexity of the radiographic images of dental implants and it is only possible to explain the images if the often complicated structure of the fixture is known and the principles of radiographic image formation understood. During the post mortem implant radiography the positioning of the X-ray device and the cadaver or part of the specimen would be greatly influenced by muscular rigor mortis. Hence this study did not include standardization of radiographs as in a real case scenario certain implant details may be identified based on the feasible radiographic system employed.

In the above descriptions of the various implants, only a gross comparison of anatomical characteristics was done with the radiographic image which varied with the type of radiograph and angulations. However it was found that even with such variations it was possible to identify the implant system used without much difficulty. Standardization of radiograph type, exposure parameters and angulations would be advisable. These methods are time consuming and require more skillful persons for the task. The method used in this study could be used for overall assessment, inclusion or exclusion of certain suspects or victims altogether and may reduce inconvenience to a lot of investigators, families of victims, patients alike.

## Conclusion

The information from this study should be considered a step towards survey of the commercially available dental implants in India through their radiographic images. It should help both the forensic odontologist and the dentist to identify pre-existing implants and compare them with their radiographic images. In the human identification process of unknown victims with no dental records available, the recognition of dental implants detected may give auxiliary information to narrow the search to a smaller number of individuals or eliminate certain candidates altogether. In performing the forensic evaluation and superimposition, forensic odontologists must be familiar with implant designs and implant therapy. A worldwide radiographic implant image database, including similar "cloned" implants, is needed for a wider geographical evaluation of the different implant designs from other countries. We acknowledge the contributions of the following dental surgeons who allowed access to the radiographic information.

- Dr. Dilip Deshpande
- Dr. Nrupal Kothare
- Dr. Kiran Kelkar

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# Forensic Pharmacokinetics : A New Dimension for Drug Related Medico-Legal Cases

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## Abstract

The incidence of drug related medico legal cases are increasing day by day, leading to frequent requirement of estimation of dose size administered or ingested by deceased, based on either postmortem blood level or concentration of drug in urine. Postmortem changes begin at cellular level with the onset of ischemia, and depending on its duration, structure and function of various organs and tissue gradually deteriorate which influence the distribution of drugs in the body fluids and tissues. So, to estimate drug concentration of deceased, postmortem redistribution phenomenon has to be considered. Deceased drug concentration may not reflect the actual concentration at the time of death, and estimating antemortem drug concentration from deceased blood level may be misleading if it is not judiciously used to simulate the dose versus toxicity relationship. In this article authors have emphasis on various aspect of co-relationship of drugs level following death and different factors that influence while predicting actual drug concentration for medico legal drugs related cases.

## Key Words

Drug concentration, postmortem, legal implication

## Introduction

The incidence of drug related medico legal cases are increasing day by day and with the advent of newer drugs on an almost daily basis, the number of medico legal cases due to complication (accidental or deliberate) of these drugs are increasing at an alarming rate. Not only therapeutic agents, the cases of poisoning from known toxicological agents like organophosphorous compounds, aluminium phosphide etc. is increasing with each passing day. In such scenario, the toxicologist has to determine the amount of the suspected poison in the dead body from the samples preserved during autopsy. But, are the results that we get from such samples accurate? Can these results be extrapolated to the living to get the amount of drug present at the time of death? Does the time passed since death has any bearing on these values? What is the correlation we get in blood and various organs? These are many such questions which need to be answered before we can use the toxicological analysis for legal evidence on the basis of these results. [1, 2]

All drugs have the potential to be misused, whether legally prescribed by a doctor, purchased over-the-counter at the local drug store, or bought illegally on the street. Taken in combination with other drugs or with alcohol, even drugs normally considered safe can cause death or serious long term consequences. Accidental drug overdose may be the result of misuse of prescription medicines or commonly used medications like pain relievers and cold remedies. Symptoms differ depending on the drug taken.

While many victims of drug overdose recover without long term effects, there can be serious consequences. Some drug overdoses causes failure of major organs like the kidneys or liver, or failure of whole systems like the respiratory or circulatory systems. Patients who survive drug overdose may need kidney dialysis, kidney or liver transplant, or ongoing care as a result of heart failure, stroke, or coma. Death can occur in almost any drug overdose situation, particularly if treatment is not started immediately.

In a study conducted in Utah between 1991 to 2003, it has been

observed that there is tremendous increase in number of death caused by use of non-illicit drug poisoning, and most of them was unintentional in nature. While in 1991, only 50 people died because of use of non-illicit drug, the number rose to more than 250 by 2001[3].

### The Phenomenon of Post mortem drug distribution:

Processes by which the movement of drugs and other chemical poisons between tissues, organs and body fluids takes place after death is known as post mortem drug distribution. This phenomenon is well recognized and was first reported some 35 years ago [4].

The role of this phenomenon is obvious in cases of suspected poisoning, marginally toxic cases, such as vehicle accidents, and potential toxicological cases of euthanasia or medical negligence where one has to rely upon the toxicological analysis of blood samples. [2].

The process of postmortem distribution results in the migration of drugs between blood and tissues, the rate and extent of which varies according to several factors, including the nature of drug and time interval between death and post mortem specimen collection. Also, the timing, method of collection, and source of sample might influence the interpretation of toxicological analysis.

Among the major organs which constitute potential drug pools, gastrointestinal tract might contain considerable quantities of unabsorbed drug, and thus central blood is subject to redistribution from these local organs, while peripheral blood, such as femoral blood, is subject to redistribution influence only from local tissues-muscle and fat. So, redistribution into central vessel is greater than that of peripheral vessels and for this reason, the blood specimen of choice for toxicological analysis after death is a femoral venous sample, ideally collected from a ligated vessel [5,6].

Often, toxicologists are requested to estimate the amount of drug present at the time of death on assuming that the drug concentration found at the time of post mortem is a reliable estimate of that present at the time of death. However there is lack of any evidence that such an extrapolation is possible, and there are only few cases reported, where antemortem blood concentration are available for comparison with values from variety of sites at post mortem examination [7].

### Calculation of antemortem drug concentration:

In cases where intervals between antemortem sampling and death was known, an estimation of the plasma concentration at the time of death can be

calculated using the following equation to account for the decline in drug concentration as a result of ongoing metabolism and elimination during life-

$$\ln N_t = \ln N_0 - kT$$

$$\text{Where } k = (\ln 2)/t_{1/2}$$

$N_t$  = calculated plasma drug concentration at time of death;  $N_0$  = plasma drug concentration at time of sampling;  $T$  = time interval between sampling and death;  $T_{1/2}$  = elimination half life of drug in plasma. [8,9].

### Variables affecting central to peripheral ratio:

Increase in interval between death and postmortem examination affect site specific postmortem drug concentration to a great extent, and hence the central to peripheral ratio calculated [10]. It is likely that this interval will also affect the postmortem to antemortem ratio calculated for the drugs, although drug concentration in the femoral vein after death appear to be relatively stable with time, again making any extrapolation using these ratios unsafe. [11,12]

To determine whether the drug concentration found at post mortem examination should be attributed to either therapeutic ingestion or overdose is very difficult because of the influences of post mortem changes.

Drugs with high central to peripheral ratio also tend to have a high postmortem to antemortem ratio. Overestimation of the antemortem drug concentration results in an artificially low postmortem to antemortem ratio. It can be dangerous to attempt to relate a drug concentration found at postmortem examination to the antemortem circulating concentration or the antemortem dose received. It is not possible to form a general rule regarding the differences between the antemortem and postmortem drug measurements as variation seen depends on the nature of drug.

Postmortem to antemortem blood drug concentration ratios for acidic/neutral drugs such as phenobarbital, acetaminophen or carbamazepine were close to 1.0. For the basic drugs codeine, amphetamine, verapamil, and trimeprazine, there were significantly elevated postmortem to antemortem blood drug concentration ratios [13].

Use of postmortem to antemortem ratios, or back extrapolation from a postmortem concentration, is not recommended. For certain drugs, it may be more appropriate to consider the parent to metabolite ratio. It has been shown consistently for several drugs (e.g., tricyclic antidepressants) that a high ratio is indicative of acute administration, as seen in overdose, because often *in vivo* metabolism is saturated or incomplete and circulating concentration of the parent compound remains high [14,15,16]. Postmortem to antemortem blood drug concentration ratios for both heart blood and blood from vena cava and also the lung to antemortem blood drug concentration ratio were closely related to the apparent volume of distribution for the drugs. Accordingly, an apparent volume of distribution of more than 3-4 L/kg is a good predictor that a drug is liable to undergo post mortem redistribution with significant increments in blood levels. Drugs like tricyclic antidepressants; barbiturate, opiates and others show postmortem concentration increases in humans [17]. On the other hand, there are substances that redistribute insignificantly post mortem, as acetaminophen and zopiclone [18].

#### **Causes of artificially increased blood drug concentration after death:**

After death, several mechanisms can give rise to artificially increased blood drug concentration. A drug may be released postmortem from tissues with high drug concentration and redistribute by means of diffusion and convection of blood and other fluids in the body. The lungs have been experimentally verified as a source of post mortem drug release to the blood [19] but also liver, myocardium, endothelium and kidney are possible sources. Drug distribute from unabsorbed from stomach, drug depots to anatomically adjacent tissues like the left lobe of the liver, left lower lobe of the lung and eventually myocardium and blood in central compartments [20,21,22]. Agonal or postmortem reflux of drug-rich material from the stomach into airways followed by release to the blood can give rise to falsely elevated drug concentration in heart blood and other central tissues [23].

#### **Case of blood alcohol measurement:**

Calculation of blood alcohol concentration for forensic purposes are based on several simplified assumption like linear pharmacokinetics of ethanol, constant value of ethanol elimination, constant rate of alcohol absorption and constant time to achieve peak blood levels, which is by convention depends only on type of beverage and quantity of food consumed. These simplified and idealized assumptions significantly restrict possibility of back extrapolations of blood alcohol concentration from the observed values and calculations based on them exclude the absorption phase of blood alcohol curve. Although many factors may alter the concentration of alcohol present in autopsy specimen, postmortem synthesis of alcohol receives most attention. The microorganisms producing ethanol post mortem can be inhibited by adding a preservative and storing the sample under refrigeration. (24)

Also if ethanol remains unabsorbed in the stomach at the time of death, there remains possibility of local diffusion into surrounding

tissue as well as in central blood which may give falsely elevated blood alcohol concentration.

In cases of accident under the influence of alcohol, skull trauma occurs commonly, rendering the person unconscious for several hours before death and the blood alcohol level may decrease due to its metabolism. In these cases, estimating the concentration of alcohol from subdural/intracerebral clot will be more appropriate. (25)

There did not seem to be any relationship between the postmortem changes and pharmacological parameters such as acid dissociation constant (pKa), molecular size, plasma protein binding or lipophilicity. The basic lipophilic drugs may interact through inhibition of accumulation in the isolated perfused lung depending on their lipid solubility [26].

## **Lung and Antidepressant**

Lungs, which function as a reservoir for antidepressants [27], addition of a second antidepressant leads to release of the first drug in volunteers, with an increased risk of toxicity. It has been established that cationic amphiphilic drugs accumulate in tissues by two major mechanisms, namely non covalent binding to membrane phospholipids and ion trapping within acidic cellular compartments like lysosomes [28]. The tissue to blood drug concentration ratio of the lung was found to be predictive of the postmortem drug level increase observed in heart blood. This is in agreement with a previous study in rats showing that removal of the lungs significantly reduced the postmortem drug level increase observed in heart blood for amitriptyline.

## **Relation with apparent volume of distribution**

The apparent volume of distribution is defined as the amount of drug in the body divided by plasma or blood concentration at distribution equilibrium. The highly significant co-variation between the postmortem drug level increase and the volume of distribution shows that the latter is a very useful measure for assessing drugs for the possibility of postmortem redistribution. It also correlates the fact that the apparent volume of distribution of a drug also expresses the average tissue to blood concentration ratio. It is a measure for the concentration gradient between tissue and blood. Fick's law of diffusion states that the rate of diffusion of a substance is proportional to the concentration gradient across the diffusion barrier. Consequently, the apparent volume of distribution is a logical measure for the liability of a drug to redistribute from tissues to blood after death.

There is highly significant co-variation between the postmortem drug level increase and the volume of distribution and it can be very useful measure for assessing drugs for the possibility of postmortem redistribution. It also correlates the fact that the apparent volume of distribution of a drug also expresses the average tissue to blood concentration ratio. It is a measure for the concentration gradient between tissue and blood. Fick's law of diffusion states that the rate of diffusion of a substance is proportional to the concentration gradient across the diffusion barrier. Consequently, the apparent volume of distribution is a logical measure for the liability of a drug to redistribute from tissues to blood after death.

Any connection between concentrations measured in life and subsequent to death cannot be established reliably. Consequently, concentrations measured after death cannot generally be interpreted to yield concentrations present before death. Presently there is very little literature available on postmortem changes of drugs and there is need for future extensive research to address various issue on drug related medicolegal cases to find out the better correlation of drug level with postmortem changes.

## **Recommendations**

### **Procedure for ideal blood sampling in postmortem cases**

A standard protocol has to be developed for toxicological samples collection at post mortem examination. Chosen method must be easily

incorporated into routine post mortem practice. Blood for quantitative analysis (e"5 ml) should be taken from two distinct peripheral sites, preferably left and right femoral veins. Femoral blood can be taken by cutting the external iliac vein proximal to inguinal ligament, and milking the distal cut end into the specimen tube. Early ligation of this vessel is recommended to avoid mixing with more central blood during evisceration. An additional larger specimen of blood (e"20ml) for qualitative screening can be collected from a convenient large vessel [29,30].

Following death there can be rapid changes in cellular biochemistry as autolysis proceeds, and drugs and other poisons may be released from heir binding sites in tissues and major organs, also unabsorbed drugs may diffuse from the stomach. Special care should always be taken in the selection of blood and tissues sampling sites, the method of collection of samples, and the labelling of sample containers.

In case of liver and lung, recommended sites are right lobe of liver and apex of the lung.

The concentration of drug found in post mortem blood specimens, even those taken from peripheral sites, will often much higher than the perimortem plasma drug concentration particularly if several days have been elapsed between death and posmortem. It is not scientifically valid to compare the reported postmortem drug concentration of a drug with literature values of plasma drug concentrations in cases of drug over dosages. Similarly the practice of calculating the dose of ingested drug or poison from the product of the posmortem blood drug concentration [C] and the reported volume of distribution [Vd] {Dose = C x Vd} is not recommended. Interpretation of findings can present a problem where there is little background information concerning the case, or where specimen collection has been inadequate. Interpretation of findings can also be difficult in drug abusers where the likely degree of "tolerance" to a drug is unclear because of inadequate history. The recent history, age and state of health are also important factors to be taken into account during interpretation.

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# Comparative Studies of DNA and Protein of *Staphylococcus aureus* Growing in Different Environmental Conditions

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## Abstract

Environment is known to influence organisms. The impact of environmental factors on growth, morphology, reproduction etc. has been reported for several organisms but scant attention has been given to impact on genome and protein expression. In the present study *Staphylococcus aureus* growing in different environmental conditions were studied for variation in DNA and protein. The two different *Staphylococcus aureus* were isolated from agricultural and saltpan soils. Biochemical tests were performed for confirming the presence of *Staphylococcus aureus*. After confirming, genomic DNA was isolated. RFLP analysis and SDS-PAGE were also done to compare the single organism growing in different environmental conditions. Although *S. aureus* growing in different environmental conditions shows similar characteristics at morphological, biochemical and DNA molecular weight level, there was a difference observed in the protein expression level.

## Key Words

Environment, *Staphylococcus aureus*, DNA, Protein, RFLP, SDS-PAGE.

## Introduction

A saltpan is a geological formation found in deserts. It is a flat expanse of ground covered with salt and other minerals, usually shining white under the sun. The organisms living in salt solutions more concentrated than sea water are called halophiles-salt loving. Many halotolerant Gram Positive bacteria are known and *S. aureus* is one of them.

*Staphylococci* are non motile, non spore forming, Gram Positive cocci about 0.5 to 1  $\mu$ m in diameter. They grow in clusters, pairs and occasionally in short chains that resemble bunch of grapes. The generation time of *Staphylococcus aureus* is about 20 min. *Staphylococcus aureus* is widely distributed in environment. *Staphylococci* are associated with skin, skin glands and mucous membrane on the warm blooded animals. Nearly one – third of the human population supports the colonization of the *Staphylococcus aureus* and has been designated as carriers. It also contains protein A, an anti phagocytic virulence factor, covalently incorporated into its cell wall.

The impact of environmental factors on growth, morphology, reproduction etc. has been reported for several organisms but scant attention has been given to impact on genome and protein expression. In the present study *Staphylococcus aureus* growing in different environmental conditions were studied for variation in DNA and protein.

## Material and Methods

Soil samples were collected from the agricultural soil and the saltpan. Agricultural soil was collected from nearby field in Salem. The saltpan soil was collected from maruthi crystals, Thiruporur, near Chennai. One gram of soil from both the samples was taken and 10 ml of water was added to make five different dilutions.  $10^{-4}$  and  $10^{-5}$  dilution showed maximum number of isolates for both the soils (Plate 1a and 1b).

## Bacterial Culture

$10^{-4}$  and  $10^{-5}$  diluted sample was spread on the surface of nutrient agar medium comprising 1 gm of peptone, 1 gm of beef extract, 1 gm of yeast extract, 0.5 gm of NaCl and 2 gm of agar in 100 ml of distilled water adjusted to a pH of 7.2-7.4 and incubated at 37°C for 24 hrs. The individual colonies were isolated and sub cultured in slants on the same medium.

**Gram's Staining:** The individual colonies were stained with Gram's stain to identify the Gram positive and Gram negative colonies.

## Catalase Test

A colony was smeared on a slide and a drop of 3 % hydrogen peroxide was placed and observed for effervescence. The appearance of effervescence indicates that the organisms are catalase producers.

## Oxidase Test

A colony was smeared on the filter disc dipped in the freshly prepared oxidase reagent. Appearance of deep purple colour within 2 seconds indicates oxidase producing organism.

## Indole Test

Tryptone broth was inoculated with test isolates and incubated at 37°C for 24 hrs. About 0.2 – 0.3 ml of Kovac's reagent was added to the test tube, shaken and allowed to stand. The positive reaction was indicated by red ring formation and negative by no colour change.

## Methyl Red Test

Methyl red-Voges Proskauer broth was inoculated with the culture and was incubated at 37°C for 24 hrs. Positive reaction was indicated as red colour and negative as yellow colour.

## Voges Proskauer's Test

Methyl red-Voges Proskauer medium inoculated with culture was incubated at 37°C for 24 hrs. After incubation 3 ml of Barrit's reagent A and 1 ml of Barrits reagent B were added, the tubes were shaken and allowed to stand for 15 minutes and colour change was observed.

## Citrate Utilization Test

Simmon's citrate agar slant were inoculated with the isolates and incubated at 37 °C for 24hrs. Colour change from green to bright blue indicated the utilization of carbon as a sole source.

## Triple Sugar Iron Agar test (TSI)

TSI agar slants were inoculated (Stable streaked) with the test organism and incubated at 37 °C for 24 hrs. The change in colour of the medium from red to yellow in the butt, indicated the production of an acid due to the fermentation of glucose, in the slant due to the fermentation of lactose and sucrose.

**Urease Test:** Urea slant were inoculated with test organism and incubated at 37 °C. The change in the colour from yellow to pink indicated the presence of urease enzyme.



**Coagulase Test:** The organisms were grown either on blood agar or nutrient agar for 18-24 hours and a portion of a single colony was added to 0.5 ml of sterile rabbit plasma in a test tube. The suspension was incubated for 1-4 hours at 37 °C and observed for clot formation by gently tilting and shaking the tubes.

**Mannitol Salt Agar:** The bacterial cultures were streaked on the Mannitol salt Agar. The positive result was indicated by the colour change from pink to golden yellow. The colour change occurs because the organism ferments the sugar. This test is specific for *Staphylococcus aureus*.

**DNA Isolation:** DNA was isolated from the *Staphylococcus aureus* grown overnight at 37 °C in LB medium by the phenol-chloroform method. The isolated DNA was checked on a 6% agarose gel.

## Restriction Fragment Length Polymorphism Analysis (RFLP)

The isolated DNA was restriction digested with BamHI and EcoRI for at least 1 hr in the deep freezer, 10  $\mu$ l of 1% EDTA solution was added to stop the reaction and the digested products were checked on a 6% agarose gel.

## Protein Isolation

Proteins were isolated from the *Staphylococcus aureus* grown overnight at 37 °C in LB medium by a standard method. The isolated proteins were checked on a 12% SDS-PAGE gel.

## Results and Discussion

Environment has deep impact on growth and diversity of organisms. There are two different types of diversities genetic and ecological diversity. Both the diversities are related to the difference among individuals of a single species and between species (Balu, 2004).

Soil taken from two different environments has been screened for the presence of *Staphylococcus aureus*. This bacteria has been isolated from different sources like mangroove, blood culture, dairy birds, clinical samples (Adams, 2005; katsuda et al, 2005; sabour, 2004) but very scant study has been carried out on saltpan and agricultural soil in Southern India.

Out of the two soil samples studied maximum number of *Staphylococcus aureus* could be isolated from cultivable soil than saltpan. (Plate 1a & 1b).

## Identification of Bacterial Culture

Table 1 and 2 summarize the results for the different identification tests and biochemical tests, respectively.

Result of all the above tests confirms the presence of *Staphylococcus aureus*.

In the molecular weight comparison study, DNA of both the isolates showed similar molecular weight (plate 8). For the comparison 500 bp DNA was used as marker. Similar result were obtained for *Staphylococcus aureus* isolated from food and human samples (Hennekinne, et.al., 2003). Another molecular approach to discriminate organism is by studying number of restriction sites (Sachanowicz, 2003). Both the isolates were studied for number of restriction site on them using EcoRI and BamHI enzyme. The study showed no digestion of the genome as no bands could be seen on the gel (plate-9) for both the enzymes. Perhaps the genome of these isolates does not have any site for these enzymes. M13 and  $\lambda$  phage does not have restriction site for these enzymes.

Another molecular approach for characterizing the organism is study of proteins (Hewscorth, 1999). Several fungal and bacterial species have been studied for the protein profile. In the present study proteins of both the isolates were extracted and analyzed using SDS-PAGE with 18.3-94.3 kDa protein marker. The study showed different

band pattern for agricultural soil and saltpan isolate (plate –10). This indicated that protein profile of organisms vary due to differential expression. Presence of different protein pattern has been reported for organisms growing in different environment (Rajagopal, 2004). Thus, it was concluded that even though organisms show similar characteristics at morphological, biochemical and DNA molecular weight level, there is a difference at protein expression level, however

**Table 1.** Result of Identification tests

TEST	RESULT
Morphology on Nutrient Agar Slant	Large circular, smooth opaque colony.
Nutrient Agar plate	Large, circular colonies with orange pigmentation.
Mannitol Salt Agar	Media colour changed to yellow i.e., Mannitol was fermented.
Gram staining	Gram positive cocci in cluster were found.

**Table 2.** Result of biochemical tests

TEST	RESULT
Catalase Test	Positive
Coagulase Test	Positive
Oxidase Test	Negative
Indole Test	Negative
Methy red Test	Positive
Voges Proskauer's Test	Positive
Citrate utilization Test	Negative
Triple Sugar Iron Test	Positive (K/A)
Urease Test	Positive
Sugar Test	Fermented

further investigation is needed towards this.

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# A Review of Common Medicolegal Dilemmas Faced by Clinicians and the Need of a Supporting System

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## Abstract

A Survey was conducted to find out the common medicolegal issues faced by practicing doctors by questionnaire method among fifty doctors.

## Objectives

1. To find out the common medicolegal issues faced by the practicing doctors.
2. To find out the present supporting system and the one they prefer to have.

## Results

The opinion of doctors about certain medicolegal issues commonly encountered by them during their clinical practice were sought. The most difficult aspect of dealing with an injury case was found to be 'determining whether that particular injury is consistent with the alleged cause' by 56%. Most difficult medicolegal issue in clinical practice was expressed as "attending court proceedings" by 64%. According to the participants, the reasons for increasing number of litigations against doctors were 'increasing awareness of public about consumer courts' (74%) and 'infighting of doctors and open criticisms' (44%). The ethical dilemma faced by them while dealing with terminally ill patients was 'relatives asking permission to take the patient home' (62%). One of the major mode of assistance in legal & ethical dilemmas is 'advice from senior colleagues' (84%). The supporting systems they found most ideal are 'medicolegal/ethical consultants' (56%) and involvement of 'Hospital Ethical Committees' (54%) in dealing with such dilemma.

## Introduction

Medical ethics is derived from values in health care. It is concerned with the obligation of doctors and the hospital to patient, other health professionals & society. The problem is medical ethics are (i) those concerning professional activities of doctors and related ones (ii) those related mainly to the beginning and end of life including right to life. It has been seen that a lot of doctors are worried about medicolegal problems faced by them in discharge of their duties.

## Material and Methods

The common medicolegal issues faced by doctors were found out by using a retested questionnaire combined with interview. Fifty doctors doing clinical practice in the Southern district of Kerala; viz. Trivandrum and Kollam were included in the study. Six difficult Medicolegal issues which are frequently encountered were probed into viz.

- i. difficult part which dealing with an injury case
- ii. difficult aspect of dealing with a terminally ill patient.
- iii. the medicolegal work most difficult to be carried out.
- iv. reason for increasing number of litigation against doctors.
- v. present mode of assistance they seek when there is a dilemma.
- vi. supporting system they consider ideal while dealing with a medicolegal or ethical dilemma.

## Results and Discussion

Of the fifty participants, 56% were from Govt. sector and 44% from Private sector, actively involved in clinical work. Distribution

according to the year of clinical experience revealed the following . <5 years (34%), 6 – 10 years (26%), 11 – 15 years (10%), 16 – 20 years (12%), 21 – 25 years (8%), 26 – 30 years (4%) and > 30years (6%). In the study, 60% were males and 40% were females.

The response to "difficult aspect while dealing with an injury case" is shown in Table (1). Most of the participants (56%) found that, 'determining whether the injury is consistent with alleged cause' is the toughest part. It was also mentioned by them that it is very difficult to maintain the medicolegal records as per the norms during casualty/ other clinical duties.

Health care professionals involved in the initial response to these victim, in the Emergency Department are faced with unique problems. The role of Forensic Medicine has been expressly designed to provide solution to some of the most urgent concern in our society and focuses on the areas in which human behaviour interfaces with law. The Forensic Medicine experts' role as a clinical investigator provides a vital liaison between the investigative process and court of law.

One of the most important aspects of any case with forensic potential is the preservation of chain of evidence, or accounting for the whereabouts of all evidences at all times, until its use by the courts. Failure to maintain the chain of evidence may later cause its admissibility to be denied in courts even though the evidence is physically present. Implementation of the role of clinical forensic medicine would provide a uniquely skilled and qualified professional whose responsibilities would be :

1. To develop appropriate forensic protocols in compliance with accreditation standards.
2. Report to proper legal agencies
3. Document collection and preservation of evidence.
4. Secure evidence and maintain the chain of custody
5. Serve as a liaison between the health care institution, law enforcement agencies and make referrals.

When medical treatment and/ crisis intervention is needed<sup>(1)</sup>

According to the participants, difficult Medicolegal works are 'attending court proceedings' (64%), doing 'Medicolegal autopsy' (40%), and 'Medicolegal certifications' (16%) (Table :2)

While dealing with terminally ill patients, 62% said that relatives ask permission to take them back home and 38% said that relatives ask to withdraw life supporting measures not to prolong life. 34% of the participants revealed that they had encountered dilemmas in decision making during such situations (Table :3)

Sometimes, a situation may arise in a case of very serious or unconscious patient whose relative may ask the doctor to discharge their patient either due to inability to afford the cost or due to unsatisfactory treatment. If the patient is serious and is conscious, make the discharge and take in writing from the patient that he is going against medical advice. If the patient in very serious, unconscious and there in a possibility that he may die in shifting and relatives are insisting that they want to take away the patient, under no circumstance the discharge be made. If relatives persist, police may be called for help in containing relatives<sup>(2)</sup>

In a survey conducted on European Doctors by Hurst SA et al<sup>(3)</sup> one of the difficulties most often encountered by them was limitations of treatment at the end of life (79.3%). This finding is consistent with the finding of the present study. The most critical aspect is in relation to continuation or discontinuation of life prolonging treatments. This incorporates many legal, financial and ethical questions<sup>(4)</sup>.

Medical judgment cannot always be guided by legal justification,

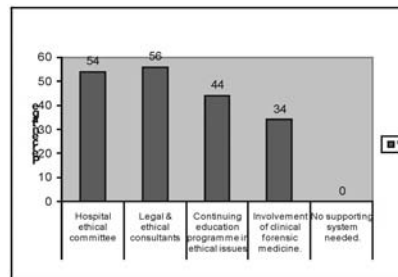
especially since the law is either silent or ambiguous on most issues related to the prolongation of life. In India, only a little discussion on this subject is available. Doctors must follow the local cultural and medical practices. The core philosophy in terminal care remains "Exit with Dignity"<sup>(5)</sup>.

The reasons for increasing number of litigations against doctors were pointed out as, 'increasing awareness of public about consumer courts' (74%), 'infighting of doctors and open criticisms' (44%), 'high amount of compensation awarded by consumer courts' (34%), 'for taking vengeance against doctors (22%) and 'doctors are easy targets and to gain more media attention' (2%). (Table : 4).

When the doctors have to face a medicolegal issue/ethical dilemma, 84% of them solve it by taking advice from the senior colleagues, 12% seek advice and assistance from hospital administrator and 18% consult some available medicolegal consultants (Table : 5). In a study by Hurst S A, Perrier et al<sup>(3)</sup> among European doctors, only 17.6% reported having access to ethical consultation in individual case.

The supporting system, they find most ideal during such dilemmas are, availability of 'Legal or Ethical consultants' (56%), Hospital Ethical Committees (HEC) involving in such matters' (54%), 'continuing education program in ethical issues' (44%) and 'involvement of clinical forensic medicine' (34%). (Figure: 1). Each participant has advocated

**Figure 1.** Supporting system preferred by doctors to deal with legal / ethical dilemmas



at least, one type of supporting system. None said that there is no need of supporting system.

An Ethics consultant is an expert in clinical ethics who either provide ethics consultation or serves as an educator<sup>(6)</sup>. Ethics consultant can improve accreditation reviews, patient satisfaction, avoid unwanted treatment and unnecessary costs, and improve employee morale<sup>(6)</sup>. In an international survey, "Should ethics consultants help clinician face scarcity in their practice"?, it was found that, the type of help offered by ethics support services are considered helpful by physicians<sup>(3)</sup>.

In a study conducted by Radhika Brahne & Sanjay Mehendale on "Profile and role of members of ethics committee in hospitals and research organization in Pune" the ethics committee members participated, suggested an expanded role of Ethics Committee by helping physician to be aware of moral problems by actually training medical doctors and colleagues<sup>(8)</sup>.

If the ethics committee in charged with three principal goals, patient care, research and education of faculty and other personnel, it is logical to entrust each of these to a subcommittee. Issues on care of patients should be considered are relief of suffering, cure of diseases, iatrogenic diseases, cost to patient, prompt attention to needs of patient, care of seriously ill, dying patients & the dead patients<sup>(9)</sup>.

**Table 1.** Difficult aspect while dealing with an injury case.

Opinions about the difficult aspect while dealing with an injury case.	No.	%
1. Determining the type of injury	5	10
2. Determining the exact measurement	12	24
3. Determining whether injury is consistent with the alleged cause	28	56
4. Writing the opinion part in wound certificate	15	30

**Table 2.** Difficult medicolegal issues in clinical practice.

Difficult Medicolegal issues	No.	%
1. Writing wound certificates	6	12
2. Certification of death	1	2
3. Medicolegal autopsy	20	40
4. Other medicolegal certifications	8	16
5. Attending court proceedings	32	64

**Table 3.** Difficult aspect in dealing with terminally ill patients.

Difficult aspect in dealing with terminally ill patients	No.	%
1. Relatives ask & to withdraw the life supporting measures not to prolong life.	19	38
2. Relatives ask permission to take them home	31	62
3. Difficulty arises on decision making	17	34

**Table 4.** Reasons for increasing number of litigation against doctors.

Opinions	No.	%
1. Increasing awareness of public about consumer courts.	37	74
2. Infighting of doctors and open criticisms.	22	44
3. High amount of compensation awarded by consumer courts.	17	34
4. Taking vengeance against doctors.	11	22
5. Doctors are easy targets & to gain media attention	1	2

**Table 5.** Present mode of assistance doctors seek in legal and ethical dilemmas.

Mode of assistance	No.	%
1. Advice from senior colleagues	42	84
2. Hospital administrator	6	12
3. Legal or ethical consultants	9	18
4. By self decision	3	6

## Conclusion

The doctors in the practicing field face a lot of Medicolegal & ethical dilemmas and they need a supporting system to address those issues.

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# Study of Suicidal Poisoning Cases in Tertiary Care Hospital in Central India

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## Abstract

**Objective:** To know the various causative factors behind self poisoning suicide cases.

**Settings:** Indira Gandhi Government Medical College and Mayo Hospital, Nagpur.

**Type of Study:** Hospital Based Cross Sectional Study. **Materials and Methods:** Pre-designed and pre-tested questionnaire schedule was used to collect data from 89 self poisoning cases. **Study variables:** Age and sex of cases, their marital status, locality, socio-economic classification and causative factors behind suicidal self poisoning.

**Statistical analysis:** Chi square test, Mean, Percentage. **Results:** Incidence of poisoning is observed to be more in males as compared to females. Most commonly affected age group is 15-30 years both males and females. Unmarried population, particularly females attempted suicide by poisoning. Self poisoning cases from urban area were found to be more than that of rural area. Population of lower middle socioeconomic strata was found to be more prone for suicidal poisoning. Interpersonal problems were found to be the commonest causative factors for self poisoning followed by financial and academic problems.

## Key Words

Poisoning, suicide, self poisoning, urban, interpersonal problem, central India

## Introduction

Over 100,000 people die by suicide in India every year and contribute to more than 10% of suicides in the world. The suicide rate in India is increasing steadily and has reached 10.8 (per 100,000 populations) in 2008 registering a 20% increase over the value of 1998<sup>1</sup>. In India in the year 2008 a total of 16,196 farmers committed suicide, bringing the total since 1997 to 1,99,132<sup>2</sup>. In Maharashtra alone over 5000 farmers committed suicide in between 2005 and 2009. Majority (76.2%) of them ingested pesticide<sup>3</sup>.

Hanging and poisoning constitute two major modes of suicide in India<sup>4</sup>. While mortality related to hanging is very high, the same is comparatively low in case of poisoning and this offers an opportunity to search for the underlying causes.

Further, the national data on suicide may be problematic as they are largely based on police records and there is no systematic study of accuracy<sup>5</sup>. It thus become necessary to focus on the topic and to find out and ascertain the reason behind such drastic steps and prevent occurrence of such events in every possible way.

## Material and Methods

### Type of Study-Hospital Based Cross sectional study

Study has been carried out under Forensic Medicine Department, Indira Gandhi Government Medical College and Mayo Hospital, Nagpur from August 2006 to April 2008. All self poisoning cases attending Out Patient Department, Medicine and Casualty Department were included in the study. Data were collected in a pre-designed-pretested schedule and were collected directly from conscious, oriented cases and for unconscious, uncooperative or irritable cases data were gathered after the patient was stabilized in the ward. The patients

were well oriented about the nature and the purpose of the study and their written consent was obtained in presence of a non-interested person. The brought dead cases, cases of alcohol intoxication, food poisoning, animal bites and poisoning by other routes except ingestion and those cases from where complete information could not be obtained were excluded from the study. A total of 95 self poisoning cases attended the hospital during the study period. Out of them 89 cases qualified for the study.

**Table I.** Age and sex wise distribution of Poisoning cases

Age group	Male	Female	Total
d" 15	4 (7.84)	2 (5.26)	6 (6.74)
15-25	21 (41.18)	29 (76.32)	50 (56.18)
25-35	15 (29.41)	5 (13.16)	20 (22.47)
35-45	7 (13.72)	1 (2.63)	8 (8.99)
45-55	4 (7.85)	1 (2.63)	5 (5.62)
Total	51 (100)	38 (100)	89 (100)

## Results

On analysis of the data, it was noted by the authors that median age of suicidal self poisoning cases was found to be 25.06 years, majority (57.3%) of the cases were male while only 42.7% of them were female. It was further noted (as shown in table I) that majority (56.18%) of the cases belong to 15-25 years age group while only 6.74% and 5.62% of the cases were from d" 15 and 45-55 years age group respectively. The same results were seen when the cases were

**Table II.** Distribution of poisoning cases according to their marital status

Marital Status	Male	Female	Total
Married	25 (49.02)	12 (31.58)	37 (41.57)
Un married	26 (50.98)	25 (65.79)	51 (57.3)
Widow/widower	0	1 (2.63)	1 (1.13)
Total	51 (100)	38 (100)	89 (100)

( $X^2 = 2.727$ ,  $df = 1$ ,  $P > 0.05$ )

distributed according to their sex (41.18% males and 76.32% females were in 15-25 years age group).

As shown in Table II, majority of the cases (57.3%) were unmarried, 41.57% were married and there was only one widow among the cases. On further analysis of the cases according to marital status and their sex, it was noted that the difference was more marked for the female cases (65.79% females were unmarried as compared to 50.98% males).

**Table III.** Distribution of poisoning cases according to their locality

Locality	Male	Female	Total
Urban	23 (45.1)	26 (68.42)	49 (55.06)
Rural	28 (54.9)	12 (31.58)	40 (44.94)
Total	51 (100)	38 (100)	89 (100)

The difference was statistically insignificant ( $X^2 = 2.727$ ,  $df = 1$ ,  $P > 0.05$ ).

As shown in Table III, majority (55.06%) of the cases belong to urban locality. While only 44.94% of the cases were from rural areas.

On distribution of the cases according to socioeconomic status the authors found that majority (41.57%) of the cases belong to lower

**Table IV.** Socio-economic classification of poisoning cases (Kuppuswami scale)

Classification	Cases
Upper	2 (2.25)
Upper Middle	15 (16.85)
Lower Middle	37 (41.57)
Upper Lower	32 (35.96)
Lower	3 (3.37)
Total	89 (100)

**Table V.** Distribution of cases according to their sex and causative factors of self poisoning

Causative factors of self poisoning	Male	Female	Total
Inter-personal problems*	22 (43.14)	30 (78.94)	52 (58.44)
Financial problems	11 (21.57)	0	11 (12.36)
Academic failure	5 (9.8)	6 (15.8)	11 (12.36)
Unemployment	4 (7.84)	0	4 (4.49)
Psychiatric illness	2 (3.92)	1 (2.63)	3 (3.37)
Addiction to alcohol	4 (7.84)	0	4 (4.49)
Other illness	2 (3.93)	1 (2.63)	3 (3.37)
Reason unknown	1 (1.96)	0	1 (1.12)
Total	51 (100)	38 (100)	89 (100)

middle socioeconomic status followed by upper lower (35.96%) socioeconomic status. While only 2.25% of the cases belong to upper socioeconomic status.

(\*Among Interpersonal Problems- 73.08% (38) were family conflicts, 19.23% (10) were problems related to love affairs, 3.85% (2) were problems with teacher, 1.93% (1) were problems with Neighbour and teacher each) ( $\chi^2 = 18.17$ ,  $df = 4$ ,  $p < 0.01$ )

On distribution of the cases according to the underlying cause of suicide by self poisoning the authors noticed that 58.44% of the cases ingested poison as a result of some interpersonal problems they had. Commonest interpersonal problem was family conflict (73.08%) followed by problems related to love affairs. Self poisoning as a consequence of psychiatric and other illness was seen with minimum number of cases (3.37% each).

When the cases were distributed according to cause of self poisoning and their sex, it was noted that financial problems (21.57%), unemployment (7.84%) and addiction to alcohol (7.84%) were the causes of self poisoning specific to males. While among females interpersonal problems (78.94%) as a cause of self poisoning was the major cause. The difference was statistically significant.

Males while coping with various responsibilities are mostly exposed to stress relating to financial problems that can result in despair, shame, and humiliation. Unemployment leads to depression especially among the males as they fail to fulfill their responsibility and further due to poverty. In India men drinks alcohol twelve times than women<sup>6</sup>, thus alcohol addiction as a cause of suicide by self poisoning is also more common in them.

## Discussion

### Age and Sex of the Cases

Kamath P.G. et al<sup>8</sup> found that majority (56%) of the poisoning cases were male. Shankar P.S.<sup>9</sup> found 71.87% of his study subjects to be male. Senewiratne B. et al<sup>10</sup> also found that among the self poisoning cases males outnumbered the females. Reddy K.S.N<sup>11</sup> found that 70.87% of the cases were male. Findings of the above mentioned studies are in accordance with the findings of the current study. Males are active and mobile and usually they are the one coping with the stress and responsibility of a family belonging to a country with a conservative society like India, this may partly explain their over representation among the self poisoning cases. Ganapati M.N<sup>12</sup> found

that most of the cases of self poisoning were teenagers. Mutalik G.S<sup>13</sup> found that majority of the cases occurred in between 15 and 24 years. Kamath P.G.<sup>8</sup> found that more males were between 13-20 years followed by 21-30 years age group. Among females cases were more in between 21-30 years than 13-20 years age group. Aggarwal P et al<sup>14</sup> found that the median age of the self poisoning cases was 26.5 years. Similar findings were seen in the present study. Boys are on the verge of turning into a young adult in the late adolescent age, on the process they experiences emotional turbulences, develops abstract thinking, copes with pressures in academic field, develops attraction towards the opposite sex and thus owns a sensitive and yet not so mature personality. There is no clear cut upper age limit of such mental set up but certainly may continue till they become young adults.

### Marital Status of Poisoning Cases

Jain R. et al<sup>15</sup> found that poisoning was more common (56%) in married individuals. Nigam M et al<sup>16</sup> found that only 36.75% of the study subjects were unmarried. Karki P et al<sup>17</sup> found that out of the total cases 62% were unmarried. Findings of the current study are in contrast with the findings of Jain R. et al<sup>15</sup> and Nigam M et al<sup>16</sup> but are in accordance with the findings of Karki P. et al<sup>17</sup>. Self poisoning with a motive to kill oneself is a drastic step and depicts the psychology of the person, who takes an eager decision to kill himself, such person usually withdraw himself from the society and prefer to stay alone till the material moment, so it is more likely from this point of view of their being unmarried. It is worth mentioning that the sample size of the current study was 89 and that of Karki P. et al<sup>17</sup> were 37 where as the sample size of Jain R et al<sup>15</sup> was 400 and that of Nigam M et al<sup>16</sup> was 117, the different findings observed may be a result of this difference and thus will need further researches with greater sample sizes.

### Poisoning Cases and their Locality:

Aggarwal P. et al<sup>14</sup> found that 71.43% of the self poisoning cases were from semi rural areas. Dhattarwal S.K. et al<sup>18</sup> found that 71.03% of the cases were from rural areas. Senanayake N et al<sup>19</sup> found that 51.67% of the cases were from urban areas. Senanayake N et al<sup>19</sup> studied 718 subjects and his sample size was bigger than that of Aggarwal P.<sup>14</sup> and Dhattarwal S.K.<sup>18</sup>. Finding of the current study (55.06% cases were from urban locality) is in accordance with the finding of Senanayake et al<sup>19</sup>. In urban areas there is a sense of isolation, uncertainty of future and anxiety which negatively affects mental health of individuals and these factors ultimately lead to increased incidences of suicides<sup>5</sup>.

### Socio-Economic Status of the Cases

Dash S.K. et al<sup>20</sup> found that majority of the cases (83.7%) belong to middle socioeconomic status. Gupta B.D.<sup>21</sup> found that most of the cases (87.1%) were from lower socioeconomic status. In the current study where Kuppuswami scale of socioeconomic classification was used more or less similar findings were observed, as majority of the cases were from upper lower (41.57%) and lower middle (35.96%) socioeconomic groups while only 2.25% of the cases were from upper socioeconomic status. People in the lower middle and upper lower socioeconomic groups are exposed to financial stress and other complexities of life.

### Causative factors behind self poisoning

Tsoi W.F. et al<sup>22</sup> found that the major causative factor was interpersonal problems (58%) that include spouse/partner, family, friends etc. Siwach S.B. et al<sup>23</sup> found that marital disharmony was the commonest causative factor (32.7%) followed by economic hardship (15.3%), while academic worries resulted in 5.5% of the cases. Psychiatric illness was the causative factor behind 3.4% of the cases. Findings of the present study are similar to the findings of Tsoi W.F. et al<sup>22</sup> and Siwach S.B. et al.<sup>23</sup>. These common causative factors give rise to emotional crisis leading to self poisoning.

**Conclusion:** Incidence of poisoning is observed to be more in

males as compared to females, probably because of burden of family is more on males in country like India, also more active lifestyle makes male more prone for suicide. Most commonly affected age group is 15-30 years both males and females, less mature thinking with high expectations in life predisposes this age group for suicide by poisoning. Unmarried population, particularly females attempted suicide by poisoning. Lack of emotional support in modern nuclear family may be the reason. Self poisoning cases from urban area were found to be more than that of rural area the reason may be the study centre being urban. Population of lower middle socioeconomic strata was found to be more prone for suicidal poisoning followed by upper lower strata. This may be because of stress of surviving in competitive world with limited resources. Interpersonal problems including family conflicts and problems related to love affairs were found to be the commonest causative factors for self poisoning followed by financial and academic problems.

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# Anthropometric and Anthroposcopic Analysis of Face in Forensic Identification-Some Essential Considerations

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## Abstract

Just like biometric fingerprint identification, facial identification using anthropometry and anthroposcopy can provide law enforcement agencies with a valuable tool for multiple public safety applications including medico-legal investigations. While analyzing the CCTV footage and questionable images at a crime scene, the facial identification is one of the most important task forensic scientists carry out manually during their investigation. The present communication is intended to emphasize on some essential and important issues related to accuracy and reliability in forensic research related to anthropometry and anthroposcopy of the face.

## Key Words

Medico-legal investigations, Anthropometry; Anthroposcopy; Personal identification; Technical/measurement error; Reliability/accuracy.

## Introduction and Background

Anthropometric and anthroposcopic analysis of face play an important role in reconstruction of face in forensic and medico-legal investigations. With the introduction of new technologies like CCTV cameras and video surveillance system, rare and common features of face help in the identification of CCTV footage. Recently published work by Mane et al [1] and Roelofse et al [2] has analyzed different human faces using anthropometry and anthroposcopy in Indian and African population respectively. Whenever, there is a video or image available from crime scene, the facial identification is one of the most important task forensic scientists carry out manually during their investigation. Forensic scientists perform manual examination of facial images or videos for a match with huge database of mug shots (Along with fingerprints, law enforcing agencies universally, routinely use photographs for criminals' records. These images have become commonly referred to as 'mug shots' and are characterized by two photographs, one from photograph of the face and the other a profile picture). The proof of identity in many cases like road traffic accidents, bomb blasts and other terrorists' attacks, is most frequently achieved by comparing the individual's appearance to a previously captured image. This may be a passport photograph in the case of immigration, a photograph on any type of identity card and driving license, credit card or a still from CCTV footage in forensic settings.

The morphological classification of faces has been successfully adopted by International Criminal Police Organization<sup>3</sup>, Vanezis et al<sup>4</sup>, Aßmann et al<sup>5</sup>, Ohlrogge et al<sup>6</sup>, Ritz-Timme et al<sup>7</sup>, however, the use of morphological facial features in personal identification still remained inconclusive.

In future research on anthropometric and anthroposcopic analysis of face it becomes necessary to be aware of certain essential issues of significance.

## Careful Anthroposcopic Observations of the Face

The anthroposcopic observations of the morphological features of the face require a great deal of practice and experience. It is very difficult for an untrained person to comment about the shape of the face like oblong, round, oval, rectangular, square and so on. Such data

collected without anthropological knowledge and specific training of the investigator is subject to major error. Besides, the intra-observer error in taking measurements should be considered so that the extent to which the measurement error can influence the shape and size of the face can be measured. Intra-observer perturbations can be avoided by ensuring that well trained group of researchers collects all the measurements using standard landmarks and techniques.

## Technical Error/Measurement Error

While taking anthropometric measurements, the researchers should take into account the technical/measurement error inherent in taking a particular measurement. The technical error of a measurement is an accuracy index and represents the measurement quality and control dimension<sup>8-11</sup>. The results of the studies conducted without calculating personal error/technical error, are thus subject to major error. The standardization of manually operated equipments with standard corrective methods should be done to avoid measurement errors. During data collection, the instruments like anthropometer, sliding caliper, spreading caliper etc. should regularly be checked for accuracy.

## Adequate Sample Size

Anthropometric and anthroposcopic studies with a small sample size are subject to major errors. The sample size is statistically significant when it is large enough to accurately represent the whole population.<sup>11</sup> Thus, such studies should be conducted on appropriate sample. Sometimes the study sample does not represent the whole population of the region especially in countries like India and Africa where a vast number of population groups reside with a unique blend of different cultures, environments, and genetic characteristics. It becomes vital to conduct studies on individual population groups and not on a mixed population.

The present communication is intended to emphasize on some essential issues related to accuracy, reliability and reproducibility in forensic research related to anthropometry and anthroposcopy. A classic and useful work on the subject matter would be to conduct a population-specific study with an adequate sample size. The findings should be compared adequately with the results obtained in other similar studies all over the country and worldwide. The study should ideally be taken by those trained well in collecting somatoscopic data and interpreting them. The standardization of manually operated equipment with standard corrective methods may also be done to avoid measurement errors. Digital data collecting instruments are often prone to errors that become unavoidable, but this is not so with manual instruments which may be corrected manually from time to time. Also, by ensuring that a small group of trained researchers collects all the measurements, intra-observer perturbations may be avoided. Taking care of the inter-observer and intra-observer biases make the study findings reproducible and enhancing the practical utility and acceptability of a standard research.

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## Conflict of Interest HIL



# Trends of Insecticide Poisoning in Bhavnagar Region of Gujarat

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## Abstract

The present study was undertaken to evaluate the pattern of insecticide poisoning deaths in Bhavnagar region of Gujarat. The Paper presents the study of 143 cases of poisoning during the span of one year from 01/04/2008 to 31/03/2009. Out of 878 Post mortem examination done during the study period 143 cases were of poisoning, out of which insecticide poisoning found in 72 cases. The cases were then analyzed on various parameters in the proforma prepared for this purpose. We concluded that majority of victims were married, Hindu, males from rural area and low socioeconomic group. The incidence of poisoning was more common during 15-30years of life. Suicidal cases were more common than accidental cases. No case of homicidal poisoning was detected in present study. Chemical analysis of viscera done in all 72 cases. Monocrotophos Insecticide topped the list as killer.

## Key Words

Poisoning, Insecticide, Monocrotophos, organophosphorus, Post mortem, Bhavnagar

## Introduction

India is a predominantly agrarian country with about 60-80% rural population. Pesticides are routinely used for advanced farming. These are readily available over the counter. Therefore, a pesticide is an easy access source for suicidal purpose particularly after trivial family squabbles

Poison and poisoning are known to antiquity. The use of Poisons dates back as far as spiritual and mythological beliefs have been recorded. [1] Death as a reason of poisoning/drug abuse is of enormous medical, legal and social significance.

According to WHO, 3 million acute poisoning cases with 2,20,000 deaths occur Annually. [2,3] Of these, 90% of fatal poisoning occurs in developing countries, especially, amongst the agricultural workers. Everyday around the world almost 700 people die from the poisoning and several thousands more are affected by poisoning. [4]

Organophosphorus compounds have come as boon to agriculturists and horticulturists to control and eradicate pest and insect affecting the plants and crops. Though these substances are in market only for decades in our country, they have created many serious problems, because most suicides in the recent years have been traced to their oral intake. They have been preferred because of their rapid action, ready availability and knowledge of lethal potency.

Poisoning due to Organophosphorus compounds has been very common in our country. The incidence of deaths due to poisoning has steadily increased in the recent past and has reached a level where it can be called 'a social calamity'. In young adult (15-29 years), it was 6<sup>th</sup> most common cause of death in India. [5] As per WHO 94 % of fatal poisonings occurred in low and middle income countries.

Accidental ingestions are most common in children less than 5 years old. Both homicidal and suicidal cases of poisoning are more common in India than in western countries, owing to easy availability of poison in the Indian markets.

Thus, the incidence of poisoning and high mortality rate has prompted to undertake this study.

## Material and Methods

This is hospital based study. This study has been carried out at Government Medical College and Sir T. Hospital, Bhavnagar during the period of one year from 01/04/2008 to 31/03/2009. During the present study period 878 autopsies were conducted in the mortuary of Sir T. Hospital, Bhavnagar was included. Out of total 878 cases of post mortem examination, Insecticide poisoning was observed in 72 cases. Relevant history was obtained from relatives of the deceased or the investigating police officer. Post mortem examination was conducted. Detailed and complete examination of bodies was done including external examination of the body and internal examination. Routine viscera were preserved for chemical analysis examination after the bottles are labeled & sealed properly. The details of cases were entered in designed Proforma.

## Observations

**Table 1.** Distribution of Post mortem insecticidal poisoning cases according to age and Sex

Age group (in year)	Male		Female		Total	
	Cases	%	Cases	%	Cases	%
00 – 10	00	00.00%	01	01.39%	01	01.39%
11 – 20	08	11.11%	16	22.22%	24	33.33%
21 – 30	14	19.45%	04	05.55%	18	25.00%
31 – 40	07	09.72%	01	01.39%	08	11.11%
41 – 50	14	19.45%	02	02.78%	16	22.23%
51 – 60	03	04.16%	00	00.00%	03	04.16%
61 – 70	01	01.39%	01	01.39%	02	02.78%
71 – 80	00	00.00%	00	00.00%	00	00.00%
Total	47	65.28%	25	34.72%	72	100%

From above table observation is made that total 47 (65.28%) males and 25 (34.72%) females died due to insecticidal poisoning. The male: female ratio is 1.88:1.

In the present study maximum numbers of cases were observed in age group 11 – 20 i.e. 24 cases (33.33%). In the age group of 11-20 years only 03 cases are below 15 years, while 21 cases are observed above 15 years & below 20 years of age, followed by 21 – 30 years 18 cases (25.00%) least incidence was found in the age group of 61 – 70 years 02 cases (02.78%) & 51 – 60 years 03 cases (04.16%). In the age group 0 – 10 years 01 Cases (01.39). Males predominated in age group 21-30 and 41-50 years, while females in 11-20 years age group.

**Table 2.** Distribution of Post mortem insecticidal cases according to area and marital status

Area	Male		Female		Total	
	Married	Unmarried	Married	Unmarried	Cases	%
Urban	10	06	04	03	23	31.94%
Rural	25	06	05	13	49	68.06%
Total	35 (48.61%)	12 (16.67%)	09 (12.50%)	16 (22.22%)	72	100%

The above table shows that maximum number of insecticidal death belong to rural area, comprising 49 (68.06%) of total while 23 (31.94%) deaths belongs to urban area. The most cases found in rural area due

to the easy availability of agricultural insecticides.

In the present study, it is evident that the incidence was higher in married persons – 44 (61.11%) cases compared to unmarried persons – 28 cases (38.89%).

Out of 47 male cases, 35 males (74.46%) were married and 12 males (25.53%) were unmarried.

Out of 25 females, 09 females (36.00%) were married and 16 females (64.00%) were unmarried.

Higher incidences of insecticidal poisoning deaths are seen in married males & unmarried females.

The male to female ratio of married person is 3.88:1 while in unmarried is 0.75:1.

**Table 3.** Distribution of poisoning Insecticidal cases according to Educational status

Educational Status	Male	Female	Total	Percent
Below SSC	04	03	07	09.72%
Graduate	00	00	00	00.00%
HSC	00	00	00	00.00%
Illiterate	32	16	48	66.67%
Not Applicable	00	00	00	00.00%
Not known	00	00	00	00.00%
Post Graduate	01	00	01	01.39%
Primary	08	06	14	19.44%
SSC	02	00	02	02.78%
Total	47	25	72	100%

From the above table the observation is made that out of 47 males 32 (68.08%) are illiterate while in females 16 (64.00%) are observed to be illiterate out of 25. Overall 48 (66.67%) cases are illiterate. 14 (19.44%) cases had primary education. Followed by below SSC 07 (9.72%) cases and in 01 (1.39%) case victim was postgraduate.

**Table 4.** Distribution of poisoning Insecticidal cases according to manner of death

Manner	Male	Female	Total	%
Suicide	43	21	64	88.89%
Accidental	04	04	08	11.11%
Homicidal	00	00	00	00.00%
Un determined	00	00	00	00.00%
Total	47	25	72	100%

**Table 5.** Distribution of Insecticidal poisoning cases according to Social Economic class

Class	Frequency	%
Lower	59	81.95%
Middle	13	18.05%
Upper	00	00.00%
Total	72	100%

**Comparison of Insecticidal poisoning cases.**

Study/ Author	Age Group	M:F	Occupation	Socio Eco	Manner	Litracy	Common poison
Manish Nigam et al <sup>6</sup>	21-30	2.44:1	Farmer, House wife	Lower	Suicide	Illiterate	Cypermethrine
Vaghela <sup>7</sup>	21-30	1.63:1	Farmers	Lower Class	Suicide	Below metric, illiterate	Insecticides
Zine K. U et al <sup>2</sup>	16-25	2.14:1	Farmers	Lower	Suicidal	—	Insecticides
S. Chaudhry <sup>4</sup>	21-30	1.36:1	—	Middle Lower	Suicide	—	Monocrotophos
Dhatarwal S.K et al <sup>8</sup>	11-30	2.18:1	Agricultural, labourer	Middle Class	—	Below metric, illiterate	—
Present study	15-30	1.88:1	Agri labourer	Lower	Suicide	Illiterate	Monocrotophos

while in females house wives are the most victim. Insecticidal poisoning is seen in person belonging to lower socio economic group. The incidence is more in married males and unmarried females. Suicide is the common mode of poisoning, because person associated with 21 – 30 years age group is most active group physically, mentally and socially. In study of

**Table 6.** Distribution of poisoning cases according to the Poisonous Compound detected after Chemical analysis.

Compound	Cases	%
Monocrotophos	24	33.33%
Quinalphos	07	09.72%
Methyl parathion	06	08.33%
Endosulphan	06	08.33%
Malathion	04	05.55%
Dimethioate	05	06.94%
Dichlorwash	03	01.38%
Phoselon	01	01.38%
Chlorpyriphos	01	01.38%
Carbamate	01	01.38%
Phosphamidon	01	01.38%
No poison detected	04	05.55%
Report not received	09	12.50%
Total	72	100%

From the above table it is seen that 64 (88.89%) cases are suicidal in nature while 08 (11.11%) cases are accidental in nature. Not a single case of Homicidal insecticidal poisoning was encountered in the present study.

In the present study the maximum cases were from lower socio-economic class-59 cases (81.95%) while 13 cases (18.05%) from middle class.

In the present study, Chemical Analysis reports were received in 63 (87.50%) cases. Out of these 63 cases insecticide poison detected in 59 (93.65%) cases out of which Monocrotophos detected in 24 (33.33%) cases, Quinalphos in 07 (09.72%) cases, Methyl Parathion in 06 (08.33%) cases, Endosulphan in 06 (04.91%) cases, Malathion in 04 (03.28%) cases, Dimethioate in 05 (04.10%) cases, Dichlorwash in 03 (02.45%) cases while Phoselon, Chlorpyriphos, Carbamate and Phosphamidon in 01 (00.82%) case each. In 13 (10.66%) cases no poison was detected.

**Discussion**

Trends of the poisons seem to be a function of need and availability of specific substances. In India, opium and arsenic were commonly abused in the olden days, but with the change of time, the incidence of various poisons is also changing. Since last few years, there is a significant increase in the misuse of agrochemicals like insecticides and Rodenticides.

From above table it is seen that insecticidal poisoning is common in 21 – 30 years age group with male predominance. Due to stress of the life, family responsibility, poverty, conflict with family member and the availability of poison at home because of agri based economy, poisoning is common in males. Among males farmers are the victim in most cases

Manish Nigam et al [6] Cypermethrine was the most common compound. In present study Monocrotophos was the most common compound which correlate with findings of S.choudhary. [4] Other findings of the Manish Nigam’s et al [6] study are correlate well with the present study findings.

Most of the authors have studied the incidence of poisoning according to poison on the history given by police officers, relatives of the victim and by medical cases papers. They have not mentioned the poisonous compound in their studies after chemical analysis except Nigam et al. While in present study we have scientifically and accurately calculated the incidence of poisoning according to the poison after the chemical analysis reports.

## Recommendation

Reducing deaths from self-poisoning require prevention strategies include treating the problems leading to suicidal behaviours involving pesticides; changing attitudes, knowledge, and beliefs about pesticides; controlling access to dangerous pesticides, including developing secure storage practices and improving the medical treatment of poisonings. More research is needed to better understand suicides involving pesticides in their cultural contexts and to evaluate the effectiveness of intervention programs, including assessment of possible substitution of methods.

1. The regulations regarding application of pesticides should be made more stringent. There should be creation of an occupation of pesticide applicator by creation of a new law. This shall help to reduce the risk of self-harm in vulnerable groups like small farmers who often find themselves in stressful situations by reducing household availability to pesticides.
2. Manufacture of chemicals and compounds with less lethality, and if required, highly lethal ones not to be available in public domain.
3. Compulsory childproof container where ever possible.

4. Making available antidote in all health care institute.
5. Training of health personnel in emergency care.
6. Public education and public awareness are required for reducing Poisoning deaths.

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# A Study of Anti-inflammatory Activity of Azadirachta Indica (Neem) Root in Wistar Albino Rats

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## Abstract

**Aim:** To evaluate antiinflammatory activity of 70% alcoholic extract of neem root.

**Materials and Methods:** The 70% of alcoholic extract of neem root(NRE)was given in the dose of 200,400,800 mg/kg in wistar albino rats of either sex in test group and for comparison Aspirin was given in the dose of 100 mg/kg in standard group. These animals were tested in carrageenan induced rat paw edema(for 24 hours) and cotton pellet granuloma(7 days)

**Results :** NRE in the dose of 800 mg/kg showed significant ( $p<0.05$ )in carrageenan induced rat paw edema model.NRE in the dose of 400 and 800 mg/kg showed significant ( $P<0.05$  and  $p<0.01$ ) in cotton pellet granuloma. But in both models it was less significant than Aspirin

**Conclusion:** NRE has antiinflammatory activity.

## Key Words

Neem root; Alcohol; Anti-inflammatory effect.

## Introduction

Different parts of Azadirachta Indica was tested for different activities e.g. antiviral, anti gastric ulcer, antiandrogenic, hepatoprotective and antifungal,(1,2,3,4,5)Seeds:- antimalarial activity(6,7),flower:- anticancer activity (8),hypolipidemic activity(9). The water soluble fractions of the alcoholic extract leaves exhibited an antiinflammatory effect against carrageenan induced rat paw edema (10). Considering these things we carried out this study to evaluate whether root of this tree is having antiinflammatory activity.

## Material and methods:

**Plant material:-** Neem roots were collected from neem tree in Navodaya Medical College campus. The roots were shade dried in department of pharmacology. Shade dried roots were powdered. Alcoholic extracts was obtained by continuous extraction in percolator using 70% ethyl alcohol. Fresh solution was prepared by dissolving extract in distilled water before each experimental procedure.

**Animals:** Wistar rats of either sex weighing around 200-250 grams were employed in present study. The rats were provided standard laboratory feed and tap water. They were exposed to an alternative light and dark cycle of 12 hours and had free access to food and water. The experimental protocol was approved by the institutional animal ethics committee. The whole project was carried out as per guidelines of the Committee for the Purpose of Control and Supervision of Experiments on Animals(CPCSEA)

**Chemicals:** Carrageenan was obtained from s.d. fine-chem Ltd Boisar. Tablet Aspirin 75 mg in each tablet(Ecosprin- USV) was purchased from pharmacy shop. The rat paw edema activity was evaluated by Mercury plethysmometer fabricated by Alka scientific company Nagpur.

## Methods

### 1. Cotton pellet granuloma(11)

On first day of experiment 4 mg cotton pellet were inserted in inner side of right thigh of each rat under aseptic precaution and ether

anesthesia. The pellets were remained in bodies of rats for 7 days. The albino rats were divided into 5 groups. All received drugs orally once daily for 7 days. Each group was containing 6 rats.

1. Control:- Received 2 ml of distilled water.
2. Standard:- Received Aspirin 100 mg/kg(12)
3. Test I:- Received NRE 200 mg/kg
4. Test I:- Received NRE 400 mg/kg
5. Test I:- Received NRE 800 mg/kg

On 8th day the rats were sacrificed and wet cotton with granuloma were removed. Weights of these cotton pellets were measured. Then they were dried in hot air oven. Again the weights were measured. Change in weight of granuloma was calculated by subtracting weight of cotton. Percentage of inhibition was also calculated.

### 2.Carrageenan induced rat paw edema (13)

1% carrageenan solution was prepared and injected in hind paw (plantar aspect) of the rats. They received carrageenan 60 minutes of oral administration of standard and test drugs similarly as that of cotton pellet granuloma. Left hind limb was marked at tibiotalar junction. Paw was dipped in mercury plethysmometer upto the mark. Readings were taken at 1,2,3,6 and 24 hours.

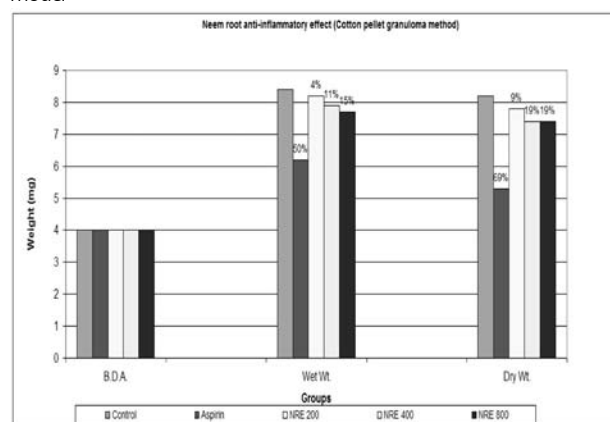
**Statistical analysis:** Analysis was done with One way ANOVA followed by Dunnet test.

## Results

NRE was given in the dose of 200 mg/kg showed reduction in wet and dry weights of granuloma but that was statistically not significant. But when given in the dose of 400 mg/kg showed significant( $p<0.05$ ) reduction in wet and dry weights of granuloma. It reduced wet weight by 11% and dry weight by 19% as comparison to control. In the dose of 800 mg/kg it showed significant( $p<0.01$ ) reduction in wet and dry weights of granuloma. It reduced wet weight by 15% and dry weight by 19% as comparison to control. Aspirin was given in the dose of 100mg/kg showed significant ( $p<0.01$ ) reduction in wet and dry weights of granuloma. It reduced wet weight by 50% and dry weight by 69% as comparison to control.(Fig 1 and table 1)

NRE in the dose of 200 mg/kg and 400 mg/kg showed reduction in rat paw volume, but it was not statistically significant. But when it was given in the dose of 800 mg /kg showed significant reduction in

**Fig 1:** Effect of Neem Root Extract On Cotton Pellet Granuloma model



**Table 1.** Effect of Neem Root Extract On Cotton Pellet Granuloma model

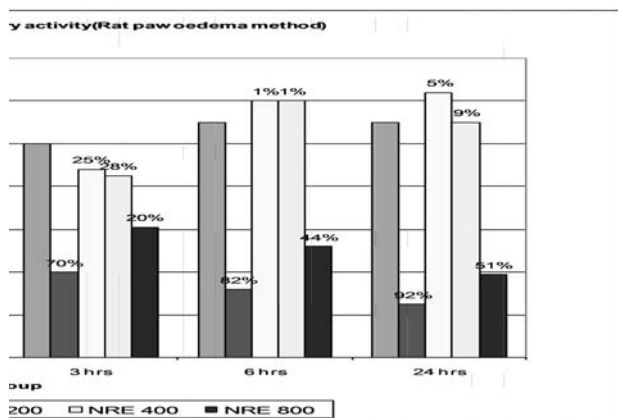
Groups	Weight of cotton pellets (mg)	B.D.A. Drugs and doses	A.D.A. (After subtraction of weight of cotton 4 mg)	
			Wet weight (mg) (mean ± S.E.M.)	Dry weight (mg) (mean ± S.E.M.)
I	4	Distilled water (2ml orally)	8.4 ± 0.14	8.2 ± 0.1
II	4	Aspirin (630mg/kg orally)	6.2 ± 0.093**	5.3 ± 0.05**
III	4	NRE (200mg/kg orally)	8.2 ± 0.22	7.8 ± 0.19
IV	4	NRE (400mg/kg orally)	7.9 ± 0.15	7.7 ± 0.097*
V	4	NRE (800mg/kg orally)	7.8 ± 0.19*	7.4 ± 0.19*

\*p < 0.05, \*\* p < 0.01, \*\*\* p < 0.001, B.D.A.- Before drug administration, A.D.A.- After drug administration, NRE- Neem root extract

**Table 2.** Effect of Neem root extract on carrageenan induced rat paw edema

Groups	Drugs and doses	LEFT HIND PAW VOLUME (c.c.) (mean ± S.E.M.)					
		B.D.A.	A.D.A.				
			1hrs	2hrs	3hrs	6hrs	24hrs
I	Distilled water (2ml)	0.25 ± 0.04	0.84 ± 0.05	0.98 ± 0.07	1 ± 0.07	1.1 ± 0.07	1.1 ± 0.1
II	Aspirin (630mg/kg)	0.2 ± 0.03	0.34 ± 0.03**	0.38 ± 0.05**	0.4 ± 0.07**	0.32 ± 0.06**	0.25 ± 0.1**
III	NRE (200 mg/kg)	0.27 ± 0.02	0.74 ± 0.05	0.78 ± 0.06	0.88 ± 0.01	1.2 ± 0.04	1.24 ± 0.06
IV	NRE (400 mg/kg)	0.27 ± 0.04	0.6 ± 0.05	0.8 ± 0.05	0.85 ± 0.03	1.2 ± 0.04	1.1 ± 0.05
V	NRE (800 mg/kg)	0.18 ± 0.03	0.4 ± 0.01*	0.52 ± 0.05*	0.61 ± 0.07*	0.52 ± 0.05*	0.39 ± 0.1*

\*p < 0.05, \*\* p < 0.01, \*\*\* p < 0.001, B.D.A.- Before drug administration, A.D.A.- After drug administration, NRE- Neem root extract

**Fig 2:** Effect of Neem root extract on carrageenan induced rat paw edema

paw volume (p < 0.05). There was 48% reduction in first hour, 20% reduction in third hour and 51% reduction in 24 hours in comparison to control. Aspirin in the dose of 100 mg/kg showed significant (p < 0.01) reduction in paw volume. There was 78% reduction in first hour, 70% reduction in third hour and 92% reduction in 24 hours in comparison to control. (Fig 2 and table 2)

## Discussion

Many studies were done on anti-inflammatory activity of part of neem tree. Sodium nimbate (a soluble salt of nimbin) showed anti-inflammatory activity in rat paw edema. (14) When alcoholic neem leaf extract used in the dose of 100, 300 and 1000 mg/kg it reduced carrageenan induced rat paw edema in dose related manner. (15) The mechanism studied using model of carrageenan induced rat paw edema was inhibition of deleterious effect of 5HT and PGE1 on blood vessels. The PGE1 was significantly inhibited by alcoholic neem leaf extract. (16) other mechanisms studied using cotton pellet granuloma model. The proliferation of fibroblasts and formation of new granuloma are associated with cotton pellet granuloma. So, DNA and RNA levels should increase during the phase of inflammation. Alcoholic neem leaf extract in the dose of 200 mg/kg decreased levels of DNA and RNA in the granulomatous tissue. It also decreased lipid peroxide levels which

causes degradation of tissue in the process of inflammation. Alkaline phosphatase and acid phosphatase are the enzymes responsible for exudation are inhibited by neem leaf extract (17)

In our study we used two models carrageenan induced rat paw edema (model for early phase of inflammation) and cotton pellet granuloma (model for exudative and proliferative phases of inflammation) (18). Nimbidin which is an active compound having anti-inflammatory activity (14). It is one of the constituent of neem root bark. (19) It may be responsible for anti-inflammatory activity of root plus root bark extract used in our study. All constituents in this extract should be studied separately for anti-inflammatory action.

## Conclusion

70% alcoholic extract of NRE has anti-inflammatory activity and it suppresses exudative and proliferative phase of inflammation in dose dependent manner. Further studies are required for active ingredient which is responsible for its anti-inflammatory activity.

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# Management of Combined Endodontic - Periodontal Lesion : Case Reports

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## Abstract

Endodontic-periodontal combined lesion is a clinical dilemma because making a differential diagnosis and deciding a prognosis are difficult. Lesions of the periodontal ligament and adjacent alveolar bone may originate from infections of the periodontium or tissues of the dental pulp. Periradicular bone loss secondary to endodontic pathosis is typically seen in teeth with necrotic pulps. The ultimate goal of periodontal therapy is not only to maintain the natural dentition, but also to restore lost periodontium. Combined periodontal and endodontic diseases involve the periodontal attachment apparatus. The treatment of endodontic-periodontal combined lesions requires both endodontic therapy and periodontal regenerative procedures. With advancements in new techniques and materials different treatment choices are available, providing a superior prognosis.

This article includes case reports of combined endo-perio lesions which were first treated with conventional endodontic therapy & then followed by periodontal surgery. This combined treatment resulted in a radiographic evidence of alveolar bone gain.

This case report demonstrates that proper diagnosis, followed by removal of etiological factors and utilizing the combined treatment modalities will restore health and function to the teeth with severe attachment loss caused by an endo-perio lesion.

## Key Words

Combined endodontic-periodontal lesion, periradicular surgery, guided tissue regeneration.

## Introduction

Preservation of the natural dentition is the ultimate goal of dental therapy. In periodontics, the goal is not only to maintain the natural dentition, but also to restore lost periodontium<sup>1</sup>. Lesions of the periodontal ligament and adjacent alveolar bone may originate from infections of the periodontium or tissues of dental pulp<sup>2</sup>. Periradicular bone loss secondary to endodontic pathosis is typically seen in teeth with necrotic pulps. Combined periodontal and endodontic diseases involve the periodontal attachment apparatus. Pulpal necrosis may lead to destruction of the attachment apparatus by extension through the apical foramen or through accessory canals that may be located at different levels on the root surface. An acceptable treatment results, for combined endodontal and periodontal (endo-perio) lesions may be obtained by endo-perio therapy. However, when a significant loss of the periodontal attachment apparatus and osseous structure occurs, the long-term prognosis becomes poor<sup>3</sup>.

Formulating a differential diagnosis among combined lesions has been challenging. Therefore, diagnostic steps should include thorough patient-reported dental history, visual inspection for presence of sinus tract and severe inflammation in association with large restoration and anatomic anomalies such as palatal grooves<sup>4</sup>, radiographic confirmation with tracing the sinus track, results of clinical findings including percussion and palpation, routine periodontal assessment for presence of mobility or deep probing depth, testing for coronal cracks, and pulp vitality testing<sup>5</sup>. These tests are customarily accepted as being reliable in differentiating between pulpal and periodontal disease.

This report presents a few cases in which no bone remained around the facial and apical areas of maxillary teeth, when a flap was raised. It

was treated first with conventional endodontic therapy combined with periodontal regenerative procedures.

## Case Reports

**Case 1:** A 34-yr-old female presented to Department of Conservative Dentistry & Endodontics, Sardar Patel Postgraduate Institute of Dental & Medical Sciences, Lucknow, Uttar Pradesh, with a chief complaint of pus discharge from maxillary central incisors. She was systemically healthy and medical history was not contributory to this dental problem. On clinical examination, probing depth was 12mm on mesial aspect of 11 (Fig. 1) and 8mm on mesial of 21 (Fig. 2). Mobility was grade II in both teeth. The buccal gingiva showed slight swelling and clear signs of inflammation. The teeth did not respond to percussion and palpation tests. It neither responded to the electrical pulp test nor cold test (Endo Ice). Periapical radiograph showed a deep bony defect extending to root apex of 11, 21, in addition to the periapical radiolucency (Fig. 7). Initial diagnosis was pulp necrosis and asymptomatic apical periodontitis, and the teeth were thought to have primary endodontic involvement. However, the pattern of periodontal bone loss, with a wide base, coupled with generalized marginal periodontitis, suggested that there was also primary periodontal involvement in this case<sup>6</sup>. Therefore, considering the dental history, clinical tests, and radiographs, the diagnosis of this case was an endodontic-periodontal combined lesion<sup>7</sup>.

Conventional root canal treatment was completed first, then followed by periodontal surgery. After local anesthesia, a mucoperiosteal flap was raised. Severe osseous destruction was observed on facial surface of 11, 21 (Fig. 3). The buccal and mesial root surfaces and the apical area were root planed. The teeth had periodontal attachment remaining on lingual and distal surfaces. Transillumination revealed no apparent cracks or fracture. After thorough root planing and apical curettage, this large osseous defect was filled with bone graft (alloplastic graft) covering the root surface (Fig. 4). Flap was repositioned and sutured with 3-0 silk nonresorbable interrupted sutures (Fig. 5). Antibiotics and analgesics were prescribed for 1 week. Patient was monitored on weekly schedule postoperatively, to ensure good oral hygiene in the surgerized area (Fig. 6). Supportive periodontal



Fig. 1. Pre-operative tooth 11 Probing Depth 12mm



Fig. 2. Pre-operative tooth 21 Probing Depth 8mm



Fig.3. Osseous defect



Fig.4. Bone graft



Fig. 5. Sutures placed



Fig. 6. Post - operative 2 Week



Fig. 13. Sutures placed



Fig. 14. Post-operative 2 week



Fig. 7. Pre-operative I.O.P.A. X-ray After endodontic treatment



Fig. 8. Follow-up 1 Year

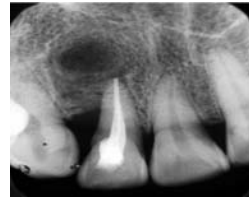


Fig. 15. Pre-operative I.O.P.A.X-ray



Fig. 16. Follow - up 1 year

maintenance at 3 months was prescribed to maintain periodontal health & to re-evaluate this area. At 1-yr recall, the teeth were asymptomatic with successful healing, mobility was reduced to less than grade I and probing depth was minimal. The radiograph after 1yr follow-up, showed evidence of apparent bone fill with resolution of the osseous defect (Fig. 8).

**CASE 2:** A 42-yr-old female presented to Department of Periodontology & Implantology, Sardar Patel Postgraduate Institute of Dental & Medical Sciences, Lucknow, Uttar Pradesh, with a chief complaint of discoloration and pus discharge from right maxillary lateral incisor. She had no contributory medical history. On clinical examination, probing depth on distal aspect of the tooth was 12mm (Fig. 9), mobility was grade I. The buccal gingiva showed sinus opening in relation to 12. The tooth did not respond to percussion and palpation tests. The tooth was non responsive to pulp vitality tests. Periapical radiograph showed radiolucency to the root apex of tooth 12 (Fig. 15). Therefore, considering the dental history, clinical tests, and radiographs, the diagnosis was an endodontic-periodontal combined lesion.

Conventional root canal treatment was completed first, then periodontal surgery. Severe osseous destruction was observed on distal surface of 12 (Fig. 10). After thorough root planing and apical curettage, the defect was filled with bone graft (alloplastic graft) & a resorbable GTR membrane (Fig. 11, 12, 13, 14). Postoperative evaluation was done same as in previous case. At 1-yr recall, radiograph showed evidence of apparent bone fill with resolution of the osseous defect



Fig. 9. Pre-operative Sinus in tooth 12



Fig. 10. Osseous defect upto apex



Fig. 11. Bone graft



Fig. 12. GTR membrane

(Fig. 16).

## Discussion

Endodontic-periodontal lesion is a clinical manifestation of the pathologic/inflammatory intercommunication between pulpal and periodontal tissues via open structures such as apical foramina, lateral, accessory canals, and dentinal tubules<sup>2</sup>. On the basis of the pathologic origin, *Simon et al.*<sup>8</sup> classified endodontic-periodontal lesions into primary endodontic lesions, primary endodontic lesions with secondary periodontic involvement, primary periodontic lesions, primary periodontic lesions with secondary endodontic involvement, or true combined lesions. Bone loss secondary to pulpal pathosis is believed to result from the spread of inflammatory irritants from the pulp to the periodontal ligament<sup>9</sup>. The treatment of endodontic-periodontal combined lesions requires both endodontic therapy and periodontal regenerative procedure, as discussed in this case report. The goal of periradicular surgery is to remove all necrotic tissues from the surgical site, to completely seal the entire root canal system, and to facilitate the regeneration of hard and soft tissues including the formation of a new attachment apparatus<sup>10</sup>.

It is interesting to note that there was no radiographic or clinical evidence of preexisting deep decay in either of the teeth, and no cracks were evident. The most common clinical/radiographic features of these endodontic-periodontal lesions reported were the periapical radiolucency and deep pocket depths with a nonvital pulp status.

Traditional approaches to treat periodontal and endodontic defects include nonsurgical debridement of root surfaces or root canals, as well as surgical approaches that provide better access to clean the root surfaces and apical lesions and to reshape the surrounding bone/root apex.

Bone loss caused by pulpal disease is reversible, whereas advanced bone loss caused by periodontal disease is usually irreversible<sup>7</sup>. The necessity of periodontal surgical therapy most likely was because the periodontal bone loss was more advanced and was less likely to resolve after Non Surgical Root Canal Therapy alone<sup>2</sup>.

Generally, partial apical root resection has been suggested for all endodontic surgery caused by the multiple apical canals to the pulp<sup>11</sup>. In this case report, root canal debridement and removal of granulation tissue around the root and apex was done, without subsequent root resection and retrograde filling. However, *periradicular curettage* was the sole procedure for the following reasons: (a) periapical curettage is able to remove the granulation tissue without root resection<sup>12</sup>; (b) there is no difference in healing with curettage alone or curettage with root-end resection more dentinal tubules may remain open after root-end resection, allowing more contaminants to leak out through the



tubules<sup>13</sup>. However, in case-2, using the GTR membrane technique, combined with bone graft, the result was clinically successful after a 1yr follow-up period. The role of bone graft in both the cases was for space-making and also for inducing bone formation and the attachment gain seen in these cases.

A long junctional epithelium formed over the dehiscid root surface has been suggested to be a contributing factor for the poor therapeutic prognosis<sup>14</sup>. Regenerative procedures frequently include the use of GTR barrier membranes and bone grafting materials to encourage the growth of key surrounding tissues, while excluding unwanted cell types such as epithelial cells<sup>15</sup>.

However, from clinical and radiographic findings, the result of this combined technique was quite impressive, resulting in a significant reduction of probing depth and bone fill. Selecting a defect that is amenable to regeneration is also critical for achieving success<sup>16</sup>. This is also true for an endodontic defect. *Wang and Boyapati*<sup>17</sup> suggested 4 factors, the so-called PASS principle, that are critical for predictable bone regeneration: primary wound closure, angiogenesis as a blood supply and source of undifferentiated mesenchymal cells, space maintenance, and stability of the wound. Space maintenance involves the creation of space for periodontal tissues to grow into.

## Conclusion

Although traditional nonsurgical periodontal therapy and regular endodontic therapy can be predictably used to arrest mild to moderate defects, it might be inadequate for treatment of disease characterized by deep pockets or wide circumferential apical defects. Currently, multiple regenerative techniques are widely available, as used in these cases, suggests that combined endodontic-periodontal lesions can be successfully managed.

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# A Study of Carotid Canals for Identification of Sex

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## Abstract

### Purpose

Determination of sex is one of the first and important factor in identifying decomposed corpses or skeleton remains. The present study was carried out to study use of the carotid canal in sexing the crania.

### Purpose

Total 310 adult human crania of known sex were studied for the present study. Out of 310 crania, 155 were of male and 155 were of female. The anteroposterior and transverse diameters were taken on the left and right side of the carotid canal.

### Result

It is observed that the anteroposterior diameter of the carotid canal is useful in the sexing of crania because it is showing the statistical significant sex difference ( $P < 0.01$ ) in mean values of male and female crania. The transverse diameter of carotid canal is not showing the statistical significant sex difference ( $P > 0.05$ ).

### Conclusion

The present study is important for the medico-legal cases in the fragmentary crania.

### Key Words

Carotid canal, sexing, crania, diameter, medico-legal

### Introduction

Determination of sex is one of the first and important factor in identifying decomposed corpses or skeleton remains. Determination of sex from analysis of human skeletal remains has been a well studied field with broad ranging applications extending beyond forensic anthropology and into archeology, paleoanthropology and comparative anatomy. If the whole skeleton is available there should be no difficulty in arriving at an accurate estimation of sex but when only part of skeleton is available then the difficulty of assessment increases.

Rare literature is available on the metrical study of carotid canal. Metrical studies may provide certain advantages over non metrical parameters because it is more objective way of attaining data with the use of osteometric techniques, determination of sex from the skulls relied very much on statistical analysis [1]. The known metrical parameters fail to show clear differences between the sexes hence the need was felt to establish more effective new parameters[2], hence we introduced new parameters of the carotid canal. This study is important for the medico-legal and anthropological studies. The sex can be determined from the crania with these new parameters. Precise knowledge of the skull base was important as in applications of microsurgery for aneurysms, Clival tumors etc. [3].

The involvement of the carotid canal found in vascular complications after basilar cranial fracture. The lacerum-cavernous junction was found to be most frequently fractured segment of the carotid canal. Fracture through petrous segment of carotid canal associated with relatively

high incidence of carotid injury and patients with these fractures suffered more severe head injuries [4].



### Material and Methods

Total 310 adult human crania of known sex were studied for the present study. Out of 310 crania, 155 were of male and 155 were of



female. The crania collected for the present study were from different religions and castes. Crania showing wear and tear, any fracture or pathology were excluded.

#### Carotid canal- Anteroposterior diameter:

The anteroposterior diameter was taken along the long axis of petrous part of temporal bone. It was measured with the help of sliding caliper.

#### Carotid canal- Transverse diameter-

The transverse diameter was taken perpendicular to the anteroposterior diameter of carotid canal. It was measured with the help of sliding caliper.

### Observations

In the metrical methods different cranial measurements were taken. Range, mean and standard deviation of these measurements of were calculated.

The identification point for each parameter was calculated from the range of each measurement. From this percentage of identified

Table 1. Carotid canal- Anteroposterior diameter

Sr. No.	Details of measurements	Right		Left	
		Male	Female	Male	Left
1.	No. of bones		155	155	
2	Range	0.5-1.1	0.5-0.9	0.5-1.1	0.5-0.9
3	Mean	0.75	0.7	0.74	0.7
4	Standard deviation	0.1	0.08	0.09	0.08
5	Statistical significance	P<0.01	P<0.01		
6	Identification point	>0.9	<0.5	>0.8	<0.5
7	Percentage of identified bones	1.29	0	10.32	0
8	Calculated range	0.46-1.04	0.47-0.93	0.47-1.02	0.47-0.93
9	Demarking point	>0.93	<0.46	>0.92	<0.46
10.	Percentage beyond demarking point	1.29	0	0.65	0

Table 2. Carotid canal - Transverse diameter

Sr. No.	Details of measurements	Right		Left	
		Male	Female	Male	Female
1.	No. of bones		155	155	
2	Range	0.3-0.8	0.3-0.7	0.3-0.8	0.3-0.7
3	Mean	0.54	0.53	0.54	0.53
4	Standard deviation	0.1	0.08	0.1	0.09
5	Statistical significance	P>0.05		P>0.05	
6	Identification point	>0.7	<0.3	>0.7	<0.3
7	Percentage of identified bones	1.29	0	1.29	0
8	Calculated range	0.25-0.83	0.29-0.76	0.24-0.84	0.27-0.79
9	Demarking point	>0.76	<0.25	>0.79	<0.24
10	Percentage beyond demarking point	1.29	0	1.29	0

crania was calculated.

Demarking points were worked out from calculated range [5]. The percentages of crania identified by each demarking point in both sexes was estimated. The demarking points identify sex with 100% accuracy [6]. The difference observed between means of male and female to know whether it is statistically significant, that is value of 'P' is calculated by applying 'Z' test.

### Discussion

The measurements of carotid canal on the CT scan are calculated by Berlis A et al. The mean values of anteroposterior diameter of carotid canal in males on right side are slightly higher than the values of male on left side. While in female crania the values are same on the right and left side.

More number of bones identified in male and female on the left sided carotid canal than the right sides. On both the sides the statistical sex difference is observed in the mean values of male and female crania. The carotid canal of left side is more useful in sexual dimorphism of crania than that of the right side

No difference was found in the mean values of the transverse diameter of carotid canal in male and female crania in left and right sides.

No statistical sex difference was found in the mean values of the transverse diameter of carotid canal in males and females on the right and left side.

### Conclusion

1. The anteroposterior diameter of the carotid canal is useful in sexing of crania.
2. The transverse diameter of the carotid canal is not useful in sexing of crania.
3. The measurements of the carotid canal also important for the surgical purpose.

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# Computed Tomography (CT Scan)-A superior Tool to Locate the Foreign Bodies and Tissue Injuries in Cases of Firearm Injuries

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## Abstract

The present study was conducted at Dept. of Forensic Medicine TNMC, Mumbai during the recent terror attack on Mumbai (26<sup>th</sup> Nov. 2008). 20 autopsies of firearm victims were conducted after whole body CT scan. Plain CT scan of all victims was imaged prior to autopsy by Siemens somatom spiral multidetector 4 slice CT- scanner. The coronal and saggital images of whole body were taken for detection of any hyperdense foreign bodies. Images were evaluated to determine the location of foreign bodies (bullet / pellet/any other metallic objects ) in the body along with defect (any fracture) in bone. Digital photographs were taken of the external appearances of the body, gunshot entry and exit wounds, dissected gunshot wound tracks, injuries to the internal organs and intact bullets / metal fragments recovered. The average time required for doing each CT scan was 10 minutes. Out of 20 autopsies , in 7 cases foreign bodies (bullet/pellets) were detected. In 13 cases foreign bodies were not detected.

## Key Words

CT scan, gunshot injuries, bullets.

## Introduction

One of the objectives of medico legal autopsy in fire arm cases is to collect evidence in order to identify the projectile causing death. Radiography is a valuable tool in the forensic investigation of gunshot wounds and is universally used for,

1. Localization of foreign bodies or metallic fragments particularly in head, face and neck region where it is difficult to retrieve the projectile.
2. Identification of the type of ammunition.
3. To assist the retrieval of the bullet.
4. Documentation of fractures during autopsy.
5. Determining Bullet/Projectile Path [Track] and Direction.

Moreover, recovery of the bullet jacket is important in forensic investigations because the jacket contains unique rifling characteristics that enable ballistics experts to identify the weapon from which the bullet was fired.

Occasionally autopsy surgeon may face difficulty in locating and retrieving the objects present inside the body especially in cases of deaths due to firearm injuries.

This is because,

1. Projectiles after piercing the skin may change their pathway due to internal ricocheting and may be lodged anywhere inside the body.
2. During medical intervention or while shifting the body to mortuary, the projectile may also shift their position inside the body.

Knowing the exact location of the bullet will save valuable time of autopsy surgeon and also avoids tedious efforts in searching for bullets that are inaccessible.

Traditional 2D radiography (X- rays) is taken in firearm injuries but sometimes the soft tissues having small density differences cannot be differentiated and also structures in 3-dimensional space tend to overlap.<sup>1</sup>

Our study assessed autopsy performed after whole body CT scan for the forensic evaluation of firearm wound victims.

CT was discovered by a Sir Godfrey Hounsfield and Dr. Alan

Cormack, and for the first time was installed in 1970. It has become a mainstay for diagnosing medical diseases. Its advances based on computer technology, CT scanners have improved patient comfort. Nowadays they are much faster and have also possibility to produce higher-resolution images, which improve the diagnostic capabilities of the test. These images allow the radiologist to look at the inside of the human without slicing it mechanically.<sup>2</sup>

Computed tomography (CT) was, foregoing, used in medical application mainly as a method for diagnostic evaluation to retrench health condition of certain tissue. Assumption of higher leverage of CT images was generated recently, mainly in healing of patients in the way that CT data were used as a database for computational visualization and production of models and medical apparatus. One of application of CT scanned data is for determination of tissue destruction dimension, which is of high interest during the consideration of characteristics and mechanism of appearance of a gunshot wound.<sup>3</sup>

The use of CT in Forensic Post-Mortem Diagnostic started about fifteen years ago. Many cases, for example gunshot injuries, head injuries, detection of foreign bodies as well as gas embolism have been published in this time. The first comprehensive studies of comparison between autopsy and Post-Mortem CT where made in 1994 by Donchin et al.<sup>4, 5</sup>

## Material and Methods

The present study was conducted at Dept. of Forensic Medicine TNMC, Mumbai after the recent terror attack on Mumbai (26<sup>th</sup> Nov. 2008) 20 autopsies of firearm victims were done after whole body CT scan. Plain CT scan of all victims was imaged prior to autopsy by Siemens somatom spiral multidetector 4 slice CT- scanner. The coronal and saggital images of whole body were taken for any detection of hyperdense foreign bodies. All victims were scanned with one mm section thickness (32 x 5 mm) with rotation speed of 0.5 second.

Images were evaluated to determine the location of foreign bodies (bullet or pellet) in the body along with defect (any fracture) in bone. Digital photographs were taken of the external appearances of the body, gunshot entry and exit wounds, dissected gunshot wound tracks, internal organ injuries, and intact bullets, metal fragments recovered.

Complete dissection of the intracranial contents, neck, chest, abdomen, and pelvis was performed in each case. All metallic fragments (bullet and metal pieces) associated with major wounds were documented and removed for evidence collection.

## Observations & Results

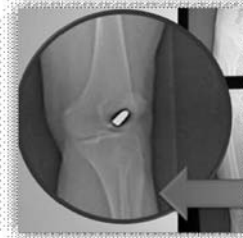
The scan time was short and ranged from 4 to 10 minutes. The time required for locating bullets was short and ranged from 2 to 4 minutes. The determination of entrance and exit wounds is possible based on the characteristic fracture pattern with inward or outward beveling of the bone respectively. In 7 victims, foreign bodies were detected. In 13 victims foreign bodies were not detected.

**CT Plate No 1.** Showing bullet present above patella of left knee joint

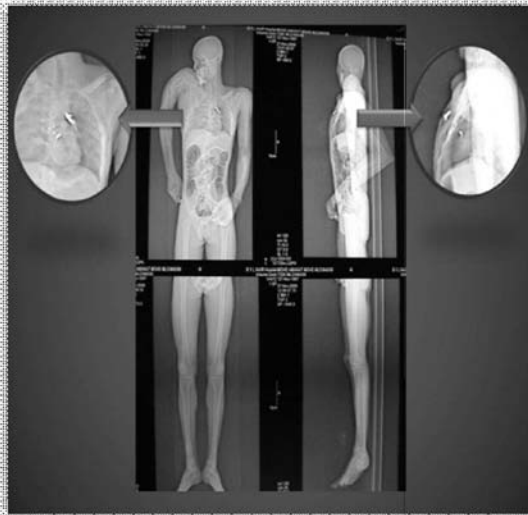




1. Saggital plane image



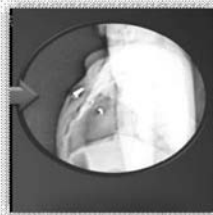
2. coronal plane image



**CT Plate No.2.** Showing a bullet was present in between 2<sup>th</sup> and 3<sup>th</sup> right side intercostals space.



1. Coronal plane image



2. Saggital plane image



**CT plate No 3.** Showing a bullet was present in right inguinal region

## Discussion

The study was prospective and performed under realistic routine conditions. This study provides an overview of the experience gained during whole body CT- scan of 20 victims before a traditional forensic autopsy. CT- scan is a quick method-a whole body scan takes 10 minutes while X- rays requires at least 1 hour. It provides documentation in digital form.

Advantages of ct scan over traditional radiography

1. CT scan completely eliminates the superimposition of images of structures outside the area of interest.
2. It detects small density differences in the various soft tissues.<sup>2</sup>
3. It provides multiple views with higher resolution than plain film radiography.
4. The time required for obtaining images of CT scan is much lesser than traditional radiograph.
5. The time required for retrieving bullet is also less as compared to traditional radiograph.
6. CT scan gives clear idea about exact location of bullets in relation to soft tissue and organs.
7. There is no need to change position of body for different views.
8. Artefacts like breakage of rigor mortis can be prevented<sup>5</sup>
9. There is no need of repeating the scan
10. Digital view is obtained directly.
11. It is very useful in instances of mass disasters where large numbers of bodies are to be handed over rapidly.
12. Limited human resources are required.
13. Multiple films of X- ray need not to be preserved.

## Conclusions

In the present prospective study, the CT scans were done before the PM which was found to be very useful in firearm cases. CT scans determined defects in bones in the areas which were not easily approachable on direct examination. CT scan provides documentation in digital form, permits review by others and provides pictures that were more suitable for presentation in court than conventional X ray photos. In cases of multiple firearm injuries it requires multiple radiographs/plates (at least 15-20), however there is no need to take multiple CT scan images only single CT scan image /plate is sufficient. We can take two plane images (coronal and saggital) in single CT plate and no need to change the position of body during scan.

So, now Computed tomography should be considered as an integral part of the postmortem examination process wherever such resources are available.

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# Visiting Card in Dentures-A New Dimension of Forensic Dentistry

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## Abstract

Forensic dentistry is one of the most innovative branches of dentistry which helps to identify victims in mass disasters and in many medicolegal investigations. Prosthodontists are playing a very important role in forensic dentistry as they are concerned with the fabrication of various prostheses, which can serve as an important tool of identification. If we go through the literature, we would find many methods to label a denture but none, till date, fulfils all the requirements of American Dental Association (ADA). This article describes a method, wherein, a lead foil with patient details was sandwiched between two layers of resin during the processing of the denture. The method has proved to be simple, easy, quick, durable and cosmetically acceptable fulfilling all the requirements of ADA. Denture labelling is important to patient's identification and to ensure that denture labeling is performed routinely, esthetic preferences must be considered.

## Key Words

Denture identification, denture labelling system, Medico-legal investigation, forensic identification

## Introduction

The frequency of edentulism has decreased in recent years primarily due to, improvements in oral health brought about by factors such as fluoridation and increased patient awareness. However, owing to a wide variation in the oral status of populations in different countries, the need to address the issue of denture identification still remains, since, it is more difficult to identify an edentulous person than a dentate one. In such cases, in the absence of marked dentures, dental identification is problematic and hence may only be established by well trained examiners via the comparison of bone trabeculation patterns that have been recorded in antemortem and postmortem radiographs. Following major disasters such as fires, floods, earthquakes, or the obvious and ever increasing effects of the proliferation of global terrorism, a definitive and early identification of the dead and injured is of utmost importance. Given that only one marked denture can reveal the identity of a deceased person when all other methods fail to do so, makes the practice of denture identification worth while. Furthermore, the efficacy of establishing ownership of dentures in long-term care facilities is both self evident and well documented. This identification is essential because a wrong identity may pose a problem in delivering justice in medico-legal cases to both the Doctor and the Patient. The identification of edentulous individual is problematic due to poor provision of labelled dental prostheses in India. Dental forensic organisations have recommended that dental prostheses should be labelled with at least the patients name and with further identifiers such as social security number. Various studies demonstrates that the method of denture labelling is important to patients and to ensure that denture labelling should performed routinely. Esthetic preferences must be considered.

## Case Report

A 62 years old male patient reported to the Out Patient Department of Prosthodontics with clinical findings of completely edentulous maxillary and mandibular arch. The findings were evaluated carefully and complete

dentures made in heat cure acrylic resin base (PMMA) using cross linked acrylic teeth with bilateral balanced occlusal scheme and a identification details sandwiched within, was planned for the rehabilitation of edentulous maxillary and mandibular arches.

After a final try in, the waxed up dentures were sealed to the master cast, The master casts were invested in the dental flask (figure-1), then dewaxed in hot water bath (figure-2). Small amount of heat cure denture base resin was mixed and placed in the postero-lateral part of palate region of maxillary cast and in the lingual flange area in the mandibular cast (figure-3). Damp cellophane sheets were placed over the resin dome and the trial closure was done to reopen the flasks easily. The flasks were reopened and the flash was trimmed away with a sharp knife, the cellophane sheet was removed and discarded. Two pieces of lead foils of size 2.5 x 1 mm (approx.) were cut from a used IOPA radiographic film (figure-4). The patient's details ( name, out patient - case number, hospital's name ) was written with 0.5 mm ball pointed tip pen and each lead foil was inserted postero-laterally in the palate of the maxillary cast and in the lingual flange area in the mandibular cast over the previously placed resin dome (figure-5). Measured powder-liquid of heat cure acrylic resin was mixed and packed into the flask at the dough consistency (figure-6). The flasks were finally closed without cellophane. Following bench curing the dentures were polymerized according to the manufacturer's instructions, then deflasked. Trimming and polishing of the dentures was carried out (figure-7). Occlusal adjustments were done, by remounting the maxillary and mandibular complete dentures on the semi-adjustable articulator. The identification was sandwiched between the two layers of acrylic resin (PMMA) and were not visible from outside, thereby, not compromising the esthetics of the dentures. The dentures were seated in patient's mouth and instructed to report for post insertion follow up. On post insertion recall intra oral periapical radiographs of the dentures were taken. The radiographs revealed the complete details of the patient (figure-8). The method proved to be simple, easy, quick, durable, cosmetically acceptable and did not require any extra armamentarium. The identification is expected to resist maximum level of disaster which was our ultimate motto.

Figure 1: Investing the master cast in the base of the flask



Figure 2: Flask halves separated after dewaxing



**Figure 3:** Small amount of heat cure denture base resin placed in area of denture where lead foil will be located



**Figure 4:** Inscription of patient's details on a lead foil with a 0.5 mm ball-pointed tip pen



**Figure 5:** Placement of the lead foil with patient details on the previously adapted heat cure denture base resin



**Figure 6:** Packing of the required amount of heat cured resin for the final closure



**Figure 7:** Final denture after trimming and polishing



**Figure 8:** Intra oral periapical radiographic film showing the patient details. (Patient's name, out patient - case number, Hospital's name)



## Discussion

Dental identification is one of the commonest means of identifying individuals who cannot be visually recognized (1). This occurs in circumstances of gross decomposition, fire, trauma, and drowning. Dental identifications are therefore frequently employed in incidents involving mass fatalities (2). Dental identifications are predicated on the individuality of the human dentition and the increase in unique features that dental treatments render(2). However, dental identifications are still usefully used in individuals without restorations where a range of other features can be determined; many of them radiographically(3). However, edentulous individuals pose a particular problem for forensic dentists. Indeed, the alveolar bone resorption and subsequent atrophy of both the maxilla but particularly the mandible often destroys what little unique features exist (4). Raymond Richmond and Iain A. Pretty(5) reported that dental records of edentulous individuals are often sparse, further complicating the identification effort. Patients wearing complete dentures will visit their dentists infrequently and require fewer special tests or examinations that would typically form the antemortem dental record. Radiographs are of particular importance in dental identifications yet they are rarely undertaken for individuals without teeth and whom require little in the way of preprosthetic surgery(6).

The provision of some form of denture labeling is an obvious solution to these problems, but their use is minimal. Attitudes towards denture identification have been investigated by several authors. Cunningham and Hoad-Reddick (7) reported, that, patients were in favor of some form of denture marking. Borrman and Rene's (8) in their survey concluded that some 93.5% of patients were found to be unaware that identification marks could have been placed in their dentures. Raymond Richmond and Iain A. Pretty(5) conducted a study and reported that 99% of the patients agreed for some form of identification when they were briefed about the importance.

Throughout the last five decades dentists used several techniques for identification like embedding onion skin or tissue paper, metal ID band, PMMA strip, engraved piece of orthodontic band, 35 mm photographic slide, some by engraving and covering with light cure resin or by pencil mark covered by polymer coating. Some dentists engraved metal band that has been rolled up and inserted into a predrilled hole, the band is covered with a wax plug and then with self cure PMMA(5). Most recently in abroad they are using RFID (Radio Frequency Identification Device) tags for this purpose(9,10), but it is expensive and till date not available in India. But none of these fulfills all the requirements of American Dental Association (ADA).

The radiographic technique used in this case, wherein, a lead foil with patient details was sandwiched between two layers of resin during the processing of the denture. The technique fulfilled all the requirements of ADA. The strength of the denture was not jeopardized; easy and inexpensive to achieve; efficient and durable; could withstand humidity and fire, cosmetically acceptable to the wearer. This technique can be used for both complete and removable partial dentures. This does not require any extra armamentarium to carry out the procedure

and can be done easily along with day to day procedures because no extra time required. P. R. Venkat Nag, Kamalakanth K. Shenoy (11) in their article described a similar technique and they concluded the method to be successful.

## Summary and Conclusions

Anticipating the recent advances in the field of forensic dentistry, prosthodontists need to contribute to their share in practice and denture marking will be the stepping stone towards that. With the technique described above, the acceptance of denture marking procedure is expected to rise both to the fellow dentists and even to the patients because of its simplicity and cosmetic appearance. Like other developed countries even we look forward for more advanced techniques like RFID to be introduced in India in near future and much more use of denture identification in day to day practice.

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# Oral Cavity a Diverse Ecosystem: A Review

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## Introduction

There are estimated to be approximately 100,000,000,000,000 cells in the human body, of which only 10% are of human origin, commensal microbial flora consisting of the remaining 90%. Different anatomical sites are associated with their own characteristic flora. Oral cavity is the entrance of the digestive tract, which is anatomically continuous and harbours approximately  $1 \times 10^{14}$  microorganisms, which is more than the approximately  $6 \times 10^{13}$  cells that constitute the entire human body<sup>1</sup>. Of the various site of the body, the oral cavity is one of the most densely populated sites in the human body and is an ecosystem of considerable complexity that has not been fully investigated yet and is far from completely understood. Until recently the oral cavity was regarded as a single habitat for microorganisms but it is now realized that the teeth, gingival crevice, tongue, other mucosal surfaces and saliva all form different habitat or sites; each containing its characteristic population with many different microbial species<sup>2</sup>. Bacteria are the most predominant type of microorganisms present in human oral cavity, including both aerobic and anaerobic groups.

## Development of the Oral Flora

**At birth:** oral cavity of the foetus is usually sterile although organisms which are only transient may be acquired from mother. Several streptococcal and staphylococcal species may be isolated, streptococcus salivarius being the most common organism to be isolated together with staphylococcus albus in the fetal oral cavity. The normal foetus is sterile until shortly before birth, as long as the amniotic membrane remains intact. After birth, the neonate rapidly acquires commensal bacteria that colonise the skin and mucous membranes. The host defence mechanisms are not well developed at this stage and some commensal may become opportunist pathogens, particularly in compromised neonates who must remain in hospital for the treatment of congenital abnormalities.

**Infancy and early child hood:** The infants come into contact with an ever increasing range of microorganisms and some of which will become established as part of commensal flora of the individual. The eruption of deciduous teeth provides a different surface for microbial attachment, characterized by the appearance of streptococcus sanguis, muelleri and mutans<sup>3</sup>.

**Adolescence:** The greatest increase in number of organisms in the mouth occurs when the permanent teeth erupt, as these teeth have deep fissures in their surfaces and interproximal spaces are much larger than in deciduous dentition. The gingival crevice is deeper than in deciduous teeth and allows for a great increase in anaerobic organisms. Bacteroids spp become established in large number as well as leptofrichia spp, fusobacterium spp and spirochetes. The lesion of dental caries will create a new environment for organisms to flourish especially streptococci spp.

**Adult hood:** Varying amount of dental plaque may be present and the degree of chronic periodontal disease<sup>4,5,6</sup> and carious lesions will govern the number and types of microorganisms found. There is increase in bacteroids spp and spirochetes, with superficial plaque containing many streptococci mostly streptococcus mutans and sanguis. Edentulous patients harbor few spirochetes or bacteroids but their carriage of yeasts increases which are normally found in the dorsum of tongue. Dentures provide what is proved to be an environment in which yeasts can multiply.

## Benefits of Oral Microflora

Resident oral microbial flora offer some beneficial aspects for the host including supply of certain nutrients, aiding in digestion and protection against pathogens. Oral bacteria like intestinal flora produce certain vitamins and cofactors which are needed by humans like vitamin K, biotin and riboflavin. Oral flora also helps in maturation of host immune system.

## Factors affecting the development of the oral flora

In order to become established in the mouth an organism must be introduced, retained and be able to multiply in the conditions present in the mouth. Adherence to tissues, presence of protected sites like dental plaque helps in retaining of microorganisms in the oral cavity. To become established as a measure of the oral flora an organism must be able to multiply in the particular site in which it can be retained. Multiplication depends on various factors like availability of increased carbohydrates in diet<sup>7</sup>, availability of glucose<sup>8</sup>, pH<sup>9,10,11,12</sup>, buffering action of saliva and microbial interactions. Saliva<sup>7</sup> and gingival crevicular fluid provide nutrients like glycoproteins, vitamins and amino acids<sup>13,14</sup> aiding in multiplication of microorganisms<sup>15,16</sup>. The bacteria themselves can provide nutrients for each other, lactic acid producing bacteria such as streptococcus and lactate utilizing species such as veillonella alkalescens.

## Normal Microbial Flora of Different Sites of the Mouth

The heterogeneity of tissue types in the oral cavity, such as teeth, tongue and mucosa, means that a variety of sites are available for colonization by oral microorganisms. Each site has unique characteristics and allows those microorganisms best suited to the environment to inhabit the site. The function or role of microorganisms in a habitat is referred as an ecological niche and a number of ecological niches exist in the oral cavity, including supragingival plaque, subgingival plaque and tongue coating.

**Lips:** On the lips there is a transition from skin to oral mucosa and so there are also changes in the bacterial population. Staphylococci along with large number of streptococci are typical organisms of the oral cavity. If the commissures are moistened by saliva an angular cheilitis may develop from which candida albicans, staphylococcus aureus and streptococcus pyogenes are isolated.

**Cheek:** Predominant cheek bacterium is streptococcus mutans with streptococcus sanguis, salivarius and yeasts being other organisms isolated from the cheeks.

**Palate:** Hard palate supports streptococcus<sup>17</sup>, haemophili and lactobacilli commonly. Few are anaerobes found in exposed mucosal surface yeasts and lactobacilli will increase dramatically in some denture wearers. The soft palate will harbor respiratory tract bacteria such as hemophilus, corynebacterium, Neisseria.

**Tongue:** The keratinized dorsal surface of the tongue<sup>18</sup> is an ideal site for the retention of microorganisms, streptococcus salivarius being the predominant organism<sup>19</sup>. Streptococcus mutans and Hemophilus spp are also common. Dorsum of the tongue is frequently colonized by small number of candida albicans.

**Gingival crevice:** The bacterial population of the gingival crevice is perhaps the most numerous of any site in the mouth, as it is relatively well protected from the forces that dislodge bacteria and the cervicular fluid transudate provides rich nutrients for some fastidious organisms. Facultative Gram +ve cocci and Anaerobic gram -ve cocci are recovered from gingival crevice<sup>20</sup>.

**Teeth:** All erupted teeth have microorganisms attached usually in the deposits termed dental plaque. These bacteria are positioned in the occlusal surfaces, enamel defects and in interproximal spaces, close to gingival margin. Oral streptococci gram +ve rods and some gram -ve anaerobic isolated. Salivary samples can be used in detecting candida albicans or beta hemolytic streptococci. Veillonella spp, streptococcus oralis, streph salivarius, strept, mutans, strept sanguis are isolated from saliva.

## The Principle Microorganisms of the Mouth Gram +ve cocci

### Streptococci

The oral streptococci comprise a group of bacteria that are either non hemolytic or produce various hemolytic patterns. For many years they were termed streptococcus viridans but it has been realized that this group consists of at least five distinct species. Streptococcus sanguis, mitis, mutans, salivarius and milleri.

### Gram -ve cocci

#### Neisseria and Branilanelia and veillonella

Number of gram -ve diplococci are found in the mouth including Neisseria and Branhamella, mostly Branhamella catarrhalis which is isolated from dental plaque as well as from most mucosal surfaces. Veillonella parvula and alkalescens are found principally in dental plaque and are the earliest anaerobic organisms to colonize the oral cavity.

#### Gram +ve rods and Filaments

There are numerous genera of gram +ve rods and filaments represents in the oral cavity mostly found in dental plaque including Lactobacillus casei and acidophilus, Corynebacterium, Actinomyces odontolyticus, viscous and naeslundii, Eubacterium alactolyticum and saburram, Propionibacterium.

#### Gram -ve rods and filaments

Genera of gram -ve rods and filaments that represent in the oral cavity are mostly found predominantly in saliva and plaque including Haemophilus influenzae and para influenza, Fusobacterium nucleatum and polymorphus. Actinobacillus actinomycetemitans, spirochetes, mycoplasmas mycoplasma orale and solivaries, protozoons Entamoeba gingivalis and trichomonas tenax are found as a commensal in the gingival crevice.

### Conclusion

The microbial flora of mouth is highly complex containing a wide variety of bacterial species. The most common type of oral disease, dental caries and periodontal disease are both related to dental plaque and seen to occur when the normal balance between the microorganisms and host is altered. It is important to fully define the human microflora of the healthy oral cavity before we can understand the role of bacteria in oral disease Application of modern molecular techniques to the study of this microbiology of oral disease should allow rapid progress in their diagnosis, risk assessment and treatment.

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# Mullarian Agensis-An Incidental Finding at Autopsy

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## Abstract

Mullarian agenesis is a congenital malformation in female characterized by a failure of mullarian ducts to develop, resulting in missing uterus and fallopian tubes. Autopsy on the body of an adolescent female who committed suicide by hanging revealed that uterus and fallopian tubes were absent. On further enquiry into the menstrual history, it was evidenced that she has not attained menarche till the age of 17 years.

## Key Words

Mullarian ducts; Mullarian agenesis; Mayor Rokitnaski Kuster Hauser Syndrome

## Introduction

Mullarian agenesis is a congenital malformation in female characterized by resulting in missing uterus with or without variable malformations of vagina.<sup>1</sup> It is the second common cause of primary amenorrhoea following gonadal dysgenesis.<sup>2</sup> Body of an adolescent female was brought for autopsy in the department of Forensic Medicine, Medical College, Thiruvananthapuram as a case of hanging. Autopsy revealed congenital absence of uterus and fallopian tubes as an incidental finding. She had normal external genitalia and lower vagina and well developed secondary sexual characters.

## History of the Case

Ms. X was a 17 years old adolescent higher secondary student. She was fairly good in her studies. As per police history she has committed suicide by hanging since she couldn't attend a paper for her examination. She has not attained menarche till that age. The body was brought for autopsy since it was a case of hanging.

## Relevant Autopsy Findings

The body was that of a moderately nourished adolescent female of height 165 cm and weight 65 Kg. Secondary sexual characters were well developed. Breasts were hemispherical and firm. Axillary and pubic hairs were cut short. Hymen was intact and elastic and its orifice admitted two fingers tightly. Internally uterus and fallopian tubes were seen missing. A membranous sac was present at the site of uterus. Vagina was short; otherwise normal. Vagina opens into the membranous sac of uterus. Ovaries were normal in size with firm white nodules in it.

Other findings were present to diagnose the cause of death as hanging. Other internal organs appeared normal.

## Discussion

### Normal development of female reproductive system

Initial appearance of human foetal genitalia is basically feminine: a pair of urogenital folds. The urogenital folds appear in early weeks after fertilization. Mullarian or paramesonephric ducts paired ducts that form epithelial lining of female reproductive organs. Mullarian ducts are named after German scientist Johannes Peter Muller. Mullarian ducts are present in both sexes. Mullarian Inhibiting Factor or Anti Mullarian Hormone from the testes leads to regression of Mullarian duct in males.<sup>3</sup> In females absence of Mullarian Inhibiting Factor leads to subsequent differentiation to female reproductive organ. Mullarian ducts fused to form uterus, cervix and upper part of vagina. The unfused portions will form fallopian tubes.<sup>4</sup> Myometrium derives from surrounding mesoderm.<sup>5</sup>

Ovaries and lower part of vagina are not developed from mullarian system. The ovaries derived from germ cells that migrate from the primitive yolk sac into the mesenchyme of peritoneal cavity and subsequently develop ova and supporting cells. Lower part of vagina develops from sino vaginal bulb.<sup>6</sup>

### Mullarian agenesis

Mullarian duct anomalies are categorized into seven classes according to American Society for Reproductive Medicine. Mullarian agenesis or hypoplasia is the Class I group among them.<sup>1</sup> Its most common form is Mayor Rokitanzki Kuster Hauser Syndrome. This is usually associated with abnormal or absent vagina. This is the second common cause of primary amenorrhoea following gonadal dysgenesis.<sup>2</sup> Karyotype of the individual is 46 XX and may be hormonally normal if ovaries are normal and ovulate. She will enter puberty with development of secondary sexual characters including thelarche and adrenarche. She fails to menstruate in time. Vagina is short and intercourse becomes difficult and painful.<sup>7</sup>

Other associated anomalies include renal problems and skeletal malformations. Renal problems were seen in 25 % to 89% of females with mullarian agenesis.<sup>1</sup> Skeletal malformations include congenital scoliosis, limb deformities, external auditory canal stenosis etc. in one tenth of cases of mullarian agenesis.<sup>2</sup>

The present one is a case of mullarian agenesis with normal lower vagina, external genitalia and almost normal ovaries. There were no associated skeletal or renal malformations. A similar case was reported earlier in a 21 year old girl with a normal vagina.<sup>8</sup>

## Medico Legal Significance

1. Mullarian agenesis is cause of primary amenorrhoea
2. Such a woman cannot become pregnant. Those who have normal ovaries can have her own genetic children with in vitro fertilization and embryo transfer to a surrogate mother.

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# Age Estimation by Eruption and Apical Foramina Closure of Second Premolar Teeth

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## Abstract

One of the major arenas of Identification in Forensic Medicine is age-estimation. The sequence of both deciduous and permanent tooth formation and eruption is considered as an excellent age-marker. Medico-legal importance of age in Forensic Medicine jargon like criminal responsibility (12 years), judicial punishments for juveniles (16 years), rape (16 years) and kidnapping (10 and 16 years) etc. fall in the age group of 10-16 and as literature on age determination among Indians from root formation is rarely encountered, this study was undertaken to aid the investigating agencies in the above mentioned circumstances and also in Identification.

The present study was conducted to estimate the age by eruption and apical foramina closure of permanent mandibular second premolar teeth, and to bring out the differences among the two genders. IOPA (Intra Oral Peri-Apical) radiographs of 200 children (100 males and 100 females) of age ranging from 8-18 years were taken. Eruption of teeth into the oral cavity was the criterion. The assessment of complete root formation and apical foramina closure was done using the stage 'H' of Demirjian method.

## Key Words

Age estimation; eruption; apical foramina closure; second premolar; IOPA radiographs;

## Introduction

"The real aim of all forensic science is to establish individuality or to approach it as closely as the present state of the science allows" is the citation of Paul Kirk, which shows the essence of identification process in the field of criminalistics<sup>1</sup>. The assistance of dental expertise can aid in personal identification either individually or in the context of mass disasters. The dental evidence in identification is equally valuable and reliable as that of finger prints<sup>2</sup>. The positive identification of living or dead using unique traits and characteristics of teeth is the corner stone of Forensic Odontology. Be it in the living, recently deceased or in human remains which are rendered unrecognizable by advanced decomposition or are completely skeletonised, experts must be able to make the four determinations: age, sex, race and stature. Of these, estimation of age is the most challenging task.<sup>3,4</sup>. In addition to identification, age estimation has other medico-legal significance in categorization of an individual for rehabilitation (juvenile) or conviction.

The most reliable way to estimate age in children and adolescents is based on the sequence of both deciduous and permanent tooth formation and eruption. These are excellent age markers because there is consistency in the timing and sequence of eruption<sup>3</sup>. Medico-legal importance of age estimation in adolescents can be solved by radiological study, determining the development of crown, root and closure of apical foramina.

## Aim of The Study

Bone growth and dental development are the two important objective criteria for estimation of age. The most reliable way to estimate age in children and adolescent is considered to be the sequence of both deciduous and permanent tooth formation and eruption. Although this sequence is well established and rarely varies, population

variation exists in the timing of dental eruption. In the present study an attempt has been made to test the variability among the population of Southern India and also to test the reliability and validity, so as to increase the accuracy of age determination in growing period of life.

## Objectives

1. To estimate the age by eruption and apical foramina closure of permanent mandibular second premolar teeth.
2. To know the differences among the two gender.

## Material and Methods

The study was conducted on the population of southern India, comprising of all the three major communities namely Hindus, Muslims, and Christians. A total of 200 students (100 males and 100 females) of age ranging from 8-18 years fulfilling the following criteria were included in the study.

## Inclusion Criteria

1. Subject who has a proper document to certify the age stated.
2. Have a healthy oral hygiene.
3. Voluntary informed consent of the parent/ guardian is obtained.

## Exclusion Criteria

Subject with congenital missing tooth, injuries, loss of tooth (accidental or extracted), decaying of tooth, and restoration are excluded from the study.

The subjects selected were categorized into 10 groups of assorted age at an interval of 12 months. Thus 10% of the subjects were selected in each of the 10 different age groups.

**Table 1.** Showing distribution of study population

Age group (in years)	No. of Cases		Total(n)
	Males	females	
8.0-9	10	10	20
9.1-10	10	10	20
10.1-11	10	10	20
11.1-12	10	10	20
12.1-13	10	10	20
13.1-14	10	10	20
14.1-15	10	10	20
15.1-16	10	10	20
16.1-17	10	10	20
17.1-18	10	10	20
Total	100	100	200

Radiographs of right mandibular permanent second pre-molar were then taken by a single exposure using paralleling cone technique from each of the participants. Each of these radiographs was interpreted in light ambient room with proper view box and magnifying lens for root development and apical foramina closure. The eruption of teeth into the oral cavity was the criterion. The root formation is said to be completed when the apical foramina in it is closed<sup>5</sup>. The criteria for assessment of complete root formation and apical closure was adopted from the description of dental formation stages by 'Demirjian et al'

The experimental error and bias of assessing the apical foramina closure was minimized by studying each radiograph by two separate observers independently. Whenever there was a difference of opinion expressed, the particular radiograph was studied jointly by both observers and a common opinion sought.

## Observation and Results

**Table 2.** Showing Eruption and Root Completion of Second Premolar.

Age in years	Eruption		Root completion	
	Male	Female	Male	Female
8.00-9.00	01	00	01	00
9.01-10.00	01	00	01	00
10.01-11.00	00	02	00	02
11.01-12.00	06	09	05	04
12.01-13.00	06	09	05	07
13.01-14.00	08	09	08	09
14.01-15.00	10	10	10	10
15.01-16.00	10	09	09	09
16.01-17.00	10	10	10	10
17.01-18.00	10	10	10	10

- From 11.1yrs to 14 yrs around 60% of boys and 90% of girls presented with erupted second pre-molar. From 14.1 yrs to 18 yrs almost 100% of girls and boys presented with erupted second pre-molar.
- In the age-group 11.1yrs to 12yrs, 50% of boys and 40% girls presented with root-completion of second premolar. This increased to 70% in girls of age-group 12.1yrs to 13.0 yrs, then to 80% boys and 90% girls in between 13.1yrs to 14 yrs age group. Almost 100% of boys and girls presented with root-completion of second pre-molar after 14 yrs. Only 10% each among boys and girls did not show root-completion in the age group of 15.1yrs to 16 yrs.

**Table 3.** Showing Accuracy percentage for estimation of Age by Second Premolar eruption

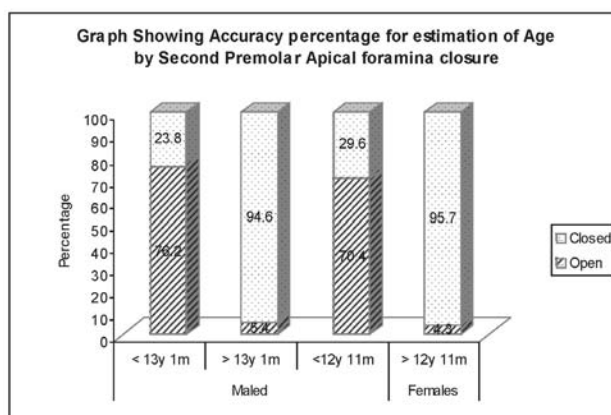
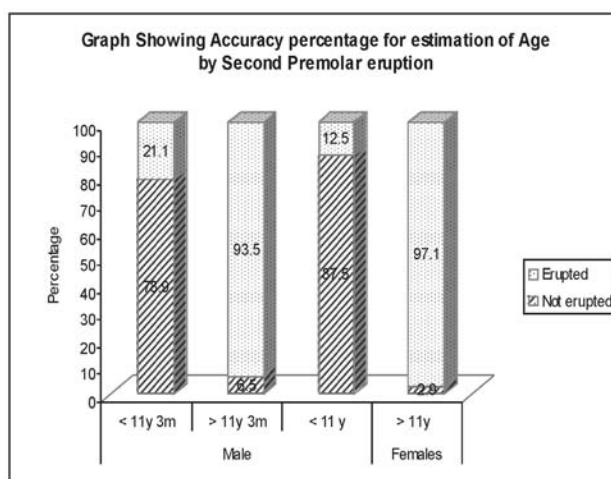
	Age	Second pre molar Eruption		Total
		Not erupted	Erupted	
Males	< 11y 3m	30 (78.9%)	04 (6.5%)	34
	> 11y 3m	08 (21.1%)	58 (93.5%)	66
Total		38	62	100
Females	< 11y	28 (87.5%)	02 (2.9%)	30
	> 11y	04 (12.5%)	66 (97.1%)	70
Total		32	68	100

**Eruption of second pre-molar:** Based on the data obtained from Table 3, eruption of second premolar occurred at 11 years 3 months (93.5%) and 11 years (97.1%), in male and female participants respectively.

The maximum age at which eruption of second premolar had not occurred was 13yrs 11 months and 15yrs 1 month and the earliest age of eruption of second premolar was 9yrs 9 months and 10yrs 3 months in males and females respectively.

**Table 4.** Showing Accuracy percentage for estimation of Age by Second Premolar Apical foramina closure

	Age	Second pre molar Apical foramina closure		Total
		Open	Closed	
Males	< 13y 1m	48 (76.2%)	02 (5.4%)	50
	> 13y 1m	15 (23.8%)	35 (94.6%)	50
Total		63	37	100
Females	< 12y 11m	38 (70.4%)	02 (4.3%)	40
	> 12y 11m	16 (29.6%)	44 (95.7%)	60
Total		54	46	100



**Apical foramina closure of pre-molar:** According to Table 4 the closure of apical foramen was observed at the ages of 13 years 1 month and 12 year 11 months in 94.6% in males and 95.7% in females respectively.

The highest age of patent apical foramina was 15yrs 5 months and 15yrs 1 month in males and females respectively, while the least age of apical foramen closure was 11 yrs 6 months and 12yrs in males and females respectively.

## Discussion

Methods for determination of a child's growth and development are of great value for medico-legal experts. Although various methods for age-determination do exist, a universal system has not been achieved due to regional differences in growth patterns. The present study is done with the main objective of determining age among the South Indian population by observing eruption and apical foramina closure of permanent mandibular second pre-molar teeth. The main aim of this study is to test the variability, reliability and validity of eruption and apical foramina closure, so as to increase the accuracy of age-determination in the growing period of life. In most of the previous studies, IOPA (Intra Oral Peri Apical) radiographs were taken using Bisecting angle technique. In the present study paralleling cone technique is used, which has more accuracy than other traditional methods. Comparison between dental ages shows that, premolar erupts and calcifies earlier in females than males. The literature in various Indian Textbooks give the age-range for eruption and apical foramina closure of second pre-molar to be between 10-12 years and 12-14 years respectively.

A study by Rajendran, Daniel. T from Chennai shows the average age of eruption of second pre-molar to be 11.10 with standard deviation  $\pm 1.37$  years. Whereas our study shows the cut-off age of eruption to be 11 years 3 months, for second pre-molar<sup>6</sup>. Thus in

children, if the second premolar has not erupted, the age is below 12 years<sup>7</sup>.

The ethnic and regional differences between populations necessitates for the studies of individual population as observed in the present study. The effect of environmental, nutritional and socio-economic factors may play an important role in the development of teeth, which may cause variations in the values reported.

## Conclusion

**The following conclusions were drawn from the present study:**

- 93.5% of males and 97.1% of females presented with erupted second premolar at the ages of 11 yrs. 3 months and 11 yrs respectively.
- 94.6% of males and 95.7% of females presented with closed apical foramina of second premolar at the ages of 13 yrs 1 month and 12 yrs 11 months respectively.

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# Battered Baby Syndrome-A Case Report

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## Abstract

Battered baby syndrome is a tragic and disturbing phenomenon. Unfortunately, it is a crime that is often successfully hidden by its perpetrators. Forensic expert has an important role to play in uncovering the cases of battered baby syndrome and gathering evidence for their successful prosecution.

A two and half year male child was admitted to Pediatrics I.C.U. of T.N.M.C. & B.Y.L. Nair Ch. Hospital with history of fever, weakness and superficial injuries. Initially Pediatricians diagnose the case as 'failure to thrive' and called forensic experts for evaluation of injuries. On detailed examination and investigations by Forensic Medicine personnel and Pediatricians it was observed that the baby was having multiple injuries and fractures of different stages of healing along with head injury. History obtained from the mother and father, who were in live in relationship was of conflicting nature. When the police were summoned to register the case both the parents absconded.

## Key Words

Battered baby, Multidisciplinary approach, Multidisciplinary team

## Introduction

Battered baby syndrome is also known as non accidental injury of childhood, child abuse syndrome, Caffey's syndrome and maltreatment syndrome in children. It is defined as one who has received repetitive physical injuries as a result of non accidental violence and deprivation of nutrition, care and affection by the parents or guardians<sup>1</sup>.

The problem was unveiled by Silverman (1953) & Wooley and Evans (1955) in its exact shape, magnitude and significance. Psychiatric factors in the perpetrator are probably of prime importance in the pathogenesis of the disorder<sup>2</sup>.

Cruelty on infants and children is not new in India. Destruction of newborn infants, stringent measures including physical torture and pain at home and in teaching institution to introduce discipline and teaching programme, child labour system and all may extend upto cruelty and negligence on children<sup>2</sup>.

## Observation

A three year child was brought to Nair hospital casualty by his mother. History stated that, the child was all right 2 hours back after which he had sudden fall with abnormal tonic posturing of upper and lower limbs with up rolling of eye balls, associated with frothing from mouth and unconsciousness. She had given history of infection on face, back and leg since five days and past history of trauma to head due to fall 15 days back.

Mother had live-in relationship since 2 years and had two children, 1 year old male child (from a live-in relationship) who was alright and a 3 year old male child (from previous estranged husband).

Mother was illiterate, domestic help living in a rented place with her partner who was educated up to 5<sup>th</sup> standard and was a watchman in a college. Both were alcoholics and ganja addicts.

On examination the child was unconscious and in tonic posture. Multiple lesions with brownish black scabs & hypopigmented scars were present over the face and trunk. Multiple contusions of various sizes were present over the left upper limb, right lower limb and

reddish blue to bluish black coloured. A bluish contusion of size 2cm x 1cm was present over right frontal region. There was frontal bossing. Teeth were fallen and loosened. Dental carries were present. Buccal mucosa had a healed ulcer. The mile stones were delayed.

## Investigation

Radiological examination showed rachitic rosary, shortening of humerus with spaying and fraying, an old healed fracture of shaft of right humerus, fracture of junction of middle and distal 1/3<sup>rd</sup> of left ulna, an old healed fracture of right ulna, deformity of right thumb, bowing deformity of both femurs, old healed fracture of mid shaft of right femur and a displaced transverse fracture of mid shaft of right tibia. Left sided frontoparietal acute subdural hematoma was noted on CT brain.

Age of the child was concluded as 2 years from radiological examination as two carpal bones were appeared, ossification centers for base of first metacarpals and lower ends of radius and ulna were not appeared. On dental examination 2<sup>nd</sup> temporary molar teeth were not erupted. Weight of the child was 8.2kg and height was 85cm. We diagnosed the case as Battered baby syndrome with left frontoparietal subdural haemorrhage with grade III PEM and rickets. The diagnosis was based on the following features-

1. Multiple contusions in different stages of healing.
2. Multiple lesions caused by some irritant.
3. Multiple fractures in different stages of healing.
4. Subdural haematoma.
5. Poor nutritional status and hygiene.
6. Inconsistent history by parents.
7. Delay in seeking medical attention.
8. Other sibling was alright.

Treatment was given to the child and responded well. The police was intimated and a case was registered against the parents. Immediately the parents absconded with the child but they were nabbed by the police. As the child was in need of care and protection, he was subsequently handed over to an NGO by the parents with the intervention of MCPC (Multidisciplinary Child Protection Centre). Age verification was done in our department for schooling and further

**Figure 1:** showing unconscious child with tonic posture, multiple lesions with brownish black scabs and hypopigmented scars over the face and trunk with deformities of right leg and left upper limb.



**Figure 2:** Showing Frontal bossing, a bluish contusion of size 2cm x 1cm was present over right frontal region



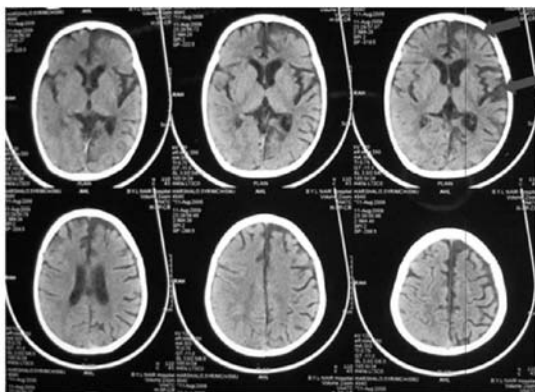
X-ray both forearm with hand antero-posterior view showing fracture at middle and distal 1/3rd of left ulna with old healed fracture of right ulna



X-ray lower limbs antero-posterior view showing bowing deformity of both femur, old healed fracture of mid shaft of right femur with displaced transverse fracture of mid shaft of right tibia noted



CT brain showing left sided frontoparietal acute subdural hematoma



rehabilitation.

The present case was handled with multidisciplinary approach. The effort is to prevent re-traumatisation of the child and to ensure that the victim has access to proper medical, legal and psychosocial care through a single unit. MCPC (Multi-disciplinary Child Protection Centre) was formed keeping in mind the best interest of the child. The MCPC at Nair Hospital was established with UNICEF support in February 2006 and Forensic Medicine being the nodal department. The other departments such as Casualty, Paediatrics, Gynaecology, General Medicine, Psychiatry, and Medical-Social Work have been working in coordination with each other and NGOs to provide care and treatment to child victims of abuse and sexual exploitation.

## Discussion

Present case had all classical features of battered baby syndrome. Forensic expert and multidisciplinary approach has an important role to play in uncovering cases of battered baby syndrome and gathering evidence for prosecution of culprits and rehabilitation of the child. A recent time has witnessed cruelty on children at an alarming rate in India too. Very little is reported about this in Indian literature. A recent WHO estimate shows that 40 million children in the world, aged 0-14 years are abused and neglected. These children require both health and social care<sup>3</sup>. This patient required medical treatment, emotional support, proper counseling and protection. Proper family rehabilitation and behavior improvement services should be supplied very enthusiastically to fight with this kind of issues. It has been found that poverty and alcohol abuse are two main devils that results in battered baby syndrome. We need to take steps to improve socioeconomic conditions to fight against this burning issue<sup>4</sup>. Before labeling the case as "Battered Baby Syndrome", it should be thoroughly investigated and all the possibilities of accidental injuries should be ruled out so as to avoid unnecessary harassment of an innocent<sup>3</sup>.

## Conclusions

In cases of child abuse, a Multidisciplinary Team (MDT) is a widely accepted and commonly used approach globally. This method unites all the agencies involved in managing the cases of child abuse and facilitates their joint efforts towards the common goal of protecting children and convicting criminals<sup>5</sup>. Generally the different systems work more or less independently with little coordination with each other. Such an approach may cause emotional trauma to the child repeatedly at every stage – history narration, treatment, investigation, prosecution and protection. An MDT approach makes such services less intrusive, more child sensitive and child friendly. The main effort is to prevent re-traumatisation of the child and to ensure that the victim has access to proper medical, legal and psychosocial care through a single unit.

Thus from this case it can be concluded that multidisciplinary approach is more promising than isolated & independent approaches in the total management & rehabilitation of the victimized child.

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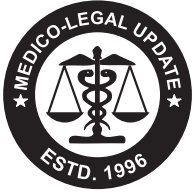
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