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Contents

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- 1 **The tell tale of a bite mark – call for action for pediatric specialists**
Arun M. Xavier, Amitha M. Hegde
- 5 **Trends of homicidal deaths in and around Belgaum, Karnataka**
Ashok Kumar Shetty
- 7 **Capital punishment**
K. K. Aggarwal
- 9 **An unusual case of death due to Lightening**
Chandra Prakash, Renu Bala, Deepa Deopa, Abhishek Rai, Roham
- 12 **Trends in culpable homicide amounting to murder in the city of Greater Mumbai- A five year study**
Dhiraj Buchade, Shailesh Mohite
- 15 **Compound odontoma in deciduous dentition – A rare case**
Firoza Samadi, J.N. Jaiswal, S. Navit, Anju Bansal, Fahad Samadi
- 17 **In camera trial and the Indian Law**
Umadevi. R. Hiremath, Hareesh. S. Gouda, Praveena. H. Gouda
- 19 **Incidence of suicides in Belgaum, Karnataka**
Ashok Kumar Shetty
- 21 **A case study of serial killers**
K. K. Aggarwal, D. S. Bhullar, Manisha Sharma
- 24 **Juvenile delinquency and nutrition – An association**
Sheetal Chhaya, Lavlesh Kumar
- 27 **Tooth morphology - A reliable tool for gender determination - A review**
Manju Gopakumar
- 31 **Forensic Odontology - A review and update**
Harini Chitta, B. V. Thimma Reddy, Rajasekhar Nutalapati, Vinay Kumar Reddy K., Nallan Chaitanya
- 36 **Railway Fatalities in South West Mumbai**
Pawan R. Sabale, Shailesh C. Mohite
- 40 **Suspected accident: A case report**
Pranav Prajapati, M. I. Sheikh
- 43 **Sjogren's Syndrome: A review**
Bastian T.S., Ceena Denny. E., Priyanka Singh, Sanjay Kumar Singh
- 47 **A study of paediatric poisoning cases at District Hospital Belgaum, Karnataka**
Ravindra. S. Honnungar, Lavlesh Kumar, Ashok Kumar Shetty, P.S.Jirli
- 51 **Adenoid cystic carcinoma of submandibular salivary gland: A case report**
Rohit Jaiswal, K.K. Gupta, Jagriti Gupta
- 54 **Microbial Forensics: The need to counter bioterrorism**
Santhosh. C.S., Vishwanathan. K. G., Jayasimha. V. L.
- 57 **Legal issues related to banking frauds in India**
Sushama Yadav, Sudhir Yadav, S. K. Tripathi
- 62 **A comparison of the methods for the recording of lip prints**
Annie J. Verghese, Vidyullatha V. Shetty, Shashidhar. C. Mestri
- 64 **Medicolegal significance of maduramycin poisoning**
Y. S. Bansal, Munish Wadhawan, Murali G., Vikas Joshi
- 66 **Extensive and unusual distribution of atherosclerosis**
Vipul Namdeorao Ambade, Hemlata D. Chimne, Dilip S. Sarate
- 68 **Evaluation of non-metric traits of supraorbital region in sexual dimorphism: A study in 60 adult human skulls**
Swami S., Patnaik V.V.G., Kaushal S., Sharma D.
- 73 **Psychological autopsy-A need of the future**
Abhishek Yadav, Manish Kumath, Manish Khanna, Alok Mishra, Alexander Khakha, Adarsh Kumar
- 77 **A case report of anesthetic and operative death due to negligence of Doctor**
L. Ananda Kumar, J. Nagalingam, L. C. Obulesu
- 79 **Lip prints (Cheiloscopy) - A review**
Vikash Ranjan, M. K. Sunil, Sophia Kurien, Ganpathi I. M.

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The tell tale of a bite mark – call for action for pediatric specialists

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Abstract

Child abuse has serious physical and psycho-social consequences which adversely affect the health and overall well-being of a child. Bite mark injuries are one of the several visual expressions of active child abuse and sexual assault. Health professionals ought to be attentive to any and all signs of child maltreatment. This paper highlights the importance of pediatric specialists in recognizing and protecting children inflicted with bite mark injuries.

Introduction

Over the centuries, children have been subjected to physical, sexual and emotional abuse as well as neglect. Depressing to note, this practice that demands the highest rank of global concerns is surrounded by a wall of silence and perpetuated by ignorance. Child abuse is shrouded in secrecy and there is a conspiracy of silence around the entire subject. Many a times it goes unnoticed and unreported on account of the innocence of the victim, stigma attached to the act, callousness and insensitivity of the investigating and the law enforcement agencies, etc. A child who has been sexually abused is traumatized for life but it is only much later in life when the emotional and psychological trauma aggravates that such people seek medical help¹.

In India, as in many other countries, however, there has been no understanding of the extent, magnitude and trends of the problem. The growing complexities of life and the dramatic changes brought about by socio-economic transitions in India have played a major role in increasing the vulnerability of children to various and newer forms of abuse. There is an urgent need to take up the problem as a larger social issue where the society, especially health professionals, have a responsibility to help the victims overcome their trauma and move on with life as normally as possible.

India has the largest number of children (375 million) in the world, nearly 40% of its population². In a report on Indian Child abuse statistics 2007, 69% of Indian children have been documented as victims of physical, emotional, or sexual abuse. 89% of the crimes are perpetrated by family members, while more than 70% of cases go unreported and unshared even with parents/family². The gravity of the situation demands that the issue of child abuse be placed on the national agenda. The Ministry has taken measures such as the enabling legislation to establish the National and State Commissions for Protection of Rights of the Child, the Integrated Child Protection Scheme, the draft Offences against Children Bill etc.

Most authorities agree that these estimates are probably low, due to underreporting as a result of a number of factors³:

1. Cultural mores make sexual abuse a stigma for victim, perpetrator, and family and an issue not easily broached.
2. Victims are often young children whose fear, lack of

awareness, or lack of language skills make them easy prey and victims who may not be ready or believable witnesses.

3. Health professionals may be unwilling to report cases of sexual abuse where clear physical evidence is lacking for fear of error, reprisal, or loss of patients.
4. Verification of sexual abuse by physical examination may be beyond the legal extent of practice for many professionals.

Being the first to encounter the victims of child abuse, pediatric fraternity in the field of medical and dental sciences ought to timely recognize, understand, document and reach out a helping hand to the oppressed.

A survey report

A cross sectional Survey was carried out recently by the Department of Pedodontics, A.B. Shetty Dental College, in ten schools in and around Mangalore to identify the non-documented cases of child abuses. To our despair, 3 out of 878 children were victimized of the same with visible bite marks on the neck (2 children) and hand (1 child). The children refused to speak about it, however, assumed to be a sign of punishment from the caregiver/parent due to the hyperkinetic nature displayed by these children. The defined problem is just the visible tip of an iceberg and the iceberg still needs to be recognized, as many more similar unreported cases are suspected; its limited documentation can be attributed to the innate fear in the child to admit, as well as our inability in prompt identification due to ethical restrictions.

Alarming to note, recent statistics document the India stands the second highest number in child labor in the world is concerned. It is more of a rural phenomenon than urban due to poverty, and represents a fundamental abuse of a child right and violation of various laws. Many working children are engaged in occupations that negatively affect their physical, mental and emotional well being and are below their minimum age for employment. While experts blame the system, poverty, illiteracy, adult unemployment; yet the fact is that the entire nation is responsible for every crime against a child. Instead of nipping the problem at the bud we unknowingly promote it by over looking at its incidence.

Bite marks – A Stigma!

Bite marks (Acute or healed) are lesions that may indicate abuse. They are frequently seen in circumstances of forcible rape, skirmishes between young children and hand-to-hand mortal combat. Dorion⁴ stated that child abuse should be listed among those human activities associated with bite mark evidence. Bite marks should be suspected when ecchymoses, abrasions, or lacerations are found in an elliptical or ovoid pattern. Bite marks may have a central area of ecchymoses (contusion) caused by two possible phenomena⁵: 1) positive

pressure from the closing of the teeth with disruption of small vessels or 2) negative pressure caused by suction and tongue thrusting.

Instances of human bites are generally rare, although it does sometimes occur that people use their teeth as a means of attack or defense. When looking into cases of the ill-treatment of children we often find bite-marks in addition to other signs of abuse. For abuse to occur, three components are necessary – an individual, usually an adult, a susceptible child, and the environment necessary to provoke the abusive action. Bite marks, when viewed as manifestations of the physical or sexual abuse of a child, support the premise and may even help the practitioner to diagnose maltreatment at an early stage. Human bite has a higher potential for infection than animal bite. Human bite can become septic and cause systemic infections. A human bite has been shown to transmit Hepatitis B, Hepatitis C, Herpes simplex virus (HSV), Syphilis, Tuberculosis, Actinomycosis, and Tetanus. Studies suggest that it is biologically possible to transmit HIV through human bites⁶.

The science of bite mark identification is potentially valuable in the field of Forensic Medicine⁷. Many pediatric dentists have seen a child in the office and not recognized or not related observed bite marks with child abuse. In United States, physicians and dentists are required to report suspected cases of child abuse and neglect to social service or law enforcement agencies⁸. Dentists trained as forensic odontologists may be of special help to physicians for the detection and evaluation of bite marks related to physical and sexual abuse⁹. Physicians receive minimal training in oral health and dental injury and disease and thus may not detect dental aspects of abuse or neglect as readily as they do child abuse and neglect involving other areas of the body. Therefore, pediatric physicians and dentists should collaborate to increase the prevention, detection, and treatment of these conditions.

Human bite mark identification

A representative human bite is described as an elliptical or circular (ring shape) patterned injury that records the specific characteristics of the teeth. Alternatively, it may be composed of two U or C shaped arches that are separated at their bases by an open space. The diameter of the injury typically ranges from 25-40 mm⁶.

The specific injury configuration of bite marks in tissue usually is caused by the respective incisal or occlusal portions of the teeth involved. Incisors cause rectangular markings, canines create triangular and premolars with either single or dual triangles or diamonds. Molars due to their posterior placements are seldom represented in the bite mark, while if they are present, they mirror the form of the specific occlusal surfaces involved¹⁰.

The normal distance between the maxillary canine teeth in adult humans is 2.5 to 4.0 cm, and the canine marks in a bite will be the most prominent or deep parts of the bite. Bites produced by dogs and other carnivorous animals tend to tear flesh, whereas human bites compress flesh and can cause abrasions, contusions, and lacerations but rarely avulsions of tissue. If the intercanine distance (ie, the linear distance between the central point of the cuspid tips) is 2.5 cm, the bite may have been caused by a child. If the intercanine distance is 2.5 to 3.0 cm, the bite was probably produced by a child or a small adult; if the distance is >3.0 cm, the bite was probably by an adult⁵.

Characterizing a Bite mark

Human bite marks are identified by their shape and size. They may appear only as bruising, or as a pattern of abrasions and lacerations. They may be caused by other children, or by adults in assault or as an inappropriate form of punishment. Sexually orientated bite marks occur more frequently in adolescents and adults¹¹.

The duration of a bite mark is dependent on the force applied and the extent of tissue damage. Teeth marks that do not break the skin can disappear within 24 hours but may persist for longer. In those cases where the skin is broken, the borders or edges will be apparent for several days depending on the thickness of the tissue. Thinner tissues retain the marks longer. A bite mark presents a unique opportunity to identify the perpetrator. Marks left by teeth in the lower arch are more circumscribed while those of the upper arch are more diffuse¹¹. This disparity can be explained because maxillary teeth are used for holding while mandibular teeth transfer the biting force and are used for incising or cutting¹².

An approach to assessment

Abuse or neglect may present to the clinician in a number of different ways:

- Through a direct allegation (sometimes termed a 'disclosure') made by the child, a parent or some other person
- Through signs and symptoms which are suggestive of physical abuse or neglect or,
- Through observations of child behaviour or parent-child interaction.

It is assumed that the pediatric dentist will be examining a child who is fully dressed. In certain instances, the diagnosis of child abuse is clear. However, there are occasions when evidence is inconclusive and the diagnosis merely suspected. In such occasions, advice should be received from other professionals specialized in pediatric medicine.

Mandatory documentation

On arrival of a child suspected of abuse with visible bite marks, pediatric specialists shouldn't fail in correctly documenting the following:

- Details pertaining to the name, age, gender and demographics of the victim; the names of the examiner(s) and the date of examination.
- A face-to-face conversation with the child who explains his encounter upon non-forceful compulsion. The rapport with the child should be so developed that the child is assured that the clinician will be his rescue.
- Recording separately what the accompanying person(s) claim for the occurrence of the injury. Reviewing the child's medical history is essential especially to rule out self inflicted injuries due to seizures.
- Describing the location, surface contour, shape, colour and size of the bite mark. The type of injury viz. Petechial hemorrhage, contusions (ecchymosis), abrasion, laceration etc. should also be documented.
- Position of mandibular arches, interdental characteristics etc. should be noted.
- If referral to a forensic specialist or others is felt necessary for further investigations, it should be mentioned in the case sheet proforma and duly referred.

Inventory in the documentation

If bite marks, particularly those involving human skin, are approached in a rational, systematic way with full understanding of the innate limitations, they can be worth while forensic evidence.

- A special photographic scale was developed by the American Board of Forensic Odontology (ABFO) for this purpose, as well as for documenting other patterned injuries, and can be obtained from the vendor (ABFO No. 2 reference scale, available from Lightning Powder Co Inc, Salem, Ore). Unlike fingerprints, which are reasonably stable over the course of an individual's life, the dentition is capable of major changes in configuration, with and without professional intervention. Teeth can be lost by extraction, trauma or exfoliation. The size and relationship of the arches can be altered by growth or orthodontic or surgical procedures. Various restorative materials can change the character of the biting surfaces or actual position of the individual teeth. The photograph should be taken at a right angle (perpendicular) to the bite. Black and white as well as color photographs should be taken, for each has a specific role in the presentation of court room evidence. The pattern, size, contour, and color(s) of the bite mark should be evaluated by a forensic odontologist/pathologist. If neither specialist is available, a pediatrician or pediatric dentist experienced in the patterns of child abuse injuries should observe and document the bite mark characteristics photographically with an identification tag and scale marker in the photograph repeated daily for at least 3 days to document the evolution and age of the bite^{5,11}.
- In addition to photographic evidence, every bite mark that shows indentations should have a polyvinyl siloxane impression made immediately after swabbing the bite mark for secretions containing DNA. This impression will help provide a 3-dimensional model of the bite mark. Written observations and photographs should be repeated daily for at least 3 days to document the evolution of the bite. Because each person has a characteristic bite pattern, a forensic odontologist may be able to match dental models (casts) of a suspected abuser's teeth with impressions or photographs of the bite⁷.
- DNA is present in epithelial cells from the mouth and may be deposited in bites. Methods to determine the ABO blood groups from the saliva on the skin were developed, and investigators tried to link bacteria and other organisms found in the bite mark to the oral milieu of the perpetrator⁷. Even if saliva and cells have dried, they should be collected on a sterile cotton swab moistened with distilled water, dried, and placed in a cardboard specimen tube or envelope. A control sample should be obtained from an uninvolved area of the child's skin. All samples should be sent to a certified forensic laboratory for prompt analysis⁷. A genotypic analysis catalogued by arbitrarily primed-PCR proved that streptococci isolated from recent bite marks provides 'proof of concept', thus, being indispensable for forensic evidence in situations where the perpetrator's DNA cannot be recovered¹³.
- Others attempted to simulate the consistency of human tissue by using articulated dental models to "bite" baker's dough and sponge rubber⁷.
- With the advent of electron microscopy and computer enhancement, these new technologies were applied to bite mark analysis⁷.
- When there are indentations in the skin, or to preserve the three-dimensional nature of the bitten area, impressions

should be taken to fabricate stone models¹⁴. This is done by fabricating custom impression trays and taking an impression of the mark and surrounding skin with a standard dental impression material. These impressions are then poured in dental stone to produce models.

Why document the earliest?

For bites on human skin, a potential bite injury must be recognized early, as the clarity and shape of the mark may change in a relatively short time in both living and dead victims. The appearance of a bite mark will change with time as swelling subsides and tissue begins to repair itself. This is especially true in children because of their rapid healing capabilities¹⁵. Bite marks appear most often as elliptical or round areas of contusion or abrasion occasionally with associated indentations. There may be avulsion of tissue, or even pieces of tissue bitten off. There may be considerable bruising and wounds that have penetrated the skin. Since the skin mark may change over time, photographs provide the most reliable means of preserving the information. However great their value, photographs have considerable inherent limitations, and there are stringent requirements regarding the accuracy of reproduction⁷. The basic difficulties involve replicating a three-dimensional object in a two-dimensional film and producing an image with true colors and spatial relations. Attention to procedure can help minimize these restrictions and create a reasonably reliable, consistent image for comparison.

The widening responsibilities of pediatric Specialists

Protecting our children includes reporting and preventing child abuse and is the responsibility of all of society, especially, pediatric health professionals. As Fontana¹⁶ stated "when they fail, we all fail, and children suffer." We can make a difference in the lives of many children through the early detection and reporting of cases of child abuse.

The Government of India has presented Childline as its response to the Child Rights Convention. Childline is a platform bringing together the Ministry for Women & Child Development, Government of India, UNICEF, Department of Telecommunications, street and community youth, non-profit organisations, academic institutions, the corporate sector and concerned individuals. The country's first toll-free tele-helpline '1098' for street children has grown into a national child protection service that operates in over 83 cities and towns in India. They not only respond to the emergency needs of children, but also link them to services for their long-term care and rehabilitation. In 12 years, Childline has received 13 million calls as off Jan. 2008 from children in need of care and protection from across the country¹⁷.

The scope of child helpline will be limited unless children are aware about it. It is important that children identify with the services as their own and feel motivated to call the helpline in need of help¹⁷. A pediatric specialist who may first observe the child in the office for their needs, could serve as the best source in imparting awareness regarding these protective strategies.

A common theme underlying most forms of child abuse is that of emotional hurt. The child who is physically abused often suffers emotionally from inconsistent parenting and fear while, the sexually abused child suffers from the lack of affection or supervision which leaves him/her vulnerable to the subtle advances of the perpetrator.

Health care professionals can highlight differences between caregiving and sexual abuse, discuss the potential of

bullying, and encourage parents to establish monitoring systems at home, in the community, and at school to protect their child. Counseling abused children is a challenging task for practitioners. The incidence of reported and substantiated child abuse and neglect has risen dramatically since the "discovery" of the Battered Child Syndrome in the sixties, and subsequent mandatory reporting laws.

The key to understanding the maltreated child is to look at the developmental stage rather than the chronological age. A coordinating pediatrician and pedodontist can follow the child's growth and development, while educators and school personnel can help to monitor the child's day-to-day safety and progress, and build programs to help the child's self-esteem and enhance cognitive development. It is important to remember that counseling alone cannot protect children, and that any effective long-term intervention will require a concerted team approach and a community which cares enough to offer adequate resources for families. Children will be healed and protected as families are helped.

Conclusion

Pediatric specialists must become more aware of their moral, legal, and ethical responsibilities in recognizing and reporting child abuse and neglect. All need to understand the seriousness of the problems of child maltreatment and realize that children do not just get hurt in abuse and neglect -- they often die as a direct result of their maltreatment. Professionals must do their part to help stop the pain, suffering, and death that result from child maltreatment as it has been said that victims of child abuse fall into either of these two categories -- those who live through it or those who never do!

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Trends of homicidal deaths in and around Belgaum, Karnataka

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Abstract

A retrospective study was undertaken to find out trends of homicidal deaths in and around Belgaum autopsied at KLE's Prabhakar Kore Hospital and Research Centre, Belgaum over a period of 5 years.

Out of 600 autopsies conducted, 28 were homicidal deaths. The commonest age group of victims were 21 to 40 years. Males predominated females in the ratio 6:1. Sharp weapon injury was the commonest type. Maximum number of victims died within 12 to 24 hours. Quarrel and Provocation was the main motive observed in most of the victims and this prevailed more in rural areas.

Keywords

Homicide, sharp cutting weapon, rural areas

Introduction

Today's generation exists in the world where science and technology has advanced itself to great heights which in-turn has led to a lot of changes in lifestyle. People today want fame and prosperity overnight. This in turn has led them to crime where they indulge themselves into violence in the form of crimes like robbery, rape, homicide, etc.

'Homicide' means killing of one human-being by another. This word has originated from two Greek words 'Homos' means human-being and 'Cidos' means destruction¹. Homicide today has been increasing rapidly all over the world and this has been increasing at an alarming rate in India too, probably due to increase in population, illiteracy, unemployment, poverty, social injustice, etc.

The objective of this study is to know the incidence of homicide in relation to age, sex, survival period and method used.

Material and methods

All homicidal deaths autopsied at KLE's Prabhakar Kore Hospital and Research Centre, Belgaum from 16th December

Trends of Homicide

Type of Injury	No. of cases	Percentage
Sharp	Stab Wound	11
	Chop Wound	2
	Incised Wound	2
Blunt	6	21.5
Fire Arm	4	14
Strangulation	0	0
Poisoning	1	4
Burns	2	7

2003 to 15th December 2008 form the material for the study. During this period out of 600 cases, only 28 were homicidal deaths, booked under Section 302 IPC.

Data was obtained from hospital case records, police records and also by direct interrogation from relatives, friends and other accompanying the deceased.

A proforma was evolved to get uniform information from all the above mentioned sources.

Observation and results

- Highest number of cases were sharp weapon injuries, stab injuries were the commonest type in sharp cutting weapon.
- Maximum number of homicidal deaths are seen in the age group of 21-40 years.
- Males predominated females in the ratio 6 : 1.
- In most of the homicidal cases, the victims and offenders were known to each other.
- The most common motive for homicide was quarrel and provocation.
- Homicidal deaths were seen highest in rural areas.
- Maximum number of victims died within 12-24 hours.

Discussion

Homicide is considered the most serious consequence of inter-personal violence. Homicide rates have been increasing rapidly probably due to increase in population, unemployment, poverty, greed, etc.

According to the present study, highest number of cases were sharp weapon injuries. This is consistent with the study conducted by Kohli & Aggarwal² in North-East Delhi, Murthy O.P. and Agnihotri A.K. in South Delhi³.

Stab injury was the commonest type which is consistent with the study of K.W.M. Scott in West Midlands⁴.

S.K.Pandey & Tripathi in Varnasi⁵ and Murphy G.K. in United States⁶ concluded that firearm was the most commonly used weapon for homicide which is in contrast to the present study. In the present study it was observed that there was a low incidence of fire arm deaths. This could be because most of the victims belonged to rural areas around Belgaum who were engaged mostly in agricultural occupation and hence they could easily have access to sharp weapons like knives, sickles, axe, dagger, etc.

The study of Oakland Homicide Trends of 2004⁷ and

Incidence of Age and Sex

Age (years)	Male	Female	Total	Percentage
0 – 20	4	2	6	21.5
21 – 40	14	2	16	57
41 – 60	6	0	6	21.5
> 60	0	0	0	0

Victim Offender Relationship in Present Study

Relationship	No. of homicidal deaths	Percentage
Family Member & Relatives	10	36
Known Persons	16	57
Unknown Persons	2	7

Motive for Homicide

Motive	No. of homicidal deaths	Percentage
Quarrel & Provocation	16	57
Previous Enmity	7	25
Dowry Harassment	2	7
Robbery	0	0
Not Known	3	11

according to the Australian Crime: Facts & Figures 2005⁸, male victims predominated female victims which is consistent with the present study.

According to U.S. Sinha, A.K.Kapoor and Surendra kumar Pandey⁹, the most common motive for homicide was dispute for money which is in contrast with the present study where quarrel and provocation was the common motive.

The study of Wolfgang¹⁰ and Centerwall¹¹ showed that the victims and offenders were known to each other which is consistent with the present study.

Conclusion

In the present study, homicide existed mostly in the rural areas and among the age group 21 to 40 years. Here the population depended mostly on agriculture for their livelihood and mostly stayed in joint families where earning people were mostly males. They usually had conflicts in the family for finance and property which in turn resulted in homicide.

Many homicidal cases never see the light of day as regards to truth and justice.

Suggestions

- Homicidal cases should be investigated very thoroughly by involving forensic experts for the investigation.
- A visit by the forensic experts to the scene of crime should be made mandatory along with the other investigating team.
- More stringent laws should be framed for offenders.
- Public awareness against homicides can be created through media like television, newspapers, etc.

Locality – Wise Distribution

Locality	No. of homicidal deaths	Percentage
Rural	16	57
Urban	12	43

Period of Survival After Assault

Time	No. of homicidal deaths	Percentage
Dead on arrival	1	4
Died within 6 hours	4	14
Died within 6 to 12 hours	4	14
Died within 12 to 24 hours	12	43
Died within 24 to 48 hours	6	21
Died after 2 days	1	4

- Strict censor regulation in screening violent movies/television shows.

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Capital punishment

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Abstract

The world is divided on the issue of Capital punishment. Many nations have abolished death as a judicial punishment, with the argument, eye for an eye is barbaric. India however has death penalty in statute. It is awarded in rarest of rare cases. Death by hanging is not complete, till autopsy is carried out on the deceased. In present day scenario, keeping in view of the rarity of capital punishment, certain important relevant points discussed.

Key words

Judicial hanging, Capital punishment, Complete Hanging

Introduction

However barbaric may the action of hanging be, it is still in vogue in many countries of the world, including India. It is often supported by the facts that, it is the least painful form of death, which can be offered to a criminal. It is also awarded in the rarest of rare category of cases. It is for the Parliament to decide whether or not to abolish capital punishment¹ with public opinion becoming stringer and stronger, against this sentence, Judges sentence with death only when no alternative is present, with them. They will continue to do so, so long the death penalty is un statute.

It is interesting to note the comment of Ex- chief justice of India of Mr. K. Sabharwal. "The debate about death penalty is growing on world over. In Europe there is no death penalty, but it is there in America. The president of India is against it, I am personally against it. In Government there are many who support it. There are two views. Opinion is equal divided, but death penalty will be given as long as it is there in law"².

Case report

In the pre-dawn hours on December 30, 2006, as shown in TV, The Former President of Iraq, Saddam Hussein stood calmly at the gallows, a thick yellow noose around his neck, ready to be hanged. The executioners, men in black ski masks and leather jackets, stood behind him.

Saddam said "Ya Allah", preparing himself for the platform he stood on to open up. He was wearing a pair of ironed black pants, an ivory-white shirt and a black, luxurious top coat.

"He seemed normal, not confused or afraid," recalled Muneer Haddad a Judge in Iraq's appeal's Court, who was responsible for execution of Saddam. Haddad read to Saddam the verdict and the ruling by the appeals court, and then they took Saddam to a large room with no windows, with a staircase that leads to a tall gallows with a large pit at the bottom. "it was very cold," recalled Handdad "It had the stench of death."

Sami al-Askari, a prominent shi'ite Politician close to Prime Minister Nuri al-Maliki, witnesses the event and told Reuters the process of Saddam's execution took 25 minutes but once he was dropped through a trap door his death was very quick. "One of the guards pulled a lever and he dropped half a meter into a trap door. We heard his neck snap instantly and we even saw a small amount of blood around the rope, they left him hanging for around 10 minutes before a doctor confirmed his death and they untied him and placed him in a white body-bag, Askari said⁴.

Discussion

It is in movies, plays and story books, imagination is used to show execution by hanging. Ironically it was Saddam Hussein, who for the first time in the History of Electronic Media, telecasted the gruesome act of execution both by Firing squad and hanging. He did this to terrorize the Iraqi Population against any upsurge. Following execution of hanging Saddam's body was handed over after port-mortem to his relatives. Thankfully, the rate of execution by hanging has drastically gone down at present times. Salient points on judicial hanging discussed.

Judicial hanging: It is a form a violent asphyxial deaths in which the body is suspended, with a ligature around the neck. The hanging is 'complete hanging (since) when the body is fully suspended and no part of the body touches the ground [5] Speaking in legal term it is one of the official methods of execution of death sentence. The rope, which is looped round neck, is of sufficient length to allow a drop of five to seven feet, so as to cause fracture of cervical column, resulting in fracture dislocation of second and third or third and fourth cervical vertebra, injuring to pons and medulla with instantaneous death, due to failures of respiratory centre⁶.

For hanging to be complete, Post-Mortem is a mandatory requirement, therefore following aspects need to be born in mind by an Autopsy surgeon.

- a) Rope: Traditionally the rope for hanging is very carefully made. It is hand made since pre-Independence time, in a jail. It is supplied to other jails on demand. Chances of its snapping off is almost nil.
- b) Hangman: In pre-Independent era hanging was a routine punishment. It was used basically to install phobia among the population. Hangman was employed in all prisons. Now with the rarity of this sentence, this trade, is virtually extinct. The Hangman of Alipur Prison in Kolkata, in an interview, after, executing a condemned prisoner, gave details of his charter of duties, in which he mentioned that he was so trained that even in dark he can tie noose properly.
- c) Autopsy: Certain instances are worth noting, like during the act of hanging of Saddam's Half Brother Brazan Ibrahim, on 14 Jan at 3 AM, local time, got decapitate, Saddam half-brother's head gets ripped off during execution⁷ The act was defended by telling that The

Convict was not subjected to any mistreatment, it was an act of God, however, there had been cases where human rights were grossly violated like it is alleged when Mr. ZA Bhutto, Ex president of Pakistan was to be hanged. He refused to go to the gallows. he was maltreated, killed and then dragged to the gallows, then his dead body was hanged.

In autopsy, following judicial hanging, it is common to see the Cervical bones crushed into pieces. Signs of typical hanging may be normally absent.

One of the common experiences during Autopsy is the body temperature, since the post-mortem is done almost immediately after death the blood is at normal body temperature, this may be disturbing to the autopsy surgeon.

d) public-outcry-Many Human activist Groups are against Hanging, may be some of them may cause harm to innocent Medical person carrying out Autopsy on orders of State.

Conclusion

This sub Continent, is planning to put Man in Moon by the first half of this century, unfortunately still has death penalty

in the statute, may be in times to come, things will change, for good. Till such time death penalty persists in the law, post mortem will have to be carried out by an autopsy surgeon, the points discussed worth keeping in mind.

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An unusual case of death due to Lightning

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Abstract

An electrical discharge between a negatively charged thunder cloud and a positively charged object on the earth causes lightning. A single flash which is of an enormous potential last about 1/1000 of seconds. The effect of lightning estimated about 100-1000 million volts with current of about 2000amperes. The effect of lightning on the human body depends on number of feature such as intensity of the current, the time it spend passing through the body and the pathway involved. Dry skin and dry clothes are bad conductors where as wet clothes and wet skins are good conductors.

Introduction

Lightning accounts for a minimal number of burn injuries (approximately 1%.) but it can have deadly effects. The victims are mostly young people who are struck during various outdoor activities. Metal instruments attract electric current in an open field. In addition to voltage, amperage there are many factors like, body resistance, contact time, pathway, and type of current, which are determining elements causing tissue damage.

Resistance depends on water in the tissues, which is a good conductor, and consequently wet skin, clothes, and shoes are less resistant than dry surfaces.

Tissue damage due to an electric discharge can be caused by local generation of heat with the passage of current, injury to the endothelial membrane in deep tissues (progressive necrosis), and flash phenomena.

1. Lightning strike is rare and causes human injury by 4 distinct mechanisms:, direct, splash stride, and blast effect. The type of injury depends on energy imparted to the body by the strike that may be mechanical, thermal, or electrical .Lightning injuries may be classified into minor (no loss of consciousness with or without amnesia), moderate (loss of consciousness and subsequent recovery with minor deficit); and severe (full cardiopulmonary arrest).
2. Although most lightning morbidity and mortality is through cardiac and neurological events, other organ systems can be affected.
3. Pathophysiological response is a function of the nature and intensity of the current and its pathway through the body. Five primary mechanisms of lightning: direct hit; splash; contact, step voltage, and blunt trauma. Direct vs. indirect processes are described as:

Direct Lightning Strikes

Hundreds of millions of volts impact the victim during the direct attachment process. According to Ohm's Law $E = I X R$,

14,000,000 volts can be generated from a 20kA lightning flash attaching to a (nominal) 700 ohm body surface resistance object. Burns, subcutaneous fluid explosions (steam), and blunt trauma from self-inflicted opisthotonic contractions may be among the results.

Indirect Lightning Strikes

Lightning exhibits radial, horizontal arcing in excess of 40meter is called as ARCHING OF CURRENT. This ground surface lightning spreads according to local soils impedance characteristics, resulting in step and touch voltage hazards. Victims insulted while near trees, or touching electrical appliances, or in contact with water or other unintended conductors often are recipients of fatal currents and voltages after lightning strikes them indirectly.

Case report

On 26th may I encountered a very strange case brought to our autopsy center, there was this 25 year old male laborer brought by the police for the post mortem examination. On 25 may 2008 around 6 pm there was witnesses of event of bad weather with drastic changes as hails and storm with thunder and lightening when he was returning from his work with three friends near gola gate forest area, lalkuan, nainital district. Deceased was unfortunate to be stroked by lightening sparing his friends. He died within 15 minutes on the spot.

On external examination, shirt was torn and burned mostly around shoulder and collar, may be due to flash over effect. This is at times easily be misleading as a victim of assault as torn cloths are very difficult to differentiate, especially in case of female it may be mistaken as a case of rape and murder. In pocket there were 2-3 coins which were distorted and melted. there were burn mostly on the right side of the upper half of the body. that is [over the right side of the neck, shoulder, fronto lateral aspect of the chest, abdomen and right upper limb] ranging from superficial to full thickness burn of various size .as in patches or in punctuate form. Base of the burnt area is reddish and parchmented. These were accompanied with burning and singing of scalp hair on the right side of the scalp with laceration over right parietal region of scalp; burning and laceration over the right pinna. A fern like or spidery pattern of lightening injury or erythema on skin present over the back of chest and abdomen mostly on the right side including right shoulder region. These type of typical pattern of mark is called as filigree burn or arborization mark or feathering or some times lichtenberg's flowers or keraunographic markings. In some studies it has been mentioned that 70% of lightening has the above mention filigree burn in occurrences to the cases.

The most popular explanation of such marks comes from hemoglobin staining of the tissue. With inflammation signs

Fig. 1: Showing lightning burn with torn cloths



all around. or due to the effect of break down of the red cells within capillaries .and subsequent escape of the hemoglobin in the loose perivascular tissue. Apart from above mention postmortem findings there were left ear bleed present and hemorrhagic congestion present over left eye.

On internal examination: Heamtoma was present over underlying layer of scalp on the both side .brain had extensive sub dural heamtoma present over frontolateral aspect of the both cerebral hemisphere and all the internal organs were congested. Some atypical presentation which may be found are steam burn secondary to lightening due to vaporization of sweat or rain water on the victim they have typical sulphur like burning odour. In vascular injuries there is disruption of the endothelium as well as disintegration of the media producing hemorrhage. In muscles sometimes we may find electroporation due to extreme heat effect on the muscles. Neuropathic changes includes focal petechial hemorrhages and chromatolysis of pyramidal cells and there is localized ballooning of myelin sheaths.

In the above given case the cause of death in particular has been due to current passing through the brain stem causing immediate cessation of vital centers [mainly respiratory center] accompanied by head injuries [subdural heamtoma]

Lightening Safety Tips

Outdoors

Not to go to an open space or roof of a building during lightening.

Stay away from the trees, electrical poles or other tall objects.

Not to touch metallic fencings or substances,

Not to be near an electrical line, telephone wire or antenna.

Never swim during lightening

Indoors

A house or other substantial building offers the best protection from lightning. Open shelters, carports, garages and sheds are designed to protect people and property from rain and sun – NOT lightning.

There are three main ways lightning enters a building:

1. A direct strike
2. Through wires or pipes that extend outside the building
3. Through the ground

Once in a structure, the current from a lightning strike can travel through electrical lines, plumbing, phone lines, and radio or TV reception systems. Lightning can also travel through any metal wiring or bars in concrete walls or flooring.

Fig. 2: Showing filigree burn



• Avoid contact with corded phones

- ◆ Stay away from windows and exterior doors
- ◆ Stay off of porches and decks
- ◆ Avoid contact with electrical equipment or cords
- ◆ Stay away from plumbing and plumbing appliances
- ◆ Be alert for direct lightning strikes

If a person is struck by lightning, immediate medical attention may be the difference between life and death.

With proper medical treatment, most victims can survive a lightning strike. However, the long-term effects on their lives and the lives of their family members can be devastating.

Death by lightning may be due to

1. Ventricular fibrillation
2. Respiratory arrest
3. Asphyxia

Although lightning causes cardiac arrest in most fatalities

Only a few victims suffer burns. Physically, only a few lightning strike victims actually suffer burns, and these are usually minor. Most lightning burns occur in the extremities where the current either enters or exits the body.

Those who survive may have the long term side effect. The strike survivors may have:

- Memory loss
- Personality changes
- Difficulty carrying on more than one task at a time
- Fatigue
- Irreparable nerve damage
- Chronic pain and/or headaches
- Difficulty sleeping
- Dizziness

Treatment

If the lightning strike is not witnessed, it is difficult and confusing at times to clarify the diagnoses. Differential diagnoses include trauma and assault, MI CVA Seizers Subarachnoid hemorrhage and the differential that is used for the unconsciousness. The presence of typical burn patterns outdoor location with thunderstorm present and tympanic rupture may be clues. Quick initial assessment and treatment needs to be instituted.

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Trends in culpable homicide amounting to murder in the city of Greater Mumbai- A five year study

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Abstract

The study was aimed to determine underlying trends in the incidences of homicides to assess the frequency of homicide by age, sex and religion of victim. An attempt is also made to find out the motive of homicide, causative weapon, pattern of injuries and cause of death in homicide cases.

Keywords

Culpable homicide, murder, motive, weapon, cause of death, panchnama, pattern of injuries.

Introduction

According to English law, "homicide" is a general term which includes several distinct crimes and means the death of one human being as the result of the conduct of another. However Indian law does not specifically define homicide. Generally speaking, therefore, a homicide may be criminal or noncriminal. It may be caused by an act of commission or omission. To constitute a criminal act, the act that causes the death of another human being must be committed with criminal intent and without lawful excuse or justification.

Material and methods

A retrospective study of 3yrs during the calendar years 2003 to 2005 and prospective study of 2yrs during the calendar years 2006 to 2007 was carried out from data obtained from all postmortem centers of Mumbai City. Total data of 600 cases was collected for this study from postmortem reports and police panchnama and gathered in a predetermined format.

Observations and results

The present study demonstrated preponderance of male victims over female. The age group of 21-30 years was the most commonly affected. The mean age of victim was 32.80 years with the youngest victim being newborn infant and

oldest victim of 94 years. Infanticide was most common in the female child. The most common motives of homicide in the age group 21-30 year were revenge and break down of relationship whereas disputes over property/money, or theft was commonest motive in age groups of 51-65 year and >=66 year. Most of the victims belonged to Hindu religion. The most common motive for homicide in Hindu religion was disputes over property/money, or theft and revenge in Muslim victims.

The head, face and neck region of the body was most often targeted, and the neck structures being most commonly involved among them. Hard and blunt instrument/objects were the weapons of choice, followed by others (ligatures, etc.). The most common motives for killing were disputes over property/money, theft and revenge. The most common motive in male victims was revenge and dispute over property/money or theft in female victims. Head injury was most commonly associated with motive of revenge and neurogenic and haemorrhagic shock with motive disputes over property/ money, or theft (theft). The commonest cause of death was neurogenic and haemorrhagic shock, followed by head injury and mechanical asphyxiation. The most common cause of death in male victims was neurogenic and haemorrhagic shock and mechanical asphyxia in female victims.

Females were most often the victims of homicidal thermal burns, and males were most commonly the victims of firearm injuries. Homicidal drowning was more common in children, and homicidal poisoning was rare in them. Two cases of homicide-suicide were recorded, involving 3 female victims, with both male perpetrators committing suicide on the same day.

Discussion

The observations and results of the present study are compared and contrasted with the work of preceding researchers as follows:

There was a male preponderance i.e. 421 (70.2%) males and 179 (29.8%) females, giving a male: female ratio of 2.4 : 1 which is consistent with observations of Ghangale, Dhawane, and Mukherjee³; Aggarwal and Bansal¹; Scott¹¹; Hilal, Cekin, Mete and Gulmen et al⁴; Mohanty, Mohanty and Acharya⁷; Hougen, Rogde and Poulsen⁵ and Perry and France⁹. Most of the victims were in the age group of 21 to 30 years

Table 1: Distribution of Cases According to Sex

			Year					Total
			2003	2004	2005	2006	2007	
Sex	Male	n	101	90	82	84	64	421
		% within Year	71.1%	66.2%	71.9%	69.4%	73.6%	70.2%
	Female	n	41	46	32	37	23	179
		% within Year	28.9%	33.8%	28.1%	30.6%	26.4%	29.8%
Total		n	142	136	114	121	87	600
		% within Year	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Table 2: Distribution of cases according to purpose or motive

		Year						Total
		2003	2004	2005	2006	2007		
Purpose or Motive	Disputes over property / money or theft	n	44	40	31	23	23	161
		% within Year	31.0%	29.4%	27.2%	19.0%	26.4%	26.8%
	Revenge	n	38	33	35	36	18	160
		% within Year	26.8%	24.3%	30.7%	29.8%	20.7%	26.7%
	Jealousy	n	3	6	2	4	5	20
		% within Year	2.1%	4.4%	1.8%	3.3%	5.7%	3.3%
	Sudden grave provocation	n	26	23	17	25	17	108
		% within Year	18.3%	16.9%	14.9%	20.7%	19.5%	18.0%
	*Breakdown of relationship	n	4	8	5	4	3	24
		% within Year	2.8%	5.9%	4.4%	3.3%	3.4%	4.0%
	Sexual assault	n	2	3	1	7	0	13
		% within Year	1.4%	2.2%	0.9%	5.8%	0.0%	2.2%
	Not known	n	25	23	23	22	21	114
		% within Year	17.6%	16.9%	20.2%	18.2%	24.1%	19.0%
Total		n	142	136	114	121	87	600
		% within Year	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

*Breakdown of relationship (e.g. strained relations between spouses or one spouse involved in an illicit relationship, with perpetrator being either one of the spouse or his/her consort)

(third decade of life) 218 (36.3%) followed by age group 31 to 40 yrs (fourth decade of life) 141 (23.5%) which is consistent with the studies of Ghangale, Dhawane, and Mukherjee³; Aggarwal and Bansal¹; Scott¹¹; Rouse¹⁰; Hilal, Cekin, Mete and Gulmen et al⁴. The youngest victim of the present study was a newborn child and the oldest victim was 94 year female which is consistent with study of Ghangale, Dhawane, and Mukherjee³ and Hilal, Cekin, Mete and Gulmen et al⁴. The mean age of victims in the present study was 32.80 years, with SD 15.69 and median 30.00 years this findings are consistent with observations of Strom, Nordenram and Johanson¹²; Hilal, Cekin, Mete and Gulmen et al⁴; Mcgrath and Oyeboode⁶. The commonest motives for homicides were disputes over property/money, or theft (161 cases, 26.8%) and revenge (160 cases, 26.7%) which is consistent with the study of Mohanty, Mohanty and Acharya⁷, in which revenge was the motive in nearly one third of the cases. Most of the victims have injuries caused by hard and blunt weapons followed by sharp edged weapons. These observations contradicts the findings of Ghangale, Dhawane, and Mukherjee³; Aggarwal and Bansal¹ and Rouse¹⁰ where injuries by sharp edged weapons was most common followed by hard and blunt weapons. The most common region of the body involved was the head, face and

neck (385, 64.2%), which is consistent with study of Mohanty, Mohanty and Panigrahi et al⁸. The most common cause of death was neurogenic and haemorrhagic shock (293, 48.8%), followed by head injury (156, 26.0%), which is consistent with the study of Aggarwal and Bansal¹ where shock was the most common cause of death(213, 62.8%). Homicidal thermal burns were more common in females (22, 91.7%) which is consistent with the study of Ghangale, Dhawane, and Mukherjee³ and Aggarwal and Bansal¹. Homicidal drowning in 2 (0.3%) cases were reported, the victims being of age 3 ½ years and 2 months which is consistent with the study of Aggarwal and Bansal¹. The most common victims of homicidal firearm injuries were males (41, 97.6%); which is consistent with that of Aggarwal and Bansal¹. In this study 2 cases (0.4%) of homicide-suicide were noted, involving 3 females the wife in one case, wife and daughter in another. In both these cases, the perpetrator was the husband, who later committed suicide on the same day. The mean age of the perpetrators was 53.5 years and that of victims 33.3 years which is consistent with Felthous, Hempel et al² where most perpetrators of combined homicide-suicides were males, most victims females.

Table 3: Distribution of cases according to region of body on which injury was inflicted

Region of body		Year					Total	
		2003	2004	2005	2006	2007		
Head Face & Neck	n	88	79	72	82	64	385	
	% within Year	62.0%	58.1%	63.2%	67.8%	73.6%	64.2%	
Thorax	n	57	52	32	32	24	197	
	% within Year	40.1%	38.2%	28.1%	26.4%	27.6%	32.8%	
Abdomen (Including genitals)	n	61	60	44	51	30	246	
	% within Year	43.0%	44.1%	38.6%	42.1%	34.5%	41.0%	
Limbs	n	25	23	23	19	13	103	
	% within Year	17.6%	16.9%	20.2%	15.7%	14.9%	17.2%	
Total		n	142	136	114	121	87	600
		% within Year	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Table 4: Distribution of cases according to weapon used

Weapon		Year					Total
		2003	2004	2005	2006	2007	
Hard and blunt	n	44	50	39	49	32	214
	% within Year	31.0%	36.8%	34.2%	40.5%	36.8%	35.7%
Sharp edged	n	23	7	18	11	12	71
	% within Year	16.2%	5.1%	15.8%	9.1%	13.8%	11.8%
Sharp edged and pointed	n	33	37	26	23	24	143
	% within Year	23.2%	27.2%	22.8%	19.0%	27.6%	23.8%
Firearms	n	17	8	8	6	3	42
	% within Year	11.9%	5.9%	7.0%	5.0%	3.4%	7.0%
Others (Ligatures, etc.)	n	29	40	30	37	28	164
	% within Year	20.4%	29.4%	26.3%	30.6%	32.2%	27.3%
Total	n	142	136	114	121	87	600
	% within Year	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Table 5: Distribution of cases according to cause of death

Cause of death		Year					Total
		2003	2004	2005	2006	2007	
Head injury	n	30	37	27	38	24	156
	% within Year	21.1%	27.2%	23.7%	31.4%	27.6%	26.0%
Neurogenic and haemorrhagic shock	n	81	62	61	48	41	293
	% within Year	57.0%	45.6%	53.5%	39.7%	47.1%	48.8%
Mechanical asphyxia	n	29	33	30	35	27	154
	% within Year	20.4%	24.3%	26.3%	28.9%	31.0%	25.7%
Thermal burns	n	6	8	2	5	3	24
	% within Year	4.2%	5.9%	1.8%	4.1%	3.4%	4.0%
Poisoning	n	1	0	0	0	0	1
	% within Year	0.7%	0.0%	0.0%	0.0%	0.0%	0.2%
Complications of injuries	n	4	5	4	4	2	19
	% within Year	2.8%	3.7%	3.5%	3.3%	2.3%	3.2%
Total	n	142	136	114	121	87	600
	% within Year	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

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Compound odontoma in deciduous dentition – A rare case

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Abstract

A compound odontoma is a mixed tumor of odontogenic origin, in which both ectodermal and mesenchymal cells exhibit complete differentiation, resulting in the formation of tooth like structures. It occurs with equal frequency in both sexes, and is often initially asymptomatic. It may lead to interference with the eruption of its associated tooth. Odontomas are mostly associated with permanent teeth, and they are rarely associated with deciduous teeth. CASE REPORT: A 4 year-old boy reported to the Department of Pedodontics for management of a compound odontoma.

Conclusion

If odontomas, which interfered with tooth eruption, were extirpated early, the impacted teeth would probably erupt normally and be normal in shape.

Keywords

Odontogenic Tumor; Complex Odontoma; Compound Odontoma.

Introduction

Odontomas is a mixed tumor consisting of the hamartomatous malformations of the functional ameloblasts and odontoblasts unlike a true neoplasm¹. Although the odontoma was firstly described by Paul Brocain 1867, it has broadly consisted of amorphous masses of calcified tissues and classified by the World Health Organization (WHO) as complex composite and compound odontoma producing toothlike structures². The etiology of odontoma is unknown, although local trauma, infection, and genetic factors have been suggested. One aspect of the etiology of odontomas is that it mostly results from extraneous buds of odontogenic

epithelial cells³. Although the lesions are commonly asymptomatic, they may be discovered on routine radiographic examination. Radiographically, the complex odontoma typically appears as a well-defined radiolucent area containing an irregular mass or masses of mineralized tissue. While in the compound type, the radiopacity does not have a specific shape but appears as disorganized irregularly formed teeth of varying sizes and shapes⁴. In the present case, a four year-old-male-child with a compound odontoma localized in the mandible was treated surgically.

Case report

A four year-old-male child reported to the Department of Pedodontics due to the failure of eruption of the right mandibular canine and lateral incisor. Past family and medical histories were unremarkable. There was no history of trauma, deformations, or swelling of the maxillofacial region. Intra-oral examination revealed all primary teeth, except the right mandibular primary lateral incisor and canine. The mucosa at this region appeared normal. The space was sufficient for the eruption of the teeth (Fig 1).

A panoramic radiograph showed multiple radiopaque masses in 82, 83 regions (Fig. 2). The initial diagnosis based on the clinical and radiographic evaluations was a compound odontoma.

Surgical removal of the masses was accomplished under conscious sedation. A full thickness mucoperiosteal flap was reflected buccally between the lower right central incisor to the first primary molar. A thin layer of the bone overlying the labial surface was removed and the calcified masses were exposed (Fig. 3). There were fourteen small teeth like structures, which were removed without disturbing the underlying permanent tooth (Fig. 4).

The flap was replaced and sutured with 4-0 silk. Post operative healing was satisfactory. Patient is kept under observation for eruption of permanent teeth. Histopathologically, under decalcification multiple, small, single rooted tooth like structures exhibiting normal dentinal tubules, predentin and pulp tissue were observed, which further confirmed the diagnosis of compound odontome.

Fig. 1:



Fig. 2:



Fig. 3:



Fig. 4:



Discussion

Although the majority of missing or unerupted teeth are seen more common in the permanent dentition, it is relatively less common in the early-mixed dentition. Odontomas often cause disturbances in the eruption of teeth such as, impaction or delayed eruption, retention of primary teeth, or abnormalities in the position of the teeth such as tipping or displacement of adjacent teeth. In this case the reason of uneruption of both the permanent and primary canine and incisor was the presence of a compound type odontoma. Surgical exposure and elimination of mechanical obstruction is frequently the treatment of choice and spontaneous eruption can then be expected. Since the occurrence of a compound odontoma in the primary dentition is rare, removal of the mass without disturbing the underlying tooth germ will lead to the eruption of the permanent teeth in its position. The dentists have to carefully remove the odontome without causing any damage to the developing permanent tooth germ. The preoperative radiographs and casts have to be

retained in the clinic to avoid any legal issues at a later date. Recurrences of odontomas are uncommon as it is removed in toto.

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In camera trial and the Indian Law

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Abstract

In camera trial is the exception to the doctrine of open justice or open court trial. In camera trial is one of the rights provided by the Indian Law to the victims of rape; and also one of the provisions towards the protection of witnesses of terrorist activities and maintenance of national security. Indian Law recommends certain offences, where publicity could otherwise prejudice the interests of justice, to be tried in camera.

Key words

In camera trial, open court, justice, section 327 CrPC, rape, immoral trafficking.

Introduction

Justice is a great civilizing force and the court of Law is one of the pillars of justice. In India, the court is considered as good as temple of God. They are required to be kept open and in most of the circumstances the law requires trial of the case in 'Open court'. Open court is the one, to which the public has free access and right to enter. As per section 327 of Criminal Procedure Code, 1973 (CrPC), the place in which any criminal court is held for the purpose of inquiring into or trying any offence shall be deemed to be open court, to which the public generally have access¹. But, in some cases the law calls for 'In Camera' trial contrary to the open court trial. Here, the hearings and discussions are held in the judge's chamber or in the courtroom cleared of public or non-participants. In camera trial is usually done to lessen the inconvenience and to protect the privacy of victims, to keep the identity of witnesses secret etc. Such trial is also carried out in the matters concerned with security of the Nation and in certain cases where publicity could otherwise prejudice the interests of justice.

Discussion

In any trial, statement of the victim is an important part of evidence and it is necessary that the victim should be able to give his statement in the court of Law freely, without any pressure or fear. This is because, in many cases victims turn hostile due to threats or pressure from the accused or his associates. In certain cases the victim also feels uncomfortable about giving answers in front of the accused. In camera trial is one of the rights provided by the Indian Law to the victims of rape; and also one of the provisions towards the protection of witnesses of terrorist activities and maintenance of national security.

Offences to be tried in camera

1. According to section 327 of CrPC¹, inquiry in to and trial of rape or an offence under following sections of Indian Penal Code, 1860 (IPC)²

- i. Section 376 [A] IPC: Intercourse by a man with his wife, who is living separately from him under a decree of separation or under any custom or usage without her consent.
- ii. Section 376 [B] IPC: Public servant by taking advantage of his official position seduces or induces any woman who is in his custody to have sexual intercourse with him (such sexual intercourse not amounting to the offence of rape).
- iii. Section 376 [C] : Superintendent of jail or remand home or woman's/ children's institution, by taking advantage of his official position seduces or induces any female inmate to have sexual intercourse with him (such sexual intercourse not amounting to the offence of rape).
- iv. Section 376 [D]: Staff or member of management of a hospital, by taking advantage of his official position seduces or induces any woman in that hospital to have sexual intercourse with him (such sexual intercourse not amounting to the offence of rape).

However, the presiding Judge may, if he thinks fit, allow any particular person to be present on an application made by either of the parties¹.

2. As per the section 44 of Unlawful Activities (Prevention) Amendment Act, 2004,³

- i. Proceedings of the offences punishable under this Act i.e. unlawful or terrorist activity of individuals and associations can be held in camera if the court desires and reasons have to be recorded in writing.
- ii. A court, if on an application made by a witness in any proceeding before it or by the Public Prosecutor in relation to such witness or on its own motion, is satisfied that the life of such witness is in danger, it may, for reasons to be recorded in writing, take such measures as it deems fit for keeping the identity and address of such witness secret.

3. As per the Terrorist and Disruptive Activities (Prevention) Act, 1987⁴, for the purpose of protection of the witnesses, the proceedings under this Act may be held in camera if the designated court so desires (Section 16).

4. According to The Prevention of Terrorism Act, 2002,⁵ for the protection of witnesses, the proceedings under this Act may be held in camera if the designated court so desires (Section 30).

5. The Immoral Traffic (Prevention) Amendment Bill, 2006,⁶ which amends the Immoral Traffic (Prevention) Act, 1956, is passed to combat trafficking and sexual exploitation for commercial purposes. This bill punishes trafficking of females for the purpose of prostitution. Trafficking for other purposes like bonded labour, domestic work etc are not covered by the Bill. All the offences listed in the bill have to be tried in camera. This is an amendment to the principal Act. The offences punishable under this bill are,

- i. Section 3: Keeping a brothel or allowing premises to be used as a brothel.
- ii. Section 4: Living on the earnings of prostitution
- iii. Section 5: Procuring, inducing or taking person for the sake of prostitution
- iv. Section 5(A): Recruiting, transporting, transferring or receiving a person for the purpose of prostitution by threat, fraud, abuse of power of position etc.
- v. Section 5(C): Visiting a brothel for the purpose of sexual exploitation of any victim of trafficking.
- vi. Section 6: Detaining a person in premises where prostitution is carried on.
- vii. Section 7: Prostitution in or in the vicinity of public place.
- viii. Section 9: Seduction of a person in custody for prostitution.

The Immoral Traffic (Prevention) Amendment Bill, 2006 does not punish an individual if she is in prostitution for her own profit, but, it penalises prostitution if carried on in a brothel or from any public place within 200 meters of an educational institution, place of religious worship, hotel, hospital, nursing home or any public place notified by the Commissioner of Police or Magistrate. The Bill seeks to penalise any person who visits a brothel for the purpose of sexual exploitation of a trafficked victim⁶.

Victim of rape undergoes two crisis, first, the Rape and second, the subsequent Trial. Whereas, the first one seriously affects her dignity, destroys her sense of security and often damage her physically, the second one forces her to re-live through traumatic experience in the glare of publicity with the whole apparatus and paraphernalia of the criminal justice system focused upon her.

Section 273 CrPC requires the evidence to be taken in the presence of the accused in criminal proceedings. However, in certain exceptional circumstances an accused may be denied of his right to cross-examine a prosecution witness in open court (section 299 CrPC). According to section 327 (3) CrPC, it shall not be lawful for any person to print or publish any matter in relation to the proceedings held under section 327(2) CrPC (in camera trial), except with the previous permission of the court¹ and Section 228 (A) of IPC prescribes punishment (imprisonment for a term which may extend to 2 years and fine) for such publication without prior permission of the court².

Section 327 of CrPC is the shelter given, in the form of in camera trial, to the victims of heinous crime of rape. If a trial is conducted in camera, it will help the victim to give her evidence comfortably. The presence of the public makes a sense of shyness in the mind of the victim and she may not give her statement freely. It will also make the victims a little comfortable and answer the questions put during trial with greater ease. In camera trial will make to improve the quality of evidence and this improved quality of evidence will assist the courts in arriving at the truth.

In *Sakshi vs Union of India*, 2004⁷, the Honourable Supreme Court observed that the whole enquiry before a Court being to elicit the truth, it is absolutely necessary that the victim or the witnesses are able to depose about the entire incident in a free atmosphere without any embarrassment. The mere sight of the accused may induce an element of extreme fear in the mind of the victim or witnesses or can put them in a state of shock. In such situation she may not be able to give full details of the incident which may result in miscarriage of justice. Therefore, a screen or some such arrangement can be made where the victim or witness do not have to undergo the trauma of seeing the body or face of the accused.

Special statutes in India for the protection of identity of witnesses

In the pre-constitutional era, section 31 of the Bengal Suppression of Terrorist Outrages (Supplementary) Act, 1932⁸, empowered the special Magistrate to exclude persons or public from the limits of the court. Protection of the identity of the witnesses is provided in section 13 of Terrorist and Disruptive Activities (Prevention) Act, 1987⁴; section 30 of The Prevention of Terrorism Act, 2002⁵; section 44 of Unlawful Activities (Prevention) Amendment Ordinance, 2004³. Apart from these provisions in special statutes, there is a need for a general Law dealing with witness anonymity in all criminal cases where there is danger to the life of the witness or of his relatives or to his property.

Conclusion

In camera trial is a special provision in the Indian Law for the protection of unfortunate victims of rape and immoral trafficking. And, it is also a legal provision towards the protection of identity of the witnesses of terrorist and disruptive activities. Though in camera trial is an exception to the Open justice, it is always associated with the administration of justice. In judicial proceedings, apart from administration of justice, it is also important to safeguard the privacy of the victims/witnesses and protect them from threats; and to guard the national security.

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Incidence of suicides in Belgaum, Karnataka

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Abstract

A retrospective study was undertaken over a period of five years to find out the incidence of suicidal deaths in Belgaum, autopsied at KLE's Prabhakar Kore Hospital and Research Centre, Belgaum, a referral hospital catering to the needs of public within a radius of 100 km.

Out of 600 autopsies conducted, 196 were suicidal deaths. The commonest age group of victims were 21 to 30 years. Females predominated males in the ratio 2 : 1. The common mode of suicide was poisoning. Maximum number of victims died within 1 to 6 hours. Majority of the victims were married and were into agricultural occupation belonging to rural areas.

Keywords

Suicidal deaths, poisoning, agricultural occupation, rural area.

Introduction

Suicide is an act of taking one's own life intentionally. Suicide is one of the leading causes of death today and is considered as a major health problem. Suicidal patterns vary from country to country depending on the cultural, social and religious values. It is estimated that over 100,000 people die by suicide in India every year. India alone contributes to more than 10% of suicides in the world. The suicide rate in India has been increasing steadily and has reached 10.5 (per 100,000 of population) in 2006 registering a 67% increase over the value of 1980¹.

Ancient Indian history reveals the fact of suicidal deaths in the form of sati, johar, etc. But today in India, act of suicide is considered illegal under section 309 and 306 IPC. Today's lifestyle has changed to such an extent that people do not have time to give for their near and dear and also for themselves. The result is loneliness and depression provoking suicidal attempts. People run a race of life struggling to win career and financial security which in turn develops stress mentally and physically. The time their goals are not met, they lose their self confidence and make an end to their lives.

Suicidal deaths are more seen among retired people, unemployed, the childless, bankrupt business people, lonely people, married ladies facing dowry pressure, young students not coping with their studies, incurable medical ailments or mental disorders, etc. Economic uncertainty also has been a major reason for suicide.

Table I: Incidence of Suicidal Deaths

Total no. of autopsies conducted	Total no. of suicidal deaths	Percentage
600	196	32.7

The objective of this study is to know the incidence of suicidal deaths in relation to age, sex, survival period, mode used for suicide, marital status and victim's occupation.

Material and methods

All suicidal deaths autopsied at KLE's Prabhakar Kore Hospital and Research Centre, Belgaum from January 2004 to December 2008 form the material for the study. During this period out of 600 cases, only 196 were suicidal deaths.

Data was obtained from hospital case records and police records. A proforma was evolved to get uniform information from all the above mentioned sources.

Observation and results

- The commonest age group of victims were 21 to 30 years (57 %).
- Males predominated females in the ratio 2 : 1.
- Poisoning was the common mode used for suicide (56 %).
- Maximum number of victims died within 1 to 6 hours (24%).
- Majority of the victims were married (81%).
- Victims were mostly into agricultural occupation (43 %).
- Maximum number of victims were from rural areas (74 %).

Discussion

Suicidal deaths have been increasing at an alarming rate in the world. A 2006 report by the World Health Organisation (WHO) states that nearly a million people take their own lives every year, more than those murdered or killed in war. WHO figures show that a suicide takes place somewhere in the world every 40 seconds. According to the National Institute of Mental Health, suicide contagion is a serious problem, especially for young people. It is estimated that global annual suicide fatalities could rise to 1.5 million by 2020².

10th September - World Suicide Prevention Day: The World Suicide Prevention Day was formally announced on 10th September, 2003. Each year the International Association for Suicide Prevention (IASP) in collaboration with WHO uses this day to call attention to suicide as a leading cause of premature and preventable death³.

Today in India, suicide among farmers is a common

Table II: Incidence of suicidal deaths in relation to age and sex

Age (years)	Male	Female	Total	Percentage
11 – 20	4		12	16 8
21 – 30	4	4	68	112 57
31 – 40	8		48	56 29
41 – 50	6		2	8 4
50	2		2	4 2

Table III: Mode used for committing suicide

Mode	No. of cases	Percentage
Burn	66	34
Poisoning	110	56
Hanging	18	9
Drowning	2	1

Table IV: Period of survival

Survival Period	No. of cases	Percentage
Brought dead	12	6
1 to 6 hours	46	24
6 to 12 hours	38	19
12 to 24 hours	20	10
1 to 2 days	19	10
2 to 5 days	15	8
5 to 10 days	16	8
10 to 20 days	18	9
More than 20 days	12	6

Table V: Marital Status

Marital status	No. of cases	Percentage
Married	158	81
Unmarried	38	19

scenario. Usually farmers are only dependent on their agricultural land for income required for their livelihood. They face many problems like failure of rainfall, uncertainties of commodity price, a large family to support, no income from non-agricultural sources, social obligations to be met, etc. The farmer usually is stressed about indebtedness, economic conflicts with members of the family, crop failure, health problems, burden of obligations like marriage in the family, etc. Their self-esteem and innate sense of honour is lost which provokes them to commit suicide. The recent spate of farmers suicide in India has raised societal and governmental concern to address this growing tragedy.

Suicides are common among housewives too. The reason being dowry harassment by in-laws. Also there may be other reasons like conflicts between husband and wives, childless ladies, extra-marital affairs, etc.

Young generations today are exposed to suicides drastically. Children are not brought up peacefully. They are under pressure to deliver at school and to appear for competitive examinations. After they reach puberty, no one in the family gives them any advice about the meaning of life. Children with fear factor unable to bear the thought of rejection end up their lives. Many youngsters commit suicide because of ragging in their colleges where in they are unable to bear the humiliation.

Psychologists generally agree that humans do not end their lives for a single reason. There are always other causes that may or may not be related to the prime motive. Suicide is not chosen; it happens when pain exceeds resources for coping with pain. Suicidal victims may feel unwanted, unloved, victimized, or like they're a burden to others.

As per the study of Dr. Kh. Pradipkumar Singh, Dr. Fremingston K. Marak, Dr. Kikameren Longkumer, Prof. A. Momonchand⁴, majority victims were 21-30 years of age which is consistent with the present study but males predominated females and common method of suicide was hanging is a contrast study.

Table VI: Occupation

Occupation	No. of cases	Percentage
Agriculture	84	43
Service	8	4
Business	10	5
Unemployed	8	4
House wife	62	32
Labourer	24	12

Table VII: Locality-Wise Distribution

Locality	No. of cases	Percentage
Rural	144	74 (73.46)
Urban	52	26 (26.53)

Mladen Marciki, Mladen Ugljarevi, Tomislav Dijani, Boris Dumen~i and Ivan Po`gain⁵, in their study revealed that males predominated females, maximum age group of victims were 55-64 years, maximum suicides were among lonely people like widows, divorcees, etc., most victims were retired people, most common method of suicide was hanging. This is contrast to the present study. A similar contrast study was also done by Lalwani S, GASK Sharma, Rautji R and T Millo⁶ and also by Ahmad Saeed, M. Zahid Bashir, Delawar Khan, Javed Iqbal, Khurram Sohail Raja, Anayatur Rehman⁷. Among both the reference studies^{6,7}, age groups were consistent with the present study.

There is an urgent need to develop a national plan for suicide prevention in India. The priority areas are reducing the availability of and access to pesticides, reducing alcohol availability and consumption, promoting responsible media reporting of suicide and related issues, promoting and supporting NGOs, improving the capacity of primary care workers and specialist mental health services and providing support to those bereaved by suicide and training gatekeepers like teachers, police officers and practitioners of alternative system of medicine and faith healers.

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A case study of serial killers

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Abstract

The term "Serial Killer" today has become a catch-phrase with the popular press churning out books and movies centred on the serial killer. Some cases of serial killings appearing in electronic and print media from time to time are summarized in this paper with discussion on the possible causes and background of serial killings and role of forensic medicine and other experts in the investigation of the heinous crime, measures to treat the offenders and check the incidences.

Key words

Serial Killer, Homicide, Disorganized, Process-Focussed, Act-Focussed, Hedonistic, Psychopath, Schizophrenia, Lie Detector, Narco-analysis, Brain Mapping.

Introduction

The words homicide, murder and killing can be used synonymously to denote ending life of one human being by an act of another human being. If a person kills several victims of usually of a particular type, over a period of time with varying intervals in between, apparently without motive except for sexual or sadistic gratification, he is described as "serial killer" and such culprit is a special psychiatric entity and invariably a male. The serial killers exist throughout the world and India is no exception rather there seems to be rise in the incidences of serial killings in the country which is attracting considerable media and public attention¹. The following cases of serial killings are just being quoted and discussed to highlight the issue and sensitize the forensic experts for understanding and evolving the measures directly or indirectly concerning them.

Case-I

On December 29, 2006 a person Mohinder Singh Pandher aged 53 years, was arrested along with his servant Surendra Kohly aged 36 years from Noida adjoining Nithari village in the suburbs of Delhi. The duo carried out serial killings for two years with 38 children done to death and the dead bodies of the unfortunate victims were dismembered and dumped in drains in and around his Bungalow. Investigating agencies collected skeleton from the drains and autopsy was done on more than 40 bags of human remains there as per CBI sources.

Case-II

"Servant held for sexually abusing and murdering six children" was the headline of a leading national newspaper.

Satish alias Surendra who was working as a domestic help in the house of a businessman, confessed to having killed five children and a grownup girl after sexually abusing them. Skeleton and clothes were recovered from gunny bag. Police claimed that the accused was mentally ill.

Case-III

Mukesh, a father of five years old daughter and one year old son from Mukatsar town in Punjab, confessed to rape and brutally murdering five children whose dead bodies were recovered from a godown. He got married out of love five years ago against the wishes of his parents, confessed to the crime done under the influence of SMAC and dumping the dead bodies.

Case-IV

Khushwant Singh, a noted writer penned down a case of serial murder in an article published in a national daily under "Malice towards one and all". I sat through a sessions trial of the serial killer Raman Raghav a Tamilian, 26 years ago in Bombay who murdered more than a dozen persons including men, women and children sleeping on the pavements during night hours. He had neither enmity against them nor any motive for the killings. He was brought in the court in handcuffs and shackle. When a photographer Jatindra Arys tried to take his picture, he went berserk jumping like a maniac and it took time for him to cool down. His trial was a tame affair. He admitted to the killings and sounded proud of what he had done. He told the judge "Phansee Lagao" (Hang me). When the iron rod with which he had smashed the skulls of his victims was shown to him, he fondled it with affection as if it was his child. When the prosecuting lawyer shrank back, he said with a grin on his face "daro nahin, tumco nahin marney ka" [don't worry, I won't kill you].

Case-V

Mumbai's "beer man" admits to 15 murders: The 36 years old suspect Ravindra Kantrulu, had admitted to killing 15 people during his narco-analysis test followed by brain mapping and polygraph tests. Kantarulu said he would make his victims drink beer before killing them. Psychologist said, "he loves see blood." Kantarulu admitted he was a drug addict and that he under the influence of intoxicants like charas, committed crimes. They said "while high on drugs, he would get violent and kill" and the police said he had traumatic childhood.

Discussion

The word "homicide" is derived from the latin word 'homo' and 'cide'. Homo means 'man' and 'cide' means 'I cut' thus homicide is causing death of a human being by a human being. The word "murder" is defined under Section 300 IPC wherein an injury is caused to a person which is sufficient to cause death in the ordinary course of nature, with the intention to cause such injury, and if the bodily injury is intended to be inflicted is likely to cause death, it is labelled as 'culpable homicide' under Section 299 IPC². Homicide or killing of human being by act, procurement or omission on another human being is as old as civilization and is the common end point of different behavioural pathways; it may be the argument between the acquaintances, domestic violence, robberies, drug addiction and terrorism and to a large extent and intimate one³.

The Federal Bureau of Investigation [FBI] defines "serial murder" as killing of several persons in three or more separate incidents over weeks or extended period and the Behavioural Science Unit of FBI classifies serial killings as:

- a. **Disorganized:** When there is little evidence of extensive pre-crime planning and the killers tend to be far more violent seeming to kill for the process of killing, than the end result. They often engage in dismemberment or abuse of the dead victim meaning the killing is "Process-Focussed".
- b. **Organized:** The killers tend to plan out the crimes in great deal and having elaborate disposal schemes for the body. They kill the victim quickly and efficiently and do not mutilate as often as the disorganized offender meaning the killing is 'Act – Focussed'.

Homes and De Burger divide serial killers into four-categories as:

- a. **Visionary:** They are out of touch with reality, may be psychosis or schizophrenics and the crime occurs as a result of psychotic delusions, like murder in response to voices or visions urging them to kill.
- b. **Mission-oriented:** They have a distinct goal, feeling it is their mission to kill certain kind of people such as prostitutes and homosexuals to clean up the society.
- c. **Hedonistic:** They are psychopathic sexual sadists who torture and kill for pleasure. They kill for the kicks of it acting thrill-seekers.
- d. **Control-oriented:** They enjoy the absolute power over the victim.
- e. Organized crime members, mafia, and street gangs etc. Who kill for instrumental/financial/territorial purposes.

Origin

Although a mystery many a times, the foundation for the serial killer is usually laid down in their early life experiences during childhood with harsh childhood punishment and discipline.

Some of the common personality characters amongst the serial killers are:

- a. **Family Background:** Many such families have a history of psychological and behavioural problems like alcoholism, drug abuse or sexual abuse and the serial killers were abused physically, emotionally or sexually with poor relationship with family members especially mothers. They suffered a traumatic childhood or came from broken families.
- b. **Goals:** Serial killers do not work for obvious understandable goals but live and die for that which

appeals only to them.

- c. **Sexual undertones:** Many researchers have noted sexual undertones in majority serial killers.
- d. **Free will:** Presence of free will is one of the common factors concerning serial killers and evidently they act from a conscious perspective.
- e. **Fantasy:** Plays a larger role in the life of serial killer and he uses it as a coping mechanism for day -to- day life as if addicted to it.
- f. **Interpersonal relationship:** There is gradual deterioration of interpersonal relationship from increased reliance on addiction.
- g. **Inability to love:** It is especially evident in the serial killer and considered to be the core of ASPD i.e. antisocial personality disorder described in psychiatry.
- h. **Behaviour:** Highly impulsive and aggressive and they require more thrills than normal people.
- i. **Sadistic Nature:** It is an inherent and another feature with fascination for violence, injury and torture.
- j. **Lack of guilt:** Absolute lack of guilt and remorse is a classic feature.
- k. **External Motive:** The victim is killed for psychological gain without any external motive.
- l. **Ability to conceal:** The serial killer has abilities to conceal the criminal activities.
- m. **Family bonding:** He never truly bonds to his family, has very few friendships and viewed as loner.
- n. **Negative personality traits:** Preference for autoerotic activity, aggression, chronic lying, rebelliousness and fetish behaviour, inability to distinguish fantasy from reality are some negative personality traits which develop in serial killers resulting in their increased isolation.
- o. **Insecure and instable:** The extreme violence of some killers is because of this insecure and instability fear.
- p. **Unchecked killing:** Unless stopped the serial killer will kill again and again with increase in frequency unless removed from society⁴.

Approach to the serial killer

a. **Psychiatric Approach:** A key in understanding and explaining serial killers as he represents a potent Freudian id residing in us all⁵

1. **Psychosis and Schizophrenia:** Overt psychotic illness (especially that characterized by a predominance of positive symptoms of paranoid nature) has a direct influence on some acts of serial killing.
 2. **Neurotic disorders:** Homicidal behaviour is associated with depression. Murders have higher score on both psychotics and neuroticism inventories than other subjects.
 3. **Psychopath personality disorder (PPD):** is a persistent disability of mind resulting in abnormally aggressive or irresponsible behaviour that is not the product of psychosis or other illness. Psychopaths behave in a socially unacceptable manner often with adverse effects on themselves and others, they may leave behind them characteristic "Chain of Chaos" and they may show lack of remorse, shallow affect, impulsivity, a grandiose sense of self worth and lack of long term goals⁶.
 4. **Substance abuse:** Some studies found a prevalence of substance abuse disorders as high as 50% in serial killers with use of alcohol, amphetamines, marijuana or other drugs before the crime⁷.
- b. **Socio-Cultural Approach:** "When once a certain class of people has been placed by the temporal and spiritual

authorities outside the ranks of those whose life has value, then nothing comes more naturally to men than murder" Simone Weil (1909-43) a French philosopher said⁸. Socio-cultural theories of murder have been largely overlooked. However, it might have some bearing on the explanation of serial killing.

c. Neurological Approach: "Some cases of serial killers had a history of head injury and abnormality on computerized tomography [CT], electroencephalography [EEG] scans and neuropsychological testing. Brain wave abnormality is seen in half of the psychopathic population, but only 15% of non-psychopathic population shows this abnormality. Injury to the limbic part of brain which controls emotions of anger and fear, it can produce excessive violence⁹. Bizarre fantasies are central to serial killers who originate in the dominant hemisphere of the brain, when it is damaged, the fantasies can become bizarre or deviant.

d. Biochemical Approach: Studies have shown a number of neurotransmitters which can influence cortical and sub-cortical mechanisms for aggression and violence in particular, 5-hydroxyindoleacetic acid [5-HIAA] a metabolic bi-product of the neurotransmitter abnormalities may thus play a role in the offence of serial killer¹⁰.

e. Role of Genetics: The role of chromosomal disorders has been implicated in criminology. The XYY chromosomal abnormality (males born with extra "Y" or male chromosome) has been associated with "Super maleness" and this increased aggressiveness and violent behaviour.

f. Physical Factors: Sheldon (1940) examined body styles and divided human body shapes into three categories i.e. Endomorphs (short and fat), Ectomorphs (tall and thin) and Mesomorphs (Athletic). Mesomorphs were most likely to have a criminal predisposition and studies confirmed these findings.

Homicide act 1957 (England)

This Act brings the conception of diminished responsibility in a psychopath. The Act defines the "psychopathic personality" as a persistent mental disorder or disability of mind which results in abnormally aggressive or seriously irresponsible conduct on the part of the patient requiring or susceptible to treatment, for which he may be compulsorily detained in hospital. The defence took the plea of diminished responsibility in the ground of sexual psychopath, who was unable to control the desire. The appeal was allowed and the charge of murder was converted into manslaughter that is diminished responsibility¹¹.

Role of forensic scientist

Interrogation, questioning and cross questioning are the tools used to be applied earlier by the police or the investigating agencies for getting information from the suspect of crime. Forensic scientists are applying recent scientific methods of suspect interrogation to extract information. Commonly used methods are:

- a. **Lie Detector (Polygraph):** It measures physiological changes caused by sympathetic nervous system during questioning thereby ascertaining if the individual is speaking the truth.
- b. **Narco Test (Narco-analysis):** The individual is given titrated dose of IV thiopental sodium infusion, 2-2.5 mg/kg of body weight/hour of 2.5% solution under medical supervision and quizzed. The person in question under mild anaesthesia will not be able to hide the truth.
- c. **Brain Mapping:** It is done by Radio isotope scan, a further confirmatory test. Photographs are shown to the accused to reconfirm whatever he has said earlier.
These tests are conducted to assist in the investigation but do not have standing in the courts of law.

Conclusions

To establish the relationship between the serial killer, the crime and the possible cause or motive behind such heinous crimes, is a major challenge for the investigating agency, the forensic and corrective experts. The serial killers may have their own compulsions or reasons behind the crime. Multi disciplinary aetiology and approach can be the answer to this crime against society.

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Juvenile delinquency and nutrition – An association

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Abstract

According to the 2001 census India, the number of children below the age of eighteen years is estimated to be more than 400 million. The concept of juvenile delinquency is a relatively modern development, as is the notion of juvenile justice. A decadal analysis data published by the National Crime records Bureau, Ministry of home Affairs, Government of India, reflects that incidence and rate of juvenile delinquency is on the increasing trend. Historically, professionals have proposed a number of factors that theoretically explain delinquent behavior. Each theory represents the height of scientific understanding in each era. The definite role of nutrition related deficiency in causation of delinquency, an important aspect, is almost unattended in Indian context. There has been a powerful link between nutrients and delinquent behaviour. This paper intends to increase awareness among the concerned experts, so that may the issue be taken up and coming years may witness the juvenile delinquent be treated in different modes.

Key words

Juvenile, delinquency, nutrition.

Introduction

From the time of the first civil communities, every society has declared certain modes of behavior to be unacceptable or criminal in nature. A crime may be defined to be any act done in violation of those duties which an individual owes to the community, and for the breach of which the law has provided that the offender shall make satisfaction to the public¹. The criminals are supposed to be punished but with a variation considering the age of accuse. A person who has not completed 18 years of age is a juvenile² and the term Juvenile delinquency applies to violation of criminal code and certain patterns to behaviour that are not approved for children and young adolescents³. According to the 2001 census India is estimated to have more than 400 million children below the age of 18. A decadal analysis of the incidence and rate of juvenile delinquency from the data published by the National Crime records Bureau, Ministry of home Affairs, Government of India shows that percentage of juvenile crimes to total crime was on the increasing trend (1996 to 2006) ranging from 0.6 in 1996 to 1.1 in 2006⁴.

It is important to remember that the concept of juvenile delinquency is a relatively modern development, as is the notion of juvenile justice. Pre modern societies simply punished juvenile offenders as if they were nothing more than young criminals. The Constitution of India provides the basis for the legal framework to protect children, whom it recognizes as a discrete group with identifiable rights and needs.

Practitioners and researchers have sought for generations to explain why juveniles engage in criminal deviance. Is such behavior a matter of individual choice? Can our understanding of biology and psychology explain delinquency? To what extent do environmental factors influence juvenile deviance? Are juvenile delinquents likely to become adult criminals?

Historically, professionals have proposed a number of factors that theoretically explain delinquent behavior. Each theory represents the height of scientific understanding in each era. This is important, because policies derived from these theories have not only sought to isolate juvenile offenders but have also tried to manage the root causes of their behavior. Thus, punishments, rehabilitative techniques, detentions, and other controls have been designed to target the accepted explanatory factors.

Different scholars have classified juvenile delinquents on different basis and many have propounded different theories to explain juvenile deviance but no single theory has been universally accepted by experts.

The theories which basically explain the causes as they understood leading to juvenile deviance are Early theories—refers to the ancient practice of linking human affairs to the natural world and inferring that human behavior is derived from the forces of nature (Naturalism) and for many centuries, humans believed that evil creatures—demons or devils—wielded great influence over humans, sometimes possessing them and making them commit offenses against the greater good (Demonology). During the late eighteenth and early nineteenth century the new Classical theory reject the early theory and put forward that juvenile deviant behavior is a product of individual rational choice. The Biological theories refer to the effect of congenital (inherited physical) traits on human behavior. They present strongly deterministic explanations of delinquency and criminality, and hold that some people are “naturally born criminals” with physical qualities that govern their deviant tendencies. Psychological theories ascribe deviant behaviors to cognitive and personality disorders brought on by one’s environment, brain chemistry, or some other condition.

It is pertinent to mention the risk factors which are believed to play an important role in generating the youthful offenders. It is generally agreed that a number of factors that play an important part in a youngster’s delinquent behaviour can be divided into two groups, individual factors and situational factors. The individual factors include personality traits like submissiveness, defiance, hostility, impulsiveness, feeling of insecurity, fear, lack of self control and emotional conflicts while situational factors may be attributed to family, companions, movies, school environment, and work environment etc³.

Review of literature

There is a definite role of nutrition related deficiency in causation of delinquency, an important aspect which is

unattended in Indian context, though researches and studies are well taken up in developed countries and are applied to improve the juvenile delinquent by substituting the deficient minerals-vitamins in diet. There has been a powerful link between nutrients and behavior. Many researchers are of the opinion that "People should be responsible for what they eat, just like they are held responsible for when they drink and drive,".

A study conducted in regard to evaluate the association between nutrition and behavior at juvenile and adult correctional home and in public schools the findings were startling⁵. For example, one study of juvenile delinquents and adult felons in five states found that the "offenders with the worst behavior consumed the least vitamins and minerals."

The same subjects when supplemented with deficient multivitamin/mineral they displayed less antisocial or violent behavior, compared with those receiving a placebo. "The most common vitamins to be low among children whose conduct and academic performance improved after nutritional intervention are pyridoxine, folic acid, thiamine, niacin, and vitamin C," Numerous studies conducted in juvenile correctional institutions have reported that violence and serious antisocial behavior have been dramatically reduced after implementing nutrient dense diets.

A study "Iron deficiency among incarcerated juvenile delinquents" done in 1985 can be viewed as one of the early looks at the effects of iron deficiency and abnormal behavior. Through research performed in juvenile detention facilities, a high prevalence of iron deficiency was found among both male and female inmates. The study suggests further research into the problem of behavior issues and iron deficiency⁶. According to Werbach Melvyn, evidence is emerging that iron deficiency among adolescent males has been shown to be directly associated with aggressive behavior⁷. A study by Walsh W, which focuses on persons born with a metal-metabolism disorder often resulting in episodic violence, hyperactivity and conduct disorder⁸.

A research conducted by Schoenthaler S showed that nutrient dense diets in 813 state facilities resulted in significantly improved conduct. The distribution of vitamin and mineral supplements was a significant factor in promoting less violent behavior⁹.

Schmidt K, et al. found through his study that hair copper levels of young males classified as delinquent, was found to be at a higher level than lab norms¹⁰. Similarly Schrauzer GN, et al, collected data from 27 counties in Texas, when adjusted for population density, show that the incidence of homicide, suicide and rape were significantly high in areas where the drinking water contained little or no lithium. Results of this study suggest that low level doses of lithium have a beneficial effect on human behavior¹¹.

In a study of patients with biochemical evidence of thiamine deficiency related to junk food diets, the adolescents especially were found to be impulsive, irritable, aggressive and angered easily, by Lonsdale D. et al¹².

Case reports

To understand the role of imbalance of nutrient resulting into abnormal/delinquent behaviour and improvement by supplementation some case reports are presented herewith (courtesy: The Pfeiffer Treatment Center, www.hripte.org and Dr. Priscilla Slagle, www.thewayup.com):

A) Michael, 15 years old, had been incarcerated in an East Coast residential facility for violent behavior. Reluctantly, officials allowed him to receive an individualized

vitamin/mineral supplement program from the Pfeiffer Treatment Center. After one month on the program, he felt better, more athletic, and less violent. By the second month he was symptom free, and he was released after one more month.

- B) Cory, 5 years old, the son of a convict, was verbally abusive and threatened to burn his mother's hand and chop off her head. Tests indicated numerous nutritional deficiencies and imbalances, including an inborn defect in zinc and vitamin B6 metabolism called pyroluria. After treatment with individually tailored vitamin and mineral supplements, he became more loving, contemplative, and better able to deal with stressful situations.
- C) Albert, at age three was killing hamsters and a year later killed the family's pet cat, showing no remorse. He hit his sister in the face with a brick and threatened to kill his mother. After taking vitamin and mineral supplements for 10 months, he was doing exceptionally well at school, was accepted into the scouts, and had no behavioral problems.
- D) Ludwig von Beethoven wasn't a criminal, but the 18th-century composer did suffer a variety of physical health problems. Some researchers believed these health problems were the result of mercury treatments for venereal disease. Last year, Walsh analyzed minerals in a lock of Beethoven's hair. It contained extraordinarily high levels of lead.

Conclusion

Much has been talked and analyzed about the linkage of socioeconomic conditions, low education, broken homes, battered childhood and many other factors, and delinquency but the other 'nutrition' aspect which has a definite role to play has been ignored as far as Indian context is concerned. To put it in simple words, mental functioning is affected by what we eat. One may have heard the old adage, "you are what you eat." It can be explored a bit further. Organs in the body are made up of cells. Cells in turn are made up of millions of molecules. These molecules are solely derived from our food, water, and even the air we breathe. Therefore, our diet is the main source of our cellular composition. When we eat "junk" then junk is what is available to make up our cells. The end result is body and mood dysfunction. Poor nutrition, characterized by zinc, iron, vitamin B and protein deficiencies, leads to low IQ, which leads to later antisocial behaviour. All these are nutrients linked to brain development. Micronutrient deficiencies, mineral-metabolism disorders, and food allergies may all be at play in delinquent and criminal behavior.

The findings linking micronutrient deficiencies to child development point to the importance of effective prevention programs that begin prenatally or early in life and extend through the periods of vulnerability, which may include adolescence. A balanced diet containing different types of foods such as cereals, pulses and vegetables in appropriate proportion is very important. It is essential that good food habits are inculcated during childhood. Use of convergence foods and entry of fast foods have had a great impact on the food preferences of children. Bad behaviour may be more than the result of mean minerals than mean streets. Measuring mineral patterns in children might identify those at risk of becoming delinquents and criminals - at a time when dietary changes can be easily made. The abnormal trace mineral metabolism may be involved in aggressive behavior and that careful mineral analysis could be effective in identifying those who are predisposed to such behavior.

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Tooth morphology - A reliable tool for gender determination - A review

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Abstract

Forensic odontology is an investigative aspect of dentistry that analyzes dental evidence for human identification. Forensic odontology plays an important role in establishing the gender of victims with bodies mutilated beyond recognition due to major mass disaster. Teeth are an excellent material in living and nonliving populations for anthropological, genetic, odontologic, and forensic investigations. This article reviews the various morphological characteristics of teeth for the determination of gender.

Keywords

Forensic odontology; sex determination; odontometrics

The science of forensic odontology is a relatively small specialty within both the dental profession and forensic science. However after experiencing the various degrees of popularity, this field is near its height at an international level. The probable reason for this expanded interest is that today members of the forensic and legal profession, law enforcement personnel and a vast number of insurance companies are much more conscious of the values of dental evidence¹.

Modern forensic odontology encompasses a wide range of subjects that include not only dental identification of unknown deceased but the examination and evaluation of child abuse cases. In recent times utilization and interpretation of bite mark evidence and lip prints, personal injury cases, determination of gender, age etc and forensic dental research and education has gained importance¹.

The accurate identification of human remains is a public duty justified by social, legal and insurance considerations. Fingerprints and dental means represent the most scientifically reliable methods of identification. In general greater the degree of tissue destruction, the greater the importance of dental characteristics in effecting proper identification².

Forensic dentists can compare characteristics recorded in a patient's dental chart, usually obtained from a private dentist, with the dental characteristics found in an unknown person or a found body. The teeth are the hardest substances in the human body and may be the only method to identify a decedent³. Teeth potentially can survive most of the insults and consequences enquired at death and during decomposition⁴. In cases in which body is exposed to tremendous forces and extreme temperatures, such as explosive automobile or aircraft accidents, the teeth often can survive well enough to be used to identify people involved in the mishap.

The adult dentition is comprised of thirty two teeth; each tooth possesses five surfaces visible on oral examination. The innumerable combinations of missing teeth, filling materials, carious lesions, and prostheses involving these 160 surfaces form the basis for dental identification. Specific morphological patterns of individual restorations (fillings and crowns) further

enhanced characterization. When one considers the additional identifying features incorporated within root canals, periapical and surrounding bone and soft tissues, it can be realized how specific the oral structures can be in terms of identification. The concept that no two dentitions are alike is a basic premise of dental identification².

Determination of gender using skeletal remains presents great problems to forensic experts especially only fragments of the body are recovered. Dental identification assumes a paramount role in the identification of remains wherein postmortem changes, traumatic tissue injury and/or lack of previous fingerprint record for comparison invalidate the employment of the visual and fingerprint methods. In such circumstances dental identification becomes of primary importance. Forensic dentists can assist other experts to determine gender of the remains by using teeth.

Various features of teeth like morphology, crown size, root lengths etc are characteristic for the male and female genders. Several authors have examined the ability to determine gender using odontometric analyses.

Gender differences in tooth size

Teeth may be used for differentiating gender by measuring their mesiodistal and buccolingual dimensions⁵. This is of special importance in young individuals whose secondary sexual characteristics had not developed⁶.

Studies show significant differences between male and female permanent and deciduous tooth crown dimensions. Lysell L and Myrberg N (1982)⁷ found that mesiodistal tooth widths of boys were larger than girls in both deciduous and permanent dentitions. Although gender differences are small, especially in the deciduous dentition, they are statistically significant for both dentitions. Arya B S et al⁸ as quoted Seipel C M (1946) who found that gender differences were maximum for deciduous and permanent canines while incisors showed a minimum difference and premolars an intermediate difference. Moorrees C F A (1959)⁹ found that gender differences in mesiodistal tooth size were greater in the permanent than in the deciduous dentition and the largest gender differences were in the canines in both dentition.

Garn S M et al¹⁰ studied the population of Ohio caucasoids and reported that the largest sexual dimorphism in mesiodistal tooth size was exhibited by the mandibular first and second molars, with the maxillary and mandibular canine next in the order of difference. Sanin C and Savara B S found that median mesiodistal crown diameter to be larger for boys than for girls in all teeth except lower central incisors¹¹. Lav alle CL B (1972) also observed that the tooth dimensions to be larger in males than in females in different racial groups¹². Same findings were reported by Lysell L and Myrberg N in 1982¹³.

Potter R H Y (1972) found that the mesiodistal diameters of all permanent teeth except the maxillary lateral incisors, mandibular central incisors and mandibular second premolars

to be significantly larger in males than in females¹⁴.

Black T.K in 1978 analyzed the mesiodistal and buccolingual crown dimensions of the right deciduous teeth and found that all teeth of boys tend to be larger than those of girls in 15-20 comparisons¹⁵. Townsend G documented that dental sexual dimorphism has been attributed to differentially balanced hormonal production between the genders, consequent upon the differentiation of either male or female gonads during the sixth or seventh week of embryogenesis, rather than any direct effect of the sex chromosomes themselves¹⁶.

A recent study investigated the presence of sexual dimorphism in the size of the permanent teeth in Chilean population and the results showed that sexual dimorphism can be found in all group of teeth¹⁷.

Gender determination using canine dimorphism

Tooth size or odontometrics is under considerable influence of the environment and such measurements, therefore, are population specific and do not apply to the world at large. In the field of forensic odontology, permanent canine teeth and their arch width (distance between the canine tips) contribute to gender identification through dimorphism. The study of permanent mandibular and maxillary canine teeth offers certain advantages in that they are the least extracted teeth, are less affected by periodontal disease and the last teeth to be extracted in respect of age (Bossert and Marks 1956, Krogh 1968). Among teeth mandibular canines show greatest dimensional difference with large teeth in males than in females¹⁸. Studies have shown that premolars, first and second molars as well as maxillary incisors are also known to have significant differences⁵.

The dimensions of canine teeth have been studied by various methods, including Fourier analysis (Minzuno 1990), Moire topography (Suzuki et al 1984) and the measurement of linear dimensions such as mesiodistal width, buccolingual width and incisocervical height (Garn et al 1967, Anderson and Thompson 1973, Rao et al 1988). The use of Fourier analysis and Moire topography were limited to small samples whereas measurement of the linear dimensions of canine teeth was used in large populations because it is simple, reliable, inexpensive and easy to perform¹⁹.

The human males appear to have canine teeth that are masculine in form^{20,21}. Among teeth; mandibular canines show greatest dimensional difference with larger teeth in males than in females. Anderson et al classified 74% of patients as males or females using mandibular canine width alone²⁰. Mandibular canine consistently show greater gender difference in mesiodistal crown size²⁰. This finding correlated with the study done by Johnson Issac 22 in 2000 (unpublished data), Morreess CFA (1959)⁹, Lewis D.W (1965), Garn SM (1967)¹⁰ and Alvesalo (1971)²³.

Garn S M et al¹⁰ concluded that the magnitude of canine teeth sexual dimorphism varies among different ethnic groups and the mandibular canine showed a greater degree of sexual dimorphism than the maxillary canine.

However other investigators (Kuwana 1983, Minzuno 1990) reported that in Japanese population the maxillary canine showed a higher degree of sexual dimorphism compared to mandibular canine. Thus controversy exists related to the degree of sexual dimorphism between maxillary and mandibular canines in different ethnic groups. A famous study by Rao et al uses the mandibular canine index to determine gender, although another study has issued a

caution in using this technique^{24,25}. Another study using dental casts of children, showed that the teeth, and in particular the canines, were larger in males than females, and suggested.6

Rao NG, Rao NN conducted a study to assess the reliability and applicability of assessing gender identity using the mandibular canine index and it was found that the accuracy of gender determination in male was 84.3% and in female 87%²⁶.

In another study, Rao et al²³ reported 88% accuracy of sex identification. The crown length was less significant in establishing gender identity.

Sherfudhin H et al¹⁹ (1996) investigated the occurrence of canine teeth dimorphism in Indian subjects and the use of two statistical methods of evaluation compared. These were the methods of N.G. Rao and co-workers published in 1988 and quadratic discriminant analysis for correct classification of gender. Parameters considered were,

1. The mesiodistal width of maxillary and mandibular canines.
2. The maxillary canine arch width (intercanine distance) and
3. The mandibular canine arch width.

The results indicated significant dimorphism of the maxillary and mandibular canine teeth. When the results of the arch widths were subjected to the two statistical methods, different results were obtained in the accuracy of gender classification. The percentage of correct classifications of gender was higher when using quadratic discriminant analysis. In another study, Iscan Kedici in 2003 could accurately establish gender in 77% of the cases using maxillary and mandibular canines, and mandibular second molar²⁷.

The role of maxillary canine arch width in establishing gender identity has not been reported in the literature¹⁹.

The sexual dimorphism specific to canines has been explained by Eimerl and DeVore on the basis of their function which, from an evolutionary point of view, is different from other teeth. During the evolution of primates, there was a transfer of aggressive function from the canines in apes to the fingers in man. Until this transfer was complete, survival of the species was dependent on the canines, especially those of males. Of late, researchers are trying to determine the influence of the X and Y chromosomes on tooth morphology. While the role of sex chromosomes in dental development has been proved, Scott considers that there is little dimorphism apparent at a phenotypic level⁵.

According to a study done by Balwant Rai it was found that among all the teeth the maxillary first molar is found to exhibit greatest sexual dimorphism²⁸. Another study conducted by the same author was concluded that mandibular canine and maxillary first molar may be used in gender determination²⁹. A study done by Ashith B. Acharya and Sneedha Mailani have pointed out that canines showed the greatest univariate sex dimorphism, followed by the buccolingual dimension of maxillary first and second molars³⁰.

Root length and crown diameter

Using optical scanner and radiographic measurements on mandibular permanent teeth gender determination can be done with 80% accuracy by measuring root length and crown diameters¹⁸.

Dental index

In addition to absolute tooth size, tooth proportions have been suggested for differentiating the genders. Aitchison³¹

presented the 'Incisor index' (Ii), which is calculated by the formula $Ii = [MDI2/MD11] \times 100$, where MDI2 is the maximum mesiodistal diameter of the maxillary lateral incisor and MD11 is the maximum mesiodistal diameter of the central incisor. This index is higher in males, confirming the suggestion of Schrantz and Bartha that the lateral incisor is distinctly smaller than the central incisor in females.

Another index, the 'Mandibular canine index' proposed by Rao²⁴ and associates has given an accurate indication of gender in an Indian population. Using the mesiodistal (m-d) dimension of the mandibular canines, these researchers obtained the formula:

$$[(\text{Mean m-d canine dimension} + (\text{Mean m-d canine dimension in female} + \text{S.D.}) \text{ in males} - \text{S.D.})] / 2$$

The value obtained using this formula was 7.1, i.e. 7.1 mm is the maximum possible mesiodistal dimension of mandibular canines in females. The same dimension is greater in males. The success rate of determining gender using the above formula was close to 89%. However, relative to the near 100 % accuracy using pelvis and skull, sexing by odontometrics is relatively poor⁵.

Odontometric differences

The odontometric difference between males and females is generally explained as a result of greater genetic expression in males.

Iskan and Kedici²⁷ caution that an overlap exists between male and female tooth dimensions, and this makes accurate diagnosis of gender challenging, even for experienced dentists. They emphasize that success is greater when all available teeth are used.

Tooth morphology and sexing

In addition to the canines being the most sexually dimorphic teeth in terms of size, Scott and Turner¹³² highlight that the "Distal Accessory Ridge", a non-metric feature on the canine" is the most sexually dimorphic crown trait in the human dentition, with males showing significantly higher frequencies and more pronounced expression than females". Rao and Rao have reported greater incidence of four-cusps (absence of the distobuccal cusp or distal cusp) on the mandibular first molar in females (40.6%) compared to males (16.2%) in a south Indian population. They cited Anderson and Thomas who suggested that the reduction in the number of cusps is a reflection of an evolutionary trend towards

Tooth no	Mesiodistal Buccolingual			
	Male	Female	Male	Female
11	8.9	8.5	7.1	7.0
12	7.0	6.65	6.5	6.2
13	8.3	7.6	8.4	7.9
14	6.9	6.8	9.3	8.9
15	6.7	6.65	9.8	9.3
16	11.0	10.6	11.0	10.9
17	10.4	9.9	11.0	10.7
41	5.5	5.3	6.2	6.1
42	6.1	5.9	6.5	6.5
43	7.2	6.6	7.55	7.4
44	7.1	7.0	7.9	7.6
45	7.4	6.9	8.6	8.2
46	11.1	10.8	10.4	10.2
47	10.5	10.2	10.3	9.9

overall reduction in the size of the lower face, with male apparently resisting this trend.

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Forensic Odontology - A review and update

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Abstract

The science dealing with establishing identity of a person by teeth is popularly known as Forensic Odontology or Forensic Dentistry. It is the specialty with the goal of investigating psychological, physical, chemical and biological phenomena that can reach human beings, comprehending aspects of human identification; criminal, civil, labor and administrative forensic investigation; forensic tanatology; legal documents; forensic traumatology; image examinations; saliva analysis; and other aspects involving a multidisciplinary team. Sustained education and demand over the past half-century has rendered forensic odontology a valuable component of forensic investigations in many countries. Forensic odontology has made great strides in the last decade, ranging from two- to three-dimensional digital analysis of bite marks to extracting DNA from teeth for the purpose of identification. Forensic odontologists are routinely consulted for assistance in legal and criminal problems. This is an attempt to give an update and a comprehensive review of the science.

Key words

Forensic odontology, Forensic dentistry, Dentition, Bite marks, Dental records, Human identification.

Introduction

The word 'Forensic' is derived from the Latin word "forensic", meaning "of the forum". It denotes the branch of medicine which deals with the application of the principles and knowledge of medicine for the purpose of law, both civil and criminal¹. The science dealing with establishing identity of a person by teeth is popularly known as Forensic Odontology or Forensic Dentistry^{2,3}.

Sustained education and demand over the past half-century has rendered forensic odontology a valuable component of forensic investigations in many countries. Forensic odontologists are routinely consulted for assistance in legal and criminal problems⁴. Bitemark records in forensic odontology occasionally facilitate the identification of assailants by comparing their dentition through bitemarks left on victim's body or food stuff⁵. With respect to possible failures of DNA identification, forensic odonto-stomatological investigations should be considered routinely in all cases of bite injuries⁶.

When all the parameters fail to identify a body, the teeth and the jaws, which appear to withstand a great deal of trauma than the rest of the body, can solve the difficulty⁷. Following major disasters such as earthquakes, fires, or floods, a definitive and early identification of the dead and injured becomes of the utmost importance. Often this identification must be accomplished via some form of forensic dentistry^{8,9}.

The teeth, their unique shape, location, external morphological features, histological components, as well as dental restorations, represent key features in determining the identity of each body¹⁰. Forensic odontology is of great significance in the identification of fatally burnt victims irrespective of age¹¹.

Dental identification

Identification is an essential requirement of any medico legal investigation because a wrong identity may pose a problem in delivering justice¹². Dental forensic identifications can be based upon visual comparison of the postmortem specimen with antemortem records or by comparison of postmortem dental radiographs of the specimen with antemortem radiographs^{13,14}. The forensic odonto-stomatological investigation was the leading method of victim identification in Southeast Asia after the Tsunami in 2004¹⁵.

A study by Dumancic et al (2001) has demonstrated the importance of dental identification in mass disasters, especially in the case of burnt victims, when teeth are the only key to the victim's identity¹⁰. Forensic odontology alone can establish the identity of 61-68% of incinerated victims, especially adults¹¹. In case of children, dental records are usually of a limited value because of the minimal amount of dental restorations, if any¹⁰.

Sex determination

Teeth add value to forensic sex identification, particularly when more reliable diagnostic parameters such as the pelvis are not adequately preserved¹⁶.

Rao et al (1989) used the mandibular canine index for sex determination and found it to give satisfactory results. Kausahal et al established the inter-canine distance and mandibular canine index as useful parameters in differentiating the sexes¹⁷.

Hu et al (2006) stated that the simultaneous use of the shape of the lower border of the mandible and the shape of the chin is the best method of predicting sex with a rate of accuracy that is higher than 90%¹⁸.

Saliva contains skin cells from the lining of the oral cavity. Each of these cells contains a nucleus that possesses a nuclear DNA. The presence of Y-chromosome in a resulting profile indicates a male biter¹⁹. An article by Ellis et al (2007) stated that ultrasonication of tooth samples yielded enough DNA to use in polymerase chain reaction (PCR) analysis to be able to determine the sex of the study subjects appropriately²⁰.

According to Das et al (2004) the sex determination from human tooth pulp in cadavers is possible up to a period of 4 weeks²¹.

Boaz and Gupta (2009) revealed the lack of statistically significant dimorphism in canines. The finding of reverse

dimorphism (i.e. the females exhibiting larger canines than males) is quite unusual and needs to be validated using a larger sample size²².

Sharma et al (2009) stated that lip prints are unique to an individual and behold the potential for recognition of the sex of an individual²³.

Age estimation

Estimation of age at death is one of the most important issues in the identification of human remains, both in forensics and anthropology²⁴. It is also necessary in paleo-demographic analyses to establish mortality patterns in past populations²⁵. The accuracy and precision of dental age estimation do depend on the age of the examined individual²⁶. From eruption of temporary teeth, one can estimate the age of a child from 6 months to 33 months²⁷. Dental criteria and ossification centers of long bones are better for age estimation when the individual belongs to the younger age group of less than 20 years. But when the age of the individual is more than 20 years the age estimation becomes difficult²⁸. Different factors have been used for age estimation but none has withstood the test of time for adults above 25 years².

Several age estimation methods apply the various forms of tooth modification, including wear, root dentine transparency, tooth cementum annulations, racemization of aspartic acid, and apposition of secondary dentine²⁵. Methods based on the measurements of the pulp/tooth and root/tooth ratios, root development, or periodontal changes on dental radiographs, but also the clinical evaluation of attrition, tooth colour, and gingival recession can be applied to dead and living individuals²⁹.

The apposition of secondary dentine is the most frequently used method for age estimation in adult subjects³⁰. In the deciduous dentition the age estimates obtained from the maxillary teeth tend to be greater than the age estimates obtained from the mandibular pair, and the differences are significant for the incisors and canine. Additionally, ages obtained from the maxillary deciduous canine also differ significantly from true chronological age²⁶.

The regression formulae developed by Liversidge and colleagues is the most comprehensive technique for estimating age from tooth length because it relies on a single measurement of the tooth, it can be applied to the whole deciduous and permanent dentition and to the entire postnatal growth period, from birth to 20 years of age³¹.

The permanent third molar is the most variable tooth with respect to size, shape, eruption timing, and the likelihood of congenital absence³². In a study, Olze et al (2007) estimated the age of investigated persons based on alveolar, gingival, and complete emergence of the third molars in the occlusal plane³³.

One method used by Cameriere et al (2007) for age estimation involved orthopantomographs of the maxillary canines to study the pulp/tooth area ratio²⁵. Studies based on the variations in pulp/tooth ratio demonstrated statistically significant correlations between the chronological age and the ratios of the pulp to root width or to tooth area²⁹.

Bite mark analysis

Bite marks found at crime scenes show an array of angled indentations, abrasions, microlacerations, and contusions³⁴. According to Endris (1979), bite marks consist of superficial abrasion, and/or sub-surface haemorrhage, or bruising of the

skin because of the bite⁶.

The first person to whom real credit must be given for having published an analysis of a bite-mark case is 'Sorup'. The method used he called "odontoscopy," analogous to the fingerprint identification called "dactyloscopy"³⁵. The standard techniques for examining bite marks are based upon interpreting photographic evidence in which a bite is compared with the models of the teeth of suspects³⁶. The most common methods for determination of bitemarks include techniques to compare the morphology of the dentition (shape, size, and position of teeth, together with the shape of the dental arches) with similar traits and characteristics present in life-sized photographs of the injury using transparent overlays or computers⁵.

Skin bite marks are generally present on the body of the victim and inflicted by the assailant, but in some cases the wounds are self-inflicted or inflicted by the victim on the assailant. The bites may be inflicted as a result of differing degrees of anger, revenge, sexual frustration, wrath, righteous indignation, and punishment. The location of the tooth marks observed on victims is related to the nature of the crime e.g., sexual assault, child abuse, burglary, or kidnapping³⁴.

There has been a degree of skepticism regarding the validity of skin bite mark analysis by expert witnesses³⁷. Bite mark analysis alone should not be allowed to lead to a guilty verdict, but it will offer the opportunity to exclude a suspect from a crime when the data do not correspond³⁶. Although the dentition can be accurately measured and described mathematically, its imprint on skin has inherent distortion that a prudent examiner might need to analyze before tendering an opinion³⁸.

Child abuse

A recent WHO estimate shows that 40 million children aged 0-14 around the world suffer from abuse and neglect and require health and social care³⁹. Physicians and dentists should collaborate to increase the prevention, detection, and treatment of these conditions⁴⁰.

Child abuse or maltreatment is commonly divided into five categories: physical abuse, emotional abuse, sexual abuse, neglect and exploitation³⁹. A battered child is one who has received injuries as a result of non-accidental violence, produced by a parent or a guardian. In addition to physical injury, there may be non-accidental deprivation of nutrition, care and affection⁴¹.

Bruising is the most common injury in physical child abuse. Cavalcanti et al (2007) reported the case of a 9 year old boy who had severe bruises on his face, neck, back, arms, elbows, wrists, buttocks, knees and ankles. On questioning, it appeared that he had been spanked in the previous night and in the morning of the attendance by his mother with a belt⁴².

The society as a whole, including the Govt., NGOs, Parents, teachers, elders etc. has the responsibility for the proper upbringing of the child and until and unless all of us shoulder the responsibility with sincerity, the children will continue to be abused³⁹.

Role of prosthodontists

The identification of edentulous individuals is problematic due to poor provision of labelled dental prostheses⁴³. Dental forensic organizations worldwide have recommended that dental prostheses should be labeled with at least the patient's (wearer's) name and preferably with further unique identifiers

such as social security number⁴⁴. Immediate identification is usually possible if a small, discreet identification code is embedded in the denture base⁴⁵. The purpose of denture marking is twofold – it assists in the recovery and return of a lost or inadvertently transferred denture and it facilitates the identification of edentulous persons both living and deceased⁴⁵. The disadvantage with this is that most of the patients do not accept the name on dentures as they are unaesthetic¹².

Radiology in forensic odontology

Comparison of antemortem and postmortem dental radiographs is a commonly used procedure for establishing identity of human remains¹⁴. Dental forensic identifications can be based upon visual comparison of the postmortem specimen with antemortem records or by comparison of postmortem dental radiographs of the specimen with antemortem radiographs⁴⁶. It requires meticulous attention to minute details of bony trabecular patterns, anatomical landmarks, and pathological conditions⁴⁷. Invasive methods using extracted teeth, ribs, or femur cannot be used in living individuals²⁹ and in cases where it is not acceptable to extract teeth for ethical, cultural, or religious reasons²⁶. Assessment of sexual and skeletal maturation, radiological examination of bones, and also clinical and radiological examination of the dentition are noninvasive ways to determine the age²⁹.

Forensic dental photography

The increased use of intraoral photographs for clinical purposes, along with the popularization of digital cameras, is providing more material with potential value for forensic odontology⁴⁸. The use of digital methods in bite mark analysis is amenable to evidence photographs that contain a scale of known dimension. The digital imaging program Adobe® Photoshop® (Adobe Systems Incorporated, San Jose, California) can be used for its adjunctive value to photographic evidence evaluation and comparative analysis⁴⁹.

Ante-mortem records

Delattre (2007) studied the attitudes and practices of forensic dentists regarding antemortem dental records reviewed for purposes of dental identification. The data suggested that there is diversity in the practices and attitudes of forensic dentists on various issues. Opening a dialogue among practicing forensic dentists on ways to manage the suspicion of dental negligence or fraud discovered in antemortem dental records may lead to a set of recommendations by the appropriate societies in the forensic dental community⁵⁰.

Mass disasters

Mass disasters may be caused by natural events, such as severe flooding, earthquake, or volcanic eruption, or they may be associated with human activity, such as mass transport by land, sea, or air¹⁰.

Lessig R et al (2006) reviewed one year of continuous forensic medical work for victim identification in Tsunami 2004. At the end of 2005, 83.5 % of the German missing persons had been identified by forensic-stomatological, 13.2

% by fingerprint, and 3.3 % by DNA investigations. 68% of all victims including Thais had been identified in the same time. 46.3% of these identifications were based on forensic-stomatological, 35% on fingerprint, 18.3% on DNA, and 0.5% on physical methods¹⁵.

Dumancic et al (2001) tried to determine the usefulness of dental identification of victims in two mass disasters – a railway accident in Zagreb (August 30, 1974) and midair collision of a British and a Slovenian airplane near Vrbovec (September 10, 1976). Small number of dental identifications was made in the victims of the railway accident because of incomplete or unavailable antemortem data, and the predominant orientation toward other forensic identification methods. Significant number of dental identifications in the plane crash was made and this was possible because of the provision of complete and accurate antemortem odontological data. Dental characteristics proved to be particularly valuable in the identification of carbonized victims¹⁰.

The establishment of guidelines requiring high quality control for the collection of the ante mortem and post mortem data is essential for an efficient disaster management including a reliable identification of all victims.

Future advances

The use of image perception technology may allow visualization of a degree of detail unavailable with any other method. With this technology it is possible to artificially colour areas with equal intensity values and depict a 2-D image as a pseudo-3-D surface object³⁶.

Significant quantities of DNA can be recovered from saliva and teeth, but although DNA analysis is a powerful and accurate tool for identifying humans, the methods for recovering DNA from teeth have not been efficient or cost-effective²⁰.

Silva RHA et al (2007) reported the use of DNA technology in forensic dentistry for victim identification. Due to their capacity of enduring environmental changes, the teeth represent an excellent source of DNA. DNA can be isolated in sufficient amount for human identification by examination of chewing gums, cigarettes, bite marks in foods, among others³.

The new discipline of microbial forensics is in the process of being founded from an array of established and emerging fields⁵¹. Epithelial cells of the oral mucosa slough off as they contact the teeth. Lijnen and Willems used a double-swab technique for the buccal mucosa and obtained a high yield of DNA⁵².

Virtopsy is a scalpel free procedure of autopsy carried out using modern medical, imaging and measuring technology. Using the different imaging techniques, which provide a complete 3-D view of the inside as well as outside of the body, all the vital information like position and dimensions of the wounds, or other pathological conditions in the body can be known and documented without use of any scalpel¹³.

Talabani et al (2006) applied two new methods (2D polyline and painting) for digital analysis of experimental human bitemarks. Results showed that both methods were applicable⁵.

A presentation made to the Odontology section of the American Academy of Forensic Sciences (AAFS) in 2004 promoted the use of a thermoplastic bite impression material in the identification of children. It was claimed that the material properly stored after impressing the teeth could also be used as a source of DNA for identification purpose⁵³.

Conclusion

Forensic odontology has made great strides in the last decade, ranging from two-to three-dimensional digital analysis of bite marks to extracting DNA from teeth for the purpose of identification⁴. Considering the contributions that forensic dentists make to scientific methods of investigation and identification, it is important that all dental students gain exposure to this specialized area during their dental school curriculum⁵³. Teaching of forensic dentistry has been included in the curriculum of dental schools in India. It is hoped that trained medico-legists will be available in India in sufficient large numbers in the near future and that forensic dentists will also become major players in the field.

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Railway Fatalities in South West Mumbai

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Abstract

The study was carried out on 542 cases of railway fatalities received from South-west Mumbai, during the 3 years period from 1st August 2005 to 31st July 2008. Railway fatalities represent 19% of all autopsies conducted at Topiwala National Medical College, and B. Y. L. Nair charitable hospital, Mumbai. The age span of 11-40 years comprised 80% of all railway fatalities. There was male predominance with ratio of 9:1. Maximum number of deaths occurred during evening and morning hours. The single most important cause leading to railway fatalities observed in this study was unauthorised crossing of railway lines to catch the train on another platform, followed by overcrowding. The most common cause of death was head injury (44.09%). Most of the deaths (90.04%) were accidental in nature. Our results indicate that, it is quite possible to make rail-travel safer by adhering to the set norms of railway safety, high quality of maintenance and vigilant supervision by the railway authorities, observance of rules and regulations by all without exception and by avoiding risky behavior / practices while travelling.

Key words

Railway fatalities, Pattern of railway fatalities, Unauthorised crossing, Railway safety.

Introduction

Mumbai is a sprawling city of more than 13 million people and growing every year. Travelling, therefore, is the greatest daily human activity. In Mumbai, the bulk of the people are carried by the suburban (local) railway system. Mumbai suburban services are run by Central and Western Railways. The Western Railway line carries about 2.6 million passengers per day, almost 43 percent of the total Mumbai suburban rail traffic¹. The local train system, which was, without doubt, an efficiently planned system at one time, carries the largest number of commuters in Mumbai.

Every setup has its own flaws and railways are no exception. The mortality and morbidity rates of train fatalities in the Mumbai are far more compared to the national statistics, about 3,500 people die every year in Mumbai^{2,3}. A systemic study of these cases regarding matters like population profile, time of incident, place of occurrence,

pattern of injury sustained, cause of death, various causative factors involved etc. enables us to evaluate different types of deaths in railway fatalities in order to make rail-travel safer.

Material and methods

The study was carried out at the postmortem centre attached to the department of Forensic Medicine, Topiwala National Medical College, and B.Y.L. Nair Charitable Hospital, Mumbai. This centre receives victims of railway fatalities generally from South-West Mumbai (Western Railway). During the 3 year study period from 1st August 2005 to 31st July 2008, a total number of 2,834 autopsies were carried out, out of which, 542 cases of railway fatalities were evaluated in the present study.

A comprehensive picture about the background of the victims was elicited after taking a proper history from investigating police and relatives of the victims. A detailed post mortem examination was carried out in each case. After evaluation of all the facts and taking into account all the injuries sustained on the body, the cause and time of death were ascertained.

Observations & results

During the study period, the center carried out 542 (19% of total) autopsies of railway fatalities from South-west Mumbai (Mumbai Central to Mahim railway station covering a stretch of 9 km).

The age span of 11–40 years comprises 80% of all railway fatalities. The mean age of the victims was 32.04 years. The youngest victim was 8 months years old and the oldest was 80 years old. The male to female proportion was 9:1. (Table 1)

Office goers and professionals constituted the highest number of cases i.e. 102 (19%) followed by workers in industries, mills, stores, etc. (73 cases or 14%). Two railway policemen died in railway accident while on duty. In 177 cases (33%) occupation could not be determined.

Most of the victims, 222 cases (41%) of railway fatalities were from suburban area, followed by slum area 105 cases (19%). In 89 cases (16%) locality was not known.

In the month of October and December, there were higher numbers of cases. However no significant variation was observed in the year wise distribution. The pattern of railway fatalities in Mumbai seems to be continuous. (Table 2)

Table 1: Age and sex wise distribution

Age	0-10	11-20	21-30	31-40	41-50	51-60	> 60	Total
Sex								
Male	1	100	206	93	43	35	11	489
Female	0	3	18	11	15	4	2	53
Total	1	103	224	104	58	39	13	542
%	00.18	19.00	41.32	19.18	10.70	07.20	02.40	100

Table 2: Month and year wise distribution

Month	2005	2006	2007	2008	Total
January	--	8	18	13	39
February	--	12	11	12	35
March	--	8	17	20	45
April	--	19	16	16	51
May	--	17	14	15	46
June	--	20	16	11	47
July	--	18	11	8	37
August	17	14	12	--	43
September	13	12	17	--	42
October	17	28	14	--	59
November	15	15	14	--	44
December	16	18	20	--	54
Total	78	189	180	95	542

Maximum number of deaths occurred during 06pm to 10pm and 06am to 10am as these are the peak hours of traveling in Mumbai. The least number of deaths occurred during 02am to 06am. During the period of 02.20am to 04.05am, no case of railway death was observed, since when no local trains run on the track during this time. (Table 3)

Highest number of deaths occurred at Mahalakshmi and Lower Parel (17.34% each) followed by Dadar West (15.68%) and Mahim Railway Stations (14.58%). Large number of fatalities 32 (5.90%) occurred near the Km pole number 7/11 which is between Lower Parel and Elphinstone Road Railway Station. There were 21 (3.87%) fatalities near Km pole number 12/12 in the vicinity of Mahim Railway station. (Table 4)

Majority of the victims were pedestrians: 418 (77.12%). In the rest, most of the victims were passengers, 117 cases (21.59%).

Most of the victims died on the spot i.e. 327 cases (61%), followed by death in the hospital, with 111 cases (20%). Hundred and four cases died on the way to hospital (19%). Amongst those reaching hospital, only 34.42% could reach the hospital within one hour.

Majority of the victims (83.03%) died within 0-2 hours. Thirty four victims (6.27%) died within 2-24 hrs.

In 375 cases (69%) body was found in one piece. In 99 cases (18%) body was found in two parts, in 68 cases (12%); mutilation was severe, cutting the body into more than two parts.

Homicidal deaths were only two. In one instance, the mother committed suicide after putting her 8 month old baby

Table 4: Pattern of Railway Fatalities in relation to Railway Station

Railway Station Pattern	Mumbai Central	Mahala-kshmi	Lower Parel	Elphinstone Road	Dadar West	Matunga	Mahim	Others	Total
Knocked down while crossing	46	59	46	25	52	16	56	20	320
Fall from running train	8	13	28	7	7	3	3	12	81
Lying on the track expecting train to run over	13	8	6	3	10	1	5	0	46
Fall in the gap between boarding or alighting	2	2	0	1	5	0	0	6	16
Leaning out of doors	0	4	5	0	2	0	0	2	13
Knocked down while standing at the edge of platform	2	2	0	0	0	0	0	2	6
Knocked down while walking along the track	1	0	0	0	3	0	1	0	5
Electrocution	1	0	0	0	4	0	0	0	5
Railway fatalities involving explosion, fire, or burning	0	0	0	0	0	0	1	0	1
Jumping from running train	0	0	1	0	0	0	0	0	1
Not known	2	6	8	6	2	4	13	7	48
TOTAL FATALITIES	75	94	94	42	85	24	79	49	542

Table 3: Time distribution of occurrence of railway fatalities

Time period	No. of cases	Percentage
06am-10am	136	25.09
10am-02pm	86	15.87
02pm-06pm	67	12.36
06pm-10pm	148	27.31
10pm-02am	85	15.68
02am-06am	20	3.69
Total	542	100

on the track. Other victim died due to bomb explosion in a terrorist activity at Mahim station. (Table 9)

Discussion

The incidence of railway fatalities among the medicolegal autopsies in all the other studies was much lower than the present study. The greater incidence in the present study is due to large suburban rail network carrying excess of passengers over the capacity in densely populated Mumbai city.

Greater number of cases in the age group of 21-30 years in the present study may be explained by the fact that persons in these age groups travel more by virtue of their occupation and a tendency to take undue risks. This finding is supported by Lerer et al,⁴ Rautji et al,⁵ Mohanty et al.⁶ The higher male percentage could be due to the fact that number of male commuters is more than that of the females and comparatively lesser crowding in the ladies compartments. Moreover there are special ladies local trains in Mumbai.

The most important cause leading to railway fatalities was unauthorised crossing (Knocked down while crossing) of railway lines to catch the train on another platform. People avoid using the foot bridges and take short-cuts across the railway lines at most of the places. Between Mahalakshmi and Lower Parel railway stations there is no public overbridge. So the residential population residing in the vicinity of railway track often moves between east and west parts of the locality by crossing unfenced tracks. Dadar railway station is more crowded and busiest station in Mumbai, and is the junction of central and western railways, where people often change lines, leading to unauthorised crossing of railway tracks to catch the train in time on another line or platform.

Table 5: Injury pattern (Body region wise)

Body regions	Number of cases	Percentage
Head, Face & Neck	492	91
Trunk	345	64
Pelvic region	240	44
Upper limbs	385	71
Lower limbs	295	54
Total exceeds 100% as different body parts of the same victim sustained different injuries		

'Fall from running train' was second common cause of railway deaths and such cases were predominantly seen at Lower Parel and Mahalakshmi railway stations. The reason behind this is overcrowding at peak hours leading to risky behaviour such as pushing and jostling. Due to the wobbling and outward push by the interior crowd, the passengers standing at the open door of running train fall down. The commuters often hang outside the compartment and fall down. In the vicinity of Lower Parel railway station a few vertical electric poles are too close to the tracks and placed at bend of the track, therefore the unaware hanging passengers get hit by these poles and fall down.

Deaths due to 'fall in the gap while boarding or alighting the train', 'getting knocked down while walking along the track' were most common at Dadar. The yawning gap between the footboard and the platform is in complete disregard of the international standard of six inches and improper fencing around the tracks could be the reason respectively. Cases of electrocution occurred at Dadar alone as people tend to travel on the roof top due to overcrowding.

Most of the victims (77.12%) were pedestrians. This finding is consistent with other two Indian studies i.e. Rautji et al.⁵ and Mohanty et al.⁶, but not similar with that of Lerer et al.⁴ and Cina SJ.⁷ In their study deaths among passengers were more in number as compared to that of pedestrians.

Most of the victims (61.40 %) of railway deaths excluding spot deaths were brought to the hospital after 1 hour. During the crucial period (within 1 hr) only 34.42% victims could reach the hospital. Lack of first aid and transport is the main cause of these potentially preventable deaths. The Western Railway does not have ambulances to carry the victims to the hospitals and at times even the taxis refuse such blood stained victims. Medical / paramedical facilities at the railway stations are almost nonexistent and none of the staff is trained to give first aid.

Mutilation of body was severe in railway fatalities. Highest number of cases showed injuries to head, face and neck region. The most commonly injured internal organ was the brain followed by lungs. This is consistent with the study of Rautji et al.⁵ and Mohanty et al.⁶.

The common causes of death were head injury, injuries to vital organs, complications like septicaemia and/or pneumonia

Table 7: Injuries to internal organs

Organ	No of cases	Percentage
Brain	344	63.65
Spine and spinal cord	119	21.96
Lungs	183	33.76
Heart	29	5.35
Liver	123	22.69
Spleen	76	14.02
Kidney	42	7.75
Bladder	12	2.21
Total exceeds 100% as the same victim sustained injuries to multiple organs		

Table 6: Type of injury

Type of injuries sustained	Number of cases	Percentage
No injuries	8	1.48
Abrasion	360	66.42
Contusion	98	18.08
Laceration	431	79.52
Crush / amputation	233	42.99
Decapitation	30	5.54
Transection of trunk	41	7.56
Closed fracture/dislocation	216	39.85
Electrocution	5	0.92
Total exceeds 100% as the same victim sustained many injuries		

due to head injury, decapitation and transection of trunk and 'multiple injuries leading to haemorrhage and shock'. Majority of deaths i.e. 488 (90.04%) were accidental, 52 cases (9.59%) were suicidal.

Conclusion

Looking into the entire record, most of the fatalities were caused due to the negligence of the educated people (knocked down while crossing the tracks) either in the form of disregard for the rules, or because of carelessness and hurry. Overcrowding also appears to be an important factor. There is lack of first aid to the injured at the stations; and also lack of definitive shifting facilities. Hence there is a considerable time lag between incidence and admission to the hospital. The deaths that occurred due to extensive blood loss leading to hypovolemic shock could possibly have been prevented. The railways should take steps for improving the rail-safety, such as:

- The laws regarding safety and trespassing should be strictly implemented and law breakers should be severely penalised and publicised in media like the drives against drunken driving conducted by Mumbai Police.
- Build sufficiently broad and strong foot-bridges / subways for crossing the tracks.
- Removal of unauthorised hawkers from foot over-bridges there by providing more space for commuters
- Proper and timely announcements / display on indicators of platform number on which train is arriving.
- Removal of some of the vertical poles close to the tracks.
- Reduction of the distance between footboard of train and platforms.
- Increasing the number of rakes to increase passenger

Table 8: Causes of death.

Cause of death	No of cases	Percentage
Head injury	239	44.09
Injuries to vital organs	123	22.69
Complications due to head injury	42	7.75
Decapitation	38	7.01
Transection of trunk	31	5.72
Crush amputation of limb /limbs	28	5.16
Multiple injuries, haemorrhage & shock	24	4.43
Electrocution	5	0.92
Others	12	2.21
Total	542	100

Table 9: Manner of death

Manner of death	No of cases	Percentage
Accidental	488	90.04
Suicidal	52	9.59
Homicidal	2	0.37
Total	542	100

- capacity.
- Adding more tracks and increasing the frequency to speed up traffic.
- Provision of ambulances to carry victims to the hospitals.
- Conducting first aid courses for the railway staff including the police.
- Reduce public access to railway tracks by fencing the tracks.
- Public awareness by involving various social groups, media etc.

Effective ways to avoid railway fatalities for the citizens are: self-vigilance, adherence to the rules / regulations and following safe practices. This effectively means no crossing of rail-tracks by the passengers, no hanging outside trains, no sitting on train roof-tops and no jostling while boarding or alighting from the trains, especially moving trains.

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Suspected accident: A case report

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Abstract

Accidental cases are rarely encountered difficulties to investigators, when evidences of accidents are usually common and recognizable. There have been cases where the victim has sharp cutting dangerous injuries over the body simulating homicidal death. Sometimes it poses difficult challenges to Investigating officer.

A case of vehicular accident is discussed here in which victim had two incised wounds and two cut throat wounds suggestive of infliction of injuries by a fairly sharp cutting weapon, which creates a suspicion of homicide. The puzzle could only be solved by visiting scene of crime, interaction with Investigating Officer (IO) and eye witness. The findings from the scene of crime investigation and autopsy made it evident that the manner of death was accidental in nature. This case is presented to highlight the importance of visiting scene of crime in crime investigation.

Key words

Suicide, homicide, scene of crime, death

Introduction

Objective of the post-mortem examination is to establish the identity of a body when not known, to ascertain the time since death; and whether the death was natural or un-natural. If un-natural, whether it was homicidal, suicidal or accidental¹.

The manner of death is the fashion in which death occurred. If death occurs from disease alone, the manner of death is natural. If death results from an injury or is hastened as the result of injury in an individual rendered vulnerable by pre-existing natural disease, the manner of death is un-natural which could be homicidal, suicidal, accidental or of undetermined origin depending on the circumstances of the death².

It is a role of forensic expert to interpret the injuries which are present over body. From injury, he should have to give time of injury, type of weapon to be used, responsible for death or not, whether it is simple, dangerous or grievous in nature. Proper history from relative of the deceased and investigating officer, finding of the medico-legal autopsy, photographs of the scene of crime, visit of scene of crime in certain suspicious cases are required before labelling the case as accidental, homicidal or suicidal.

If medical officer / forensic expert see the dead body for first time in the autopsy room, he may form incorrect opinions about the origin of various injuries. Looking the body at the scene of crime with the various surrounding objects will help to avoid such mistakes. The visit to the scene of death is more valuable if the body shows a patterned injury, the origin of which is in doubt. Even a retrospective visit to the scene

enables the doctor to have a true appreciation of the nature of the surroundings, which are usually found to differ from impression formed from the description of other persons, and will be of help in interpretation of the findings on the victim.

Even where initial evidence points to a sudden death, subsequent post mortem examination may reveal foul play and a murder inquiry is initiated. The doctor should therefore ensure that in all circumstances a satisfactory examination has been carried out and attention paid to evidence preservation. The role of the forensic scientist is to carry out appropriate scientific examination in support of the investigation of crime.

The purpose of these examinations may be

- To determine if a crime has been committed
- To provide corroborative evidence.
- Identifying a suspect from blood left at the scene of crime through the DNA database³

Case history

On dated 3rd march 2009, dead body of 25 years old male was brought by investigating officer of concern police station for medico-legal autopsy in Forensic Medicine & Toxicology department, SMIMER, Surat. In post-mortem examination injuries which were present over face and neck raised suspicious in our mind. The investigating officer gave history that he was a driver of three wheeler tempo. In early morning on the same day of post-mortem examination, his tempo was stricken to gutter pipe which was left on road side accidentally due to break up of axel. His head was stricken to the front duplicate wind glass and fixed into the broken glass. The broken ends of wind glass were pierced into the neck. He was expired on the spot in the early morning accidentally.

Due to suspicious nature of injuries we had requested to the investigating officer for visiting the scene of crime and submitting the photographs of scene of crime. At the scene of crime, we had observed pool of dried blood over the road, left side of front light of tempo was broken, axel of tempo was broken, wind glass was broken in the middle in round shape and blood stains were present over the wind glass and steering. We took the photographs of the scene of crime and took the piece of wind glass stained with blood for further investigation.

On receiving the photographs of scene of crime from the investigating officer, post-mortem examination was conducted. On post- mortem examination, following findings were observed.

External findings

- o Right side of shirt & banyan was stained with blood.
- o Blood stained fluid was coming out from nose.
- o Lower half of upper limbs, neck and front of chest stained with blood.
- o Faint post-mortem lividity was present over back of body except pressure area.

Photograph No. 1: Incised looking wounds over left side of neck & face.



- o Conjunctiva was pale.
- o Tip of tongue, ear lobules, nail beds and lips were pale.
- o External injuries were as follows:
 1. Incised looking wound was present over left side of face of size 5cm x 0.5cm x skin deep, 2cm left to eyebrow.
 2. Incised looking wound was present over left side of neck of size 4cm x 0.5cm x skin deep, 8.5cm below lower border of left ramus of mandible, 2cm left to midline.
 3. Cut throat wound was present over left side of neck of size 7cm x 2cm x structure deep, 3 cm below left angle of mandible, margin of upper outer half contused.
 4. Cut throat wound was present over left side of neck of size 6cm x 3cm x trachea deep, 3.5 cm below injury no.3.

Note: Margins of all above injuries were relatively clean cut & reddish in color, both angles were acute.

Internal findings

- o Extravasation of blood was seen in an area of 8cm x 7cm underneath the left side of neck tissue.
- o Left sternocleidomastoid muscle showed clean cut.
- o Left carotid artery, left jugular vein, and left vagus nerve (content of left carotid sheath) show clean cut.
- o Whole trachea was transacted except posterior wall.
- o Trachea contains blood stained fluid.
- o Stomach contains 200ml of partially clotted blood and blood stained fluid.
- o All organs were pale.

After post-mortem examination, cause of death was given " Shock as a result of hemorrhage due to cut throat injuries".

Discussion

Things are not always what they seems to be at first sight. Many cases of homicides go undetected because of lack of suspicion and improper or inadequate or unscientific investigation. There is no specialization of work in the police force at the level of the police station, leading to inexperience personnel, mishandling the forensic aspects of a case. This

Photograph No. 2: Left carotid artery show clean cut margin.



Photograph No. 2: Scene of Crime.



leads to miscarriage of justice and exerts an additional burden upon the forensic pathologist or autopsy surgeon in any given case. The role of doctor in criminal justice system is vital. More so when the case is ambiguous, it acquires much more importance and as a forensic expert he will have to deliver the goods for administration of justice. The motto of us should be "Let hundred culprits go scot-free, but one innocent should not be punished".

The forensic pathologist is required to go beyond stating the mere cause of death. He might be required to establish all the facts, both lethal and non-lethal. The medico legal autopsy demands meticulous detailed descriptions, measurements and collection of evidence⁴.

In cases of unnatural death, a complete understanding of the cause, mode and manner of death and related aspects of forensic thanatology involves a thorough examination in all of a case. The examination in a medico legal case should include:

- o Inspection of the body and its surroundings at the place where it was found, including the inspection of the clothings, weapons and any other articles that may have any connection with the case.
- o External and internal examination of the body in the mortuary.
- o Chemical examination of the viscera, in case in which any suspicion of poisoning attaches with a case.

Above examinations should ideally be made by the forensic pathologist. In routine practice, however for the first, the forensic pathologist has to rely upon the information that is made available by the ill trained police officers. In law, it is the police and concerned magistrate who are authorized to visit the scene of occurrence and carry out their investigations in accordance with section 174 and 176 of CrPC⁵.

In some countries where medical examination system is placed the forensic pathologist or medical examiner is required to visit the scene of occurrence of any unnatural death. In India, however the system of inquest that is practiced is the police and magisterial inquest. Therefore in a vast majority of cases, the forensic pathologist first sees the body only in the mortuary⁶.

A complete and wholesome forensic pathological opinion can be formed only after taking into account information obtained from the investigation of the scene of a death. The evaluation of circumstances of death in a medico legal case may be of critical importance in establishing the manner of

death i.e. a suicide or homicide or accident.

It is more common that multiple incised wounds or cut throat wounds present over body without any sign of struggle mark or defence wounds over body directly suggestive of suicidal or homicidal death. In the present case interesting findings are those that only two incised wounds, one over neck and the other over face with two cut throat wounds damaging the trachea; no any other injury was found over body, struggle mark / defence wound was not present over body, blood stained cloths were not torn.

All these findings put our forensic team to think over suicide or homicide. It is obvious that the injuries present over body were likely to be by sharp cutting weapon. Some points are favouring toward homicide like the injuries which are present over neck in a form of incised looking wound or cut throat wounds are lethal due to cutting the trachea and the content of left carotid sheath which are vital and injuries over these deep vital structures by sharp cutting weapon suggesting the intention of accused to kill the victim. But on the other corner there are some findings which suggest the manner of death may be suicide because there was no struggle mark over body or cloth, no defence wound found over forearm or hand inspite of healthy young male, three out of four injuries were found only on the neck.

The puzzle of manner death is becoming more and more difficult for us. To solve this problem our team has decided to visit the scene of crime. On visiting the scene of crime, it was beyond our imagine. The scenario of the case was completely changed. The scene of crime is opened road side place. Blood was found over the accident site. On inspecting the tempo, wind glass was broken in round shape in middle; blood stained was present over wind glass. Trace evidence like blood stained glass piece, photograph of scene and tempo, photograph from investigating officer and statement from the eye witness which are more helpful for us to solve this case. Finally we gave our opinion that the death was accidental in nature and the injuries possible by broken wind glass.

Suggestions

To stop the miscarriage of justice some of the changes should be made in our working:

1. Training of police officers about the forensic aspects of the cases.
2. Creating a post of Forensic Pathologist in each district head quarter to help the police for its day to day working.
3. Making mandatory for the visit of Forensic Pathologist to scene of crime in all unnatural suspected deaths.

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Sjogren's Syndrome: A review

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Abstract

Sjogren's syndrome is a slowly progressive, inflammatory autoimmune disease affecting primarily the exocrine glands like lacrimal and salivary glands. Histologically, it is characterised by lymphocytic infiltrates that replace functional epithelium and lead to decreased exocrine secretions. The various clinical features of Sjogren's syndrome are keratitis, xerostomia and salivary gland enlargement. The condition can be diagnosed by various methods like Schirmer test, sialography, biopsy, etc. and can be treated accordingly.

Keywords

Sjogren's syndrome, xerostomia, sialography.

Sjogren's syndrome (SS) is a chronic systemic autoimmune disease that affects the exocrine glands, particularly the salivary and lacrimal glands resulting in xerostomia and xerophthalmia (keratoconjunctivitis sicca). The clinical presentation of both xerostomia and xerophthalmia is often called as Sicca syndrome. It was first described by the Swedish ophthalmologist Sjogren, in 1933¹.

Sjogren's syndrome is of two types

- Primary Sjogren's syndrome- Sicca complex (dry eyes and dry mouth) and extra glandular symptoms without any additional connective tissue disorder.
- Secondary Sjogren's syndrome-Sicca complex that occurs with other autoimmune disorders such as Systemic lupus erythematosus, Rheumatoid arthritis or scleroderma².

Etiopathogenesis

The etiopathogenesis of Sjogren's syndrome remains unclear, though it is known to be multifactorial and complex. The disease is known to be autoimmune but studies have also suggested certain viruses, endocrine and genetic factors as causative agents¹. The generalized alteration also relates to a polyclonal B-cell hyperactivity that reflects a lack of regulation by T-cell lymphocytes³. Environmental factors include links to Epstein-Barr virus, Hepatitis C, HIV and Human T-cell leukemia virus-1. Whatever the trigger, afterwards a glandular tissue autoimmune complex then becomes infiltrated with lymphocytes of CD4 cell type. These CD4 interact with the MHC class II receptors and initiate a cascade of events that include release of cytokines IL-1, TNF- α and interferon- γ . Subsequent destruction of tissue and interference with acetylcholine release occurs, which leads to gland dysfunction. Certain MHC antigens (HLAs) are found with greater frequency in patients with Sjogren's syndrome that consist of HLA-DR3 and HLA-B8 (associated with primary form of SS) and HLA-DRw52 (associated with both forms of SS). Changes in IgA glycosylation can also be detected in patients with primary Sjogren's syndrome⁴.

Clinical features

Sjogren's syndrome occurs predominantly in females above 40 years of age with male to female ratio being 9:1¹. The condition is usually associated with a wide variety of clinical features:

Ocular involvement

Patients frequently complain of their eye feeling dry, sore and gritty due to hypofunction of lacrimal glands. Complications of untreated sicca syndrome results in corneal ulceration, and perforation, leading to uveitis, cataract and glaucoma.

Oral involvement

All patients with Sjogren's syndrome complain of dryness of mouth, lip cracking, difficulty in mastication and at times dysphagia. These occur due to reduced salivary flow due to hypofunction of salivary glands⁵. Parotid gland enlargement which is often recurrent and symmetric, occurs in approximately 50% of the patients³. Drying of tongue and absence of salivary pool can cause angular stomatitis, ulceration of the tongue, dental caries and candidiasis.⁵ The patients may also have non-tender or slightly tender diffuse swelling of minor salivary glands⁶.

Articular features

During the course of Sjogren's syndrome, 75% of patients with primary Sjogren's syndrome may complain of arthralgia. Less than 10% have true arthritis. Articular symptoms and signs include arthralgia, morning stiffness, intermittent synovitis and chronic polyarthritis⁷.

Dermatological involvement

Annular erythema mainly on the face and trunk and dryness of the skin particularly nasal and vaginal dryness are noted. Secondary Sjogren's syndrome is also associated with scleroderma and systemic lupus erythematosus.

Vascular involvement

There are two types of inflammatory vascular diseases in patients with Primary Sjogren's syndrome namely neutrophilic inflammatory vascular disease and mononuclear inflammatory vascular disease. Both types may cause end-organ damage.

Raynaud's phenomenon is present in 35-50% of patients with Primary Sjogren's syndrome. In this, the patients present with swollen hands, but in contrast to scleroderma they do not develop telangiectasias or digital ulcers. Other complications of SS also include anemia, leukemia and vasculitis in cardiovascular system².

Pulmonary involvement

Significant pulmonary involvement is uncommon, reported in primary SS in 9% to 75% of cases. Symptoms vary from dry cough to dyspnoea from interstitial lung disease⁸.

Gastro-intestinal involvement

Oesophageal dryness may cause dysphagia. Atrophic gastritis has been recognized as a complicating factor for

primary and secondary Sjogren's syndrome. Biliary cirrhosis and hepatitis may also occur.

Renal involvement

Well-known renal association is renal tubular acidosis. Renal histological examination may demonstrate the infiltration of the tubules and renal parenchyma by lymphocytes and plasma cells.

Endocrine involvement

Hypothyroidism which is clinically apparent is present in 10-15% of patients with Sjogren's syndrome.

Links to lymphoma

Patients with Sjogren's syndrome have 44 times increased risk of developing lymphoma as compared to general population. Most of the lymphomas are low grade B cell lymphomas of the mucosa-associated lymphoid tissue (MALT)².

Diagnosis

To date, no specific diagnostic test has been developed for Sjogren's syndrome. An attempt was made by the American-European Consensus Group in 2002 to establish the diagnostic criteria. According to them, diagnosis depends upon the correlation between the patient history and laboratory data, clinical examination and assessment of salivary function¹. The diagnostic criteria is as follows:

I. Eye symptoms. Positive response to at least one of the following:

- a. Have you experienced dry eye sensation in the last three months?
- b. Do you have sand in the eyes sensation?
- c. Do you have to use artificial tear drops at least three times a day?

II. Oral symptoms. Positive response to at least one of the following:

- d. Have you experienced dry mouth sensation in the last three months?
- e. Have you noticed persistent or recurrent salivary gland enlargement?
- f. Do you need to drink liquid in order to swallow food?

III. Eye symptoms. Positive result with at least one of the following:

- g. Schirmer test
- h. Bengal rose stain

IV. Histopathology

V. Gland involvement. Positive result with at least one of the following:

- i. Sialometry: total resting saliva
- j. Sialography
- k. Scintigraphy

VI. Autoantibodies: anti-SS-A/Ro, anti-SS-B/La, rheumatoid factor, antinuclear Antibodies¹.

Diagnostic methods for Eye symptoms

Tear Break-up Time

Saline moistened fluorescein strips are instilled in the inferior cul-sac to stain the tear film. After several blinks, the tear film is examined using a broad beam of the slit lamp with a blue filter. The time lapse between the last blink and the

appearance of the first randomly distributed dry spot is the tear break-up time. Dry spots that appear in less than 10 seconds are considered abnormal.

Ocular Surface Dye Staining

Fluorescein, rose bengal or lissamine green dye may be used to assess the ocular surface. Fluorescein stains corneal and conjunctival epithelial cells when there is disruption of intercellular junctions, thereby allowing access to the dye. Mild fluorescein staining can be observed in normal eyes. The staining may be more prominent in the morning. An exposure zone fluorescein staining pattern is observed in dry eye and it is more obvious on the cornea than on the conjunctiva⁹.

Rose Bengal staining of the tear film may be performed using a saline-moistened strip or 1% solution. Areas of the ocular surface are stained where tear mucous/agar is discontinuous. Debris in the tear film is also stained. This staining is observed with a red-free filter. Exposure zone staining of the cornea and bulbar conjunctiva is seen in cases of dry eyes¹⁰.

Lissamine green dye has a staining profile similar to that of the Rose Bengal but causes less ocular irritation.

Schirmer Test

This test quantifies aqueous tear production by measuring the amount of wetting. A narrow strip of filter paper is placed in the inferior cul-de-sac. Less than 5 to 10 mm of wetting in 5 minutes is suggestive of an abnormality in patients tested without anaesthetic¹⁰.

Other tests

Include tear osmolarity, fluorescein clearance, impression cytology, tear function index and tear protein analysis (e.g. lactoferrin)⁹.

Diagnostic methods for Salivary gland involvement

Sialometry

It takes as reference the total amount of saliva under resting and stimulated conditions – stimulation being carried out via a mechanical process such as chewing paraffin, or chemically in the form of 2% citric acid. Abnormal values are considered to be less than 0.1 ml/min of saliva under baseline conditions and less than 0.7 ml/min with stimulation¹.

Sialography

It has the potential to produce diagnostic findings in the parotid gland ducts of patients with Sjogren syndrome. Sialography is a radiographic method of assessing anatomic changes in the salivary gland duct system. Sialographic studies with oil-based contrast material have shown an increased incidence of sialectasis in Sjogren's syndrome patients. Sialographs demonstrate formation of punctuate, cavitory defects that are filled with radio-opaque contrast media¹¹. The defects usually appear in a pattern of 'cherry blossom' or 'branchless fruit laden tree'. However, sialography causes pain and swelling of the parotid glands and occasional allergic reactions to radio-opaque material⁴.

Magnetic resonance (MR) imaging can also be performed on a 1.5-T unit with a neck phased-array coil. MR sialographic source images were obtained using a heavily T2-weighted fast spin-echo sequence with spectral fat suppression. Images are analyzed on the basis of maximum intensity projection reconstruction¹¹.

MR sialography can be graded according to the grading system established for conventional sialography where grade

0 is normal, grade 1 is punctuate, grade 2 is lobular and grade 3 is cavitory lesions observed in salivary glands⁵.

Scintigraphy

Patients are fasted for 1 hour, and then after intravenous injection of 185 MBq 99mTc-pertechnetate, dynamic salivary gland scintigraphy is performed with a gamma camera, using a low-energy, high-resolution, parallel-hole collimator. Images are collected into a 128 × 128 matrix with a 140 keV photopeak for 99mTc. Sequential salivary gland images are obtained at 30 s per frame for 30 mins. A scoring system has been established with 4 grades: severe dysfunction = 3 (excretion rate < 25%), moderate dysfunction = 2 (25% excretion rate < 40%), mild dysfunction = 1 (40% ≤ excretion rate < 50%) and normal function = 0 (50% ≤ excretion rate)¹².

Saxon test

After the patient had swallowed the intra-orally excreted saliva, patient is asked to bite and clamp down on a folded weighed piece of gauze for 2 minutes. The inserted gauze and a laboratory dish containing the remaining intra-orally saliva are weighed. The difference in weight is defined as the amount of excreted saliva. Patient has to undergo the Saxon test twice, and the average value of excreted saliva will be defined as the result of the Saxon test for the patient¹².

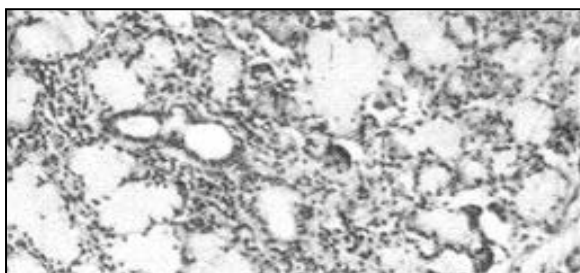
Sialochemistry

It demonstrates significantly elevated levels of Immunoglobulin A (IgA), potassium and sodium in the saliva of patients with Sjogren's syndrome⁴.

Blood investigations

The common findings are mild anemia, leucopenia, eosinophilia, elevated erythrocyte sedimentation rate (ESR). Hypergammaglobulinemia is a consistent laboratory finding, found in 80% of primary Sjogren's syndrome patients. Autoantibodies are common and can be categorized into rheumatoid factors, antinuclear antibodies (ANAs), anti-Ro (anti-SS-A) and anti-La (anti-SS-B) based on ELISA (enzyme-linked immunosorbent assay)³. Multiple organ-specific antibodies consist of antigastric parietal cell, thyroglobulin thyroid microsomal, mitochondrial, smooth muscle and salivary duct antibodies.

Anti-SS-A/Ro antibodies can also be detected in other autoimmune diseases such as rheumatoid arthritis and systemic lupus erythematosus; for this reason, anti-SS-B/La antibodies are considered to be more specific of SS. These antibodies concentrate in the nucleoplasm and cytoplasm of the acinar cells, with a diffuse or perinuclear distribution, and their presence is associated to prolonged duration of the disease, recurrent parotid gland enlargement and florid extraglandular symptoms. It is common to observe positivity



Destruction of mucous acini and aggregation of lymphocytes in a Sjogren's syndrome case. (H&E, X40)

for antinuclear antibodies (ANA), rheumatoid factor (RF), anti-centromere antibodies (ACA), anti-alpha-phodrin and anti-muscarinic receptor M3 antibodies. Anti-SS-A/Ro can be isolated in 25-65% of cases, and anti-SS-B/La in 13-48%¹.

The above mentioned investigations are found to be adjuncts in the diagnosis of Sjogren's syndrome. However, the diagnosis should be confirmed by salivary gland biopsy and immunogenetics.

Biopsy

Salivary gland biopsy serves as a cornerstone for the diagnosis of Sjogren's syndrome. The characteristic finding in SS is a lymphocytic infiltration of the salivary gland parenchyma, with destruction of the acinar units¹³.

Histopathologically, three types of alterations are seen in SS:

- Intense infiltration of the gland replacing all acinar structures
- Proliferation of ductal epithelium and myoepithelium to form 'epimyoeptithelial islands'
- An atrophy of the glands sequential to the lymphocytic infiltration⁴.

The most widely selected site for biopsy in patients with Sjogren's syndrome, is the lower lip minor salivary gland, to determine the corresponding focus score¹³. A focus is taken to be an aggregate of over 50 lymphocytes, and the focus score is the number of foci contained in 4 mm² of gland tissue. The biopsy is considered to be positive for SS when the focus score is ≥ 1. This method is considered to be the most accurate test available¹.

Immounogenetics

Immunogenetic typing indicates statistically significant expressions of various histocompatibility antigens in patients with both forms of SS³. Primary Sjogren's syndrome show an increased association with HLA-Dw3 (DR3) and DR52.

Patients with antibodies to Ro and La have an increased frequency of HLA DR3. In secondary Sjogren's syndrome, only DR 52 was increased².

Treatment

The treatment of Sjogren's syndrome is symptomatic relief of the effects of chronic xerostomia and keratoconjunctivitis. This is achieved by keeping the mucosal surfaces moist. Xerostomia is treated by salivary substitutes such as pilocarpine and cevimeline. Parotid gland infection is treated with tetracycline (500 mg four times a day)³.

Dry eyes need artificial tears as often as necessary. Hydromellose (Hydroxyethylcellulose) helps to replace aqueous layer⁹.

Arthralgia or joint symptoms are treated with non-steroidal anti-inflammatory drugs or simple analgesics. Hydroxychloroquine (200 mg a day) helps both arthralgia and fatigue of Sjogren's syndrome. It also reduces hypergammaglobulinaemia, decreases titre of IgG antibodies to La/SS-B, and increases heamoglobin.

Dry skin is treated with moisturizing creams².

Conclusion

The assessment of a cumulative focus score and various parameters in the clinical features of Sjogren's syndrome provide valuable method for evaluation of salivary gland function in Sjogren's syndrome patients. These findings can improve the diagnostic accuracy and further help the clinician to correctly identify Sjogren's syndrome patients and treat accordingly.

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A study of paediatric poisoning cases at District Hospital Belgaum, Karnataka

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Abstract

During the last three decades, the study on pattern of accidental poisoning cases in pediatrics has become an important subject for the forensic pathologists and the toxicologists worldwide. A Retrospective analysis of cases of all childhood poisonings in District Hospital, Belgaum over 5 years in the 1 to 15 years age group were studied with respect to age, sex, type of poison and outcome. A total of 116 cases were studied. The most common ingested poisons were Organophosphorus compounds (38.16%). Most common age group involved was 1-3 yrs. The study showed male predominance. There was no significant season-wise variation observed. Manner of poisoning in 92% cases was accidental in nature. Amongst 116 cases, 40 cases were due to snake and insect bites. In this, 30 cases were due to snakes and 10 were due to insect and scorpion bite. Maximum number of cases observed was in the age group 4 and 12 years. The study showed male predominance than females. Maximum number of snake and insect bites occurred in rainy and summer season. All the cases were accidental in nature. We recommend that access prevention and massive health education campaign should be instituted to reduce the incidence of accidental poisoning in children.

Keywords

Accidental ingestion; Pediatric poisoning; Organophosphorus compound; Snake bite.

Introduction

The exact incidence of poisoning in India is uncertain due to lack of data at central level as majority of cases are not reported, as mortality data are a poor indicator of incidence of poisoning. This varies from country to country depending on the kind of poisons encountered, the extent of awareness about poisoning, and the availability of treatment facilities. While in developed countries the rate of mortality from poisoning is as low as 1 to 2%, in India it varies from a shocking 15 to 35%. Children less than 15 yrs of age account for most cases of accidental poisoning, but fortunately they are associated with relatively low mortality. On the other hand, most suicidal exposures are seen in individuals over 15 years of age but are associated with high mortality¹. Accidental poisoning, a common pediatric emergency is one of the important causes of morbidity and mortality in children

Table 1: Pattern of Poisoning Cases in Pediatric Age Group.

Type of Poison	Total	Percentage
Ingested poisons	76	65.51
Snake and insect bites	40	34.48
	116	100

especially in developing countries. Thousands of innocent children under the age of 5 years are poisoned accidentally every year throughout the world, mainly due to their innovative and exploratory nature and mouthing tendencies^{2,3}.

Methodology

The data was collected from District Hospital, Belgaum from the year Jan 1999 to December 2003. 116 poisoning cases admitted to pediatric wards in District Hospital, Belgaum.

Poisoning due to ingested poisons

All patients with history of consumption of poison having positive and significant signs and symptoms, accompanied or unaccompanied by container or poison are included and food poisoning, idiosyncratic reactions to drugs are excluded from this study.

Poisoning due to snake and insect bites

All patients with history of bites having positive and significant signs and symptoms due to poisonous creatures like snakes, scorpions, bees and insects are included in the study and patients with history of bite but having no signs and symptoms either locally or systemically are excluded from the study.

Results

During this period, 116 poisoning cases admitted to pediatric wards in District Hospital, Belgaum. Out of which, 76 were ingested poisons and 40 were poisoning due to snake and insect bites which accounted for 65.51% and 34.49% respectively [Table1].

Poisoning due to ingested poisons

In the present study, 44% of the total poisoning was due to insecticides which includes Organophosphorus compounds,

Table 2: Common Types of Poison Consumed

Poison	No. of Cases	Percentage
Organophosphorous compound	29	38.16
Kerosene	16	21.06
Seeds	14	18.42
Drugs	5	6.58
Rodenticide	2	2.63
Carbamate	2	2.63
Corrosives	2	2.63
Organochlorine	1	1.31
Miscellaneous	5	6.58
Total	76	100.00

Table 3: Age Wise Distribution of ingested poisons

Age (Yrs)	No. of Cases	Percentage
1-3	36	47.36
4-6	17	22.36
7-9	11	14.47
10-12	10	13.15
13-15	2	2.63
Total	76	100

Table 4: Sex Wise Distribution.

Age (Yrs)	Males		Females	
	No.	Percentage	No.	Percentage
1-3	22	50	14	43.75
4-6	12	27.28	5	15.62
7-9	5	11.36	5	15.62
10-12	5	11.36	6	18.76
13-15	0	0	2	6.25
	44	100.00	32	100.00

carbamate and chlorinated hydrocarbon compounds, the second commonest poison was kerosene (21.05%) and the third commonest poison was seeds (18.42%) [Table2]. The maximum numbers of patients were in the age group between 1 and 3 yrs, approximately two-thirds of the patients were between 1 and 6 years [Table3]. The ratio of male: female was 1.3: 1 [Table4]. There was no significant season-wise variation was observed [Table5]. The 68% of the patients were from the rural and the remaining 32% from urban areas [Table6]. The manner of poisoning in 92% cases was accidental in nature [Table7]. The suicidal poisoning was seen in 2 females who had failed in the exams. There were 3 homicidal cases, where parents frustrated in life and had given poison to their 3 children, (1 male and 2 female) and later they have also consumed the same.

Poisoning due to snake and insect bites

Out of 116 cases, the number of poisoning cases due to snake and insect bites were 40. This constituted 34.48% of the total studied. Non-poisonous snakes constituted 73.34% and poisonous snake bite was only 26.66% [Table8]. The maximum numbers of patients were in the age group between 10 and 12 years (47.5%) [Table9]. More than 85% of the cases were between the age group 4 and 12 years. Decline in the incidence of snake and insect bites was noticed after 13 years of age. The males constituted 65% whereas in females it was 35% [Table10]. The maximum number of male victims was observed in the age group between 4 and 12 yrs (84.6%) whereas in females it was 64.3% in the same age group. Maximum number of snake and insect bites occurred in rainy

Table 5: Seasonal Variation.

Season	No. of Cases	Percentage
Rainy season	29	38.15
Summer season	25	32.90
Winter season	22	28.95
	76	100.00

Table 6: Urban and Rural Variation

Areas	No. of Patients	Percentage
Rural	52	68.42
Urban	24	31.58
	76	100.00

Table 7: Manner of Poisoning

Manner	Males		Females	
	Cases	Percentage	Cases	Percentage
Suicidal	0	0.00	2	6.25
Homicidal	1	2.28	2	6.25
Accidental	43	97.72	28	87.5
	44	100.00	32	100.00

Table 8: Type of Snake Bite

Snake	Cases	Percentage
Poisonous	8	26.66
Non-poisonous	22	73.34
	30	100.00

and summer season [Table11]. The maximum number of bites (65%) occurred in the lower extremities while in the upper extremities it was 22.5% [Table12]. In the study 70% of patients were from rural areas whereas 30% of them from urban areas [Tab13]. All the reported cases were accidental in nature involving more number of male victims [Table14]. Among the reported, 3 cases ended in death. 2 cases on the way to hospital from the rural areas and 1 case died in the hospital due to severe internal hemorrhage and respiratory failure.

Discussion

Poisoning due to ingested poisons

In our study, it was observed that 44% of the total poisoning was due to insecticides which includes Organophosphorus compounds, carbamate and chlorinated hydrocarbon compounds followed by Kerosene (21.05%) and seeds (18.42%). Similar studies done at Calicut (42.5%)⁴, Srinagar (39.25%)⁵ and Thanjavur (76.5%)⁶ showed that kerosene was the commonest poison encountered. Insecticides were the most common in our study, mainly because agriculture is the main occupation in and around Belgaum and most of the farmers keep the insecticides in their home. This mainly accounted for accidental poisoning in the children. Maximum numbers of patients were in the age group between 1 and 3 years, approximately two-thirds of the patients were between 1 and 6 yrs. The ratio of male: female was 1.3: 1. A retrospective analysis of the telephone calls

Table 9: Age Wise Distribution of Snake and Insect Bites

Age (Yrs.)	No. of Patients	Percentage
1-3	5	12.5
4-6	9	22.5
7-9	3	7.5
10-12	19	47.5
13-15	4	10
Total	40	100

Table 10: Sex Wise Distribution

Age (Yrs.)	Males		Females	
	No.	Percentage	No.	Percentage
1-3	2	7.7	3	21.42
4-6	5	19.20	4	28.58
7-9	2	7.7	1	7.14
10-12	15	57.7	4	28.58
13-15	2	7.7	2	14.28
Total	26	100.00	14	100.00

Table 11: Seasonal Variation

Season	No. of Cases	Percentage
Rainy season	18	45%
Summer season	13	32.5%
Winter season	9	22.5%
	40	100

Table 12: Site of Bite

Body site	No. of Cases	Percentage
Upper limbs	9	22.5
Lower limbs	26	65
Others	5	12.5
	40	100

received by the National Poisons Information Centre, AIIMS, New Delhi reveals children below the age of 6 yrs have been affected more than other groups which accounted for 64.75% and there was a higher ratio of poisoning in males (63.11%) than in females (36.88%).⁷ Similar study done in Sri Lanka also revealed the similar results in which, children below 5 years have been affected more (60%) compared to others. There was a male preponderance (66%)⁸. No significant season-wise variation was observed in our study. In a study conducted in South West Maharashtra, 43% cases seen in summer, 37% in the rainy season and 20% in winter⁹. So not much significant seasonal variation is observed. The present study shows that the manner of poisoning in 92% cases was accidental in nature. Similar results were seen in a study conducted in Ankara, which showed 97.1% accidental poisoning in children¹⁰. In another study conducted in Accident and Emergency Department, at the Children's University Hospital, Ireland, a total of 148 cases were recorded, out of them, 86% were accidental poisoning¹¹. So manner of poisoning in children is almost always accidental in nature. In our study, out of 76 ingested poisoning, 2 female cases died due to consumption of Organophosphorus compound which accounted for 2.6% of the total reported cases. According to WHO, mortality due to poisoning in children up to 4 years age varies between 0.3 to 7.0 per 1,00,000 population in various countries¹².

Poisoning due to snake and insect bites

In our study, non-poisonous snakes constituted 73.34% of all the snake bite cases whereas poisonous snake bite was only 26.66%. In a study conducted in J. L.N. Medical College Ajmer, 75% of the total bites were due to non-poisonous snakes and 25% were due to poisonous snakes¹³. In another study conducted in Central Research Institute, Himachal Pradesh, non-poisonous snakes were the most common (90.5%). Although snake bites are a cause for concern, most of them are caused by non-poisonous snakes¹⁴. In our study, more than 85% of the cases were between the age group 4 and 12 years. The males constituted 65% and in females it was 35%. A similar study done in Government Children Hospital, Jammu, 77 cases were in the age group of 5-10 years. Male outnumbered female in the ratio of 55:45¹⁵. In another retrospective study conducted in department of pediatrics of the Royal Victoria Hospital, Banjul, the Gambia the age range was 2-14 years and the male: female ratio was 2.1: 1¹⁶. In our study, maximum number of snake and insect bites occurred in rainy and summer season. The maximum number of bites (65%) occurred in the lower extremities while in the upper extremities it was 22.5%. A prospective study done in

Table 13: Urban and Rural Distribution

Area	No. of Cases	Percentage
Rural	28	70
Urban	12	30
Total	40	100.00

C.G. Hospital, Davangere . They studied 633 cases of snake bite. Most of the cases were seen during two periods, i.e. October, November, December (210 cases) and April, May, June (199 cases). Most cases (506) were encountered in the lower limbs¹⁷. In another retrospective study on scorpion sting was done in a hospital in Calcutta. They noticed maximum numbers of cases were seen during summer and rainy season. The parts where the stings were inflicted were the fingers, back of the hands, palms, soles, ankles and legs¹⁸. A similar study done in rural Zimbabwe¹⁹ and B.P. Koirala Institute of Health Sciences, Nepal²⁰ also showed bites were common in the lower limb. In our study, 70% of the patients were from rural areas whereas 30% of them from Urban areas. A retrospective study done in Postgraduate Institute of Medical Education and Research, Chandigarh, also showed urban to rural ratio was 1: 4.7. They came to conclusion that snakebites are common in the rural population of developing countries²¹. All the reported cases of snake and insect bite in our study were accidental in nature involving more number of male victims. No reported cases are available for homicidal or suicidal poisoning due to snake bites in India. In our study 3 cases died due to snake and insect bites which accounted for 7.5% of the total reported cases. The morbidity and mortality can be reduced substantially by increasing and maintaining confidence in victims, good medical care and providing health education.

Conclusion

In developing countries, a combination of factors contributing to accidental poisoning among children is likely to exist in households of lower socio-economic groups. Such a family is likely to have lower standards of housing, hence inadequate space. The mother has to cope with difficult and time consuming household work which minimizes the time for supervision of young children.

The data available from the present study does not enable the assessment of risk factors. However, by identifying the importance of childhood poisoning as a cause of morbidity as well as the relative importance of different poisoning agents may help in channeling the intervention programmes and further research in the right direction.

Preventive measures

Accidental poisoning in children is preventable. Early detection and first aid measures at the site of poisoning need to be stressed. Public education to keep toxic substances out of reach of children is important. Regional toxicological centers with well equipped laboratories to treat, guide and conduct research in the problem will be helpful.

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Adenoid cystic carcinoma of submandibular salivary gland: A case report

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Abstract

Adenoid cystic carcinoma (ACC) is a rare malignant tumor. It is believed to arise from the epithelial cells of mucous-secreting glands. It most commonly occurs in the major and minor salivary glands of the head and neck. Many individuals are diagnosed with the disease in the fourth to sixth decades of life. There is a slight female preponderance (3:2). No strong, genetic or environmental risk factors have been identified. It is a slow-growing but aggressive tumor with a propensity for perineural invasion. Positive margins, perineural invasion and solid histology of ACC are associated with increased morbidity and treatment failure. An interesting case of adenoid cystic carcinoma along with clinical presentation, differential diagnosis, ultra sonography, histo- pathological features and surgical treatment is described here.

Keywords

Adenoid cystic carcinoma, malignant, perineural.

Introduction

Adenoid cystic carcinoma (ACC) accounts for less than 1% of all head and neck malignancies and approximately 10% of all salivary gland neoplasm. It was first described by Billroth in 1856 and was called cylindroma because of its unique histological pattern¹. ACC is a malignant neoplasm that originates in both minor and major salivary glands characterized by slow growth, diffuse invasion and potential to produce distant metastasis mainly to the lung and bones. The most common intraoral site for minor salivary gland tumor is hard palate followed by the base of the tongue². It can be seen in other glandular tissue such as lacrimal glands, the ceruminous glands of the external auditory canal, the esophagus, the breast, and Bartholin's glands of the vulva, the uterine cervix, and the prostate.

Histopathologically, ACC may present in three different patterns: solid, tubular, and cribriform³. The cornerstone of treatment is surgery, while radiotherapy has been considered for advanced tumor stages and as adjuvant in the presence of positive microscopic margins¹.

Some authors suggest that advanced and non-resectable tumors may be treated only with radiotherapy⁴. It has recently been found that c-kit (CD-117), a tyrosine kinase receptor involved in growth and development of normal tissues and in some neoplasms⁵ expresses in ACC⁶. The behavior of ACC has been shown to be unpredictable. Several factors have been indicated for poor prognosis such as an advanced tumor stage, a solid histologic type, the presence of nodal metastasis, and the presence of positive margins and perineural spread. Although surgery is the main treatment for ACC of the head and neck, postoperative radiotherapy is often

recommended because tumors without well defined borders easily infiltrate into adjacent tissues¹.

Case report

A female patient 45 years of age reported to the Department of Oral Medicine and Radiology with a 4 month history of swelling in the lower left half of the face (fig 1). The contralateral side was normal. The swelling gradually increased to the present size (fig1). Patient's family & medical history was not significant. Extraoral examination revealed firm tender swelling measuring approximately 2x2 cm below the angle of the mandible. The overlying skin was normal with a smooth surface. The swelling was non fluctuant and non pulsatile. On palpation, swelling was hard in consistency, tender, diffuse and mobile in nature. Margins were indistinct merging with the surrounding structure. Regional lymphadenopathy was non evident.

Intraoral examination did not show any swelling or paresthesia of the affected jaw. Routine blood investigations were normal. Fine needle aspiration of the fluid showed hemorrhagic whitish tissue fragments.

Microscopically, fine needle aspiration cytology (FNAC) revealed benign looking epitheloid cells present in small clusters. Cytoplasm was present in moderate amount. Nuclei of cells appeared normal with fine granular chromatin. Phagocytic histiocytes were present in fair number. Background showed few inflammatory cells, predominantly lymphocytes. A provisional diagnosis of chronic non specific sialadenitis was made, along with differential diagnosis of sialolithiasis.

High resonance ultrasonography (HRUSG) of neck revealed enlargement of gland with heterogenous predominantly hypoechoic lesion with few cystic & necrotic areas. Considering the unfavorable prognosis of conservative treatment, the gland was surgically excised and the specimen was sent for histopathological examination (fig 2). Grossly, specimen was grayish white in color firm in consistency measuring 4.2 x 3.7 x 3.8 cm in size. The tissue was processed and multiple sections were stained with Hematoxylin and Eosin. Microscopically, (fig 3) sections revealed a solid pattern of arrangement of cells with basaloid-type tumor cells arranged in islands, cords and sheets. In some areas islands

Fig. 1: Swelling in the region of left Submandibular Salivary Gland.



Fig. 2: Excised specimen of the submandibular Gland.



of cells showed spherical spaces with a classical “Swiss cheese” pattern. The histological examination confirmed the diagnosis of Adenoid cystic carcinoma. Distant metastasis was not detected upon thorough screening.

Discussion

ACC is a relatively rare tumor. The pathognomy of the local growth of ACC is its insidious and widespread dissemination through submucosal and fibrous tissue planes around the primary site and its perineural extension through minor and major nerves⁷.

Compared with other cancers of the head and neck, it is more difficult to completely resect due to the perineural extension to the skull base, and proximity to important neural and vascular structures. Therefore, radiotherapy is recommended as an adjunct to surgical resection^{8,9}. Until now, there has been no clear guideline on the use of irradiation therapy in the management of ACC¹.

The prognostic factors of ACC depend on tumor site, tumor stage, the presence of perineural invasion and tumor grade. Tubular and cribriform pattern have better prognosis than solid subtypes.

The treatment of choice was total tumor resection⁷. However, there is still controversy regarding the adjuvant treatment of this tumor. Several authors recommend post operative radiation, since radiation produces tumor regression and relieve the symptoms. However, in our case complete surgical excision of the gland was done and no radiotherapy was advised as there was no sign of metastasis. On other hand, some investigators, doubt that the post operative radiation may influence the course of the disease.

The use of chemotherapy is controversial in ACC. Some authors report it to be ineffective while others had some positive response and recommend chemotherapy as a palliative treatment in advance cases of ACC¹⁰.

In a study of a large series of patients with ACC, Fordice et al.¹¹ reported that neither tumor site nor tumor stage had a significant effect on survival. However, considering the limited length of follow-up in that study (as little as 2 years in some cases) and the tendency of ACC to recur late, their conclusions

Fig. 3: Microphotograph: Hematoxylin-Eosin stain evidencing Swiss Cheese pattern(40X)

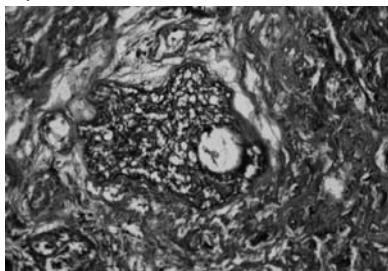
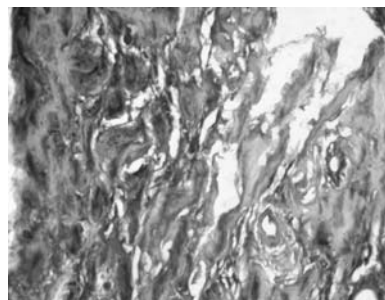


Fig. 3b: Microphotograph: Hematoxylin-Eosin stain exhibiting Solid pattern of arrangement of tumor cells.(40X)



should not be considered definitive. The TNM stage of ACC at presentation appears to be relevant to survival. Spiro et al. have also suggested that local spread is a major factor in decreasing the cure rate of patients with ACC. Aggressive primary resection might be the only way to lower the mortality of patients with ACC in sites of prevalent local spread. Some studies have reported that postoperative radiotherapy conferred no advantage, but others have shown that ACC is radiosensitive, although not necessarily radio curable. Radiation, therefore, might still be of value both in treating (postoperatively) locally advanced disease and in treating patients who refuse surgical resection.

Treatment delivered to the neck should be tailored to the specific site of origin. In our case, surgical excision of the submandibular gland in toto was the treatment of choice. Regional recurrences, which are most common in cases of ACC that arise in the minor salivary glands, carry an ominous outcome. Surgery is the preferred primary treatment, and complete resection of the tumor with negative margins is indicated². In the present case initially the diagnosis was misleading due to FNAC report. It was only after histopathological analysis the diagnosis of ACC could be made, showing the importance of biopsy.

Conclusion

Adenoid cystic carcinoma is a tumor with distinctive clinical and histopathological features. The solid variant of the tumor has a poor prognosis when compared to tubular or cribriform pattern. Patients with advanced-stage ACC had higher distant metastasis rates even when receiving postoperative radiotherapy. Distant metastasis is still the main problem in the management of ACC of the head and neck. More-effective treatment for tumors with distant metastasis is lacking¹. Metastasis can manifest very late and hence a long term follow-up and a high index of suspicion is necessary to diagnose them early. Chemotherapy could be considered in selected patients as a therapeutic option in metastatic disease¹². In non metastatic cases surgery is curative, however considering the aggressive nature and potential for local recurrence a long term follow -up is mandatory even in the non metastatic cases.

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Microbial Forensics: The need to counter bioterrorism

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Abstract

Microbial forensics is a newer concept for many of us, but it gained importance earlier after the 2001, anthrax attack in U.S.A which killed 5 people. Following which a new dimension towards the forensic investigation of the microbes was evolved in which the species, serotype, phage type, genetic profile is identified to know whether the strain is from the naturally occurring zoonosis or is an independent strain developed in the laboratory. The Law enforcement agencies must be prepared to counter any biological attack. The Governments and the public should work together to meet the needs of biosecurity.

Key words

Biocrime, Bioterrorism, Microbial Forensics, Microbial evidence.

Introduction

Biocrimes and bioterrorism have been of great concern to all the nations worldwide. It has posed a great challenge to many Governments and the citizens of the country at large. Poor preparedness was observed in many of the developed countries until the outbreak of anthrax in 2001 in the United States. Microbial Forensics is a new approach to the analysis of microbial evidence from a biocrime for attribution purpose. In other words microbiology and epidemiology is utilized in the legal sense to provide the evidence and prosecute the bioterrorists. Majority of the infections/diseases among animals and zoonotic infections among humans occur naturally without much significance. Alarm has to be raised when the epidemiologic pattern retrieved is different from those expected of the animal population. International guidelines and polices for the prevention of devastating loss of human life has to be made. Nations should be well prepared to handle and deliver microbial evidence to Forensic investigation which is of prime importance in the near future.

History of bioterrorist acts on humans

During the First World War the Germans carried out a variety of biological attacks on different types of livestock. Dr. Antony Dilger, a German-American Physician living in the northwest suburb of Washington DC supplied with seed stocks of *Bacillus anthracis* (Anthrax) and *Burkholderia mallei* (Glanders) by the Imperial German government, he set up a small laboratory in his home and was believed to produce at least a liter of the agent. This was used to infect 3500 horses, mules and cattle's waiting to be supplied to Allied forces in Europe¹.

During the second World War in 1944 "operation Vegetarian" the United kingdom developed 5 million anthrax laden linseed oil cattle cakes that were intended to be dropped from aircraft over German Pasture and the cattle's would die in about 5.25 days after consuming. But this was cancelled due to the Normandy invasion².

In USA the biological warfare programme tested hog cholera (classical swine fever) and Newcastle disease, using experimental bombs that released virus coated feathers that would float down into farms².

In 1984 at least 751 people were contacted with *Salmonella gastroenteritis* in Dallas, Oregon. The source was from 10 restaurants. No specific food or any food handler was responsible for the contamination. Clinical investigation revealed that members of Rajneesh religious commune were responsible for the intentional contamination of the salads and the police also seized a sample of *Salmonella typhimurium* which was indistinguishable from the outbreak strain and was subsequently obtained from a local supplier. The motive was to intentionally incapacitate the voters in the upcoming local county election³.

West Nile virus is a zoonosis that first appeared in 1999 in the New York City. Though mortality was seen in birds, later the illness spread to humans⁴. The investigation revealed that this strain was closely related to the strain circulating in Israel between 1997 to 2000².

The latest incidence being the 2001 anthrax tainted letter which occurred in the USA in which out of 22 case 5 cases were fatal. So far no conviction was made in this case².

Microbial forensics

Forensics is defined as the use of science and technology to investigate and establish facts in criminal and civil courts of law². Microbial forensics has been defined as a scientific discipline dedicated to analyzing evidence from a bioterrorism act, Biocrime or inadvertent microorganism/ toxin release for attribution purpose^{5,6}. The properties and the most important criteria that make microorganisms useful biological weapons include (1) accessibility; (2) culturability; (3) capability for large-scale production; (4) stability during preparation; (5) ability to retain potency during transport and storage; (6) ability for dissemination; (7) stability and retention of potency after dissemination; (8) incubation period; (9) infectivity; (10) lethality; (11) pathogenicity; (12) toxicity; (13) transmissibility; and (14) virulence⁷.

It is based upon the traditional microbiology and epidemiology within the legal limits. The epidemiological investigation which is done by veterinary or public health officer to check the spread of animal disease like foot and mouth disease or a zoonotic like yersiniosis which is identified up to the species level. On the contrary in microbial forensics, the characteristics of the organism like the species, serotype, phage type, genetic profile is identified to know whether the

strain is from the naturally occurring zoonosis or is an independent strain which confirms the origin of the strain (intentional spread)². Maintaining a chain of custody on evidentiary samples is an additional requirement in Forensics. There are new challenges like the quality assurance/ quality control and proficiency testing programmes in microbial forensics, which are to be developed⁸.

The Center for Disease Control has prescribed a list of harmful microorganisms and toxins that are monitored and restricted. It has been classified into

1. **Category A:** Microorganisms that are easily disseminated or transmitted from person to person, can cause high mortality, have major impact on public health and cause substantial social disruption. The toxin in this category is very lethal.

E.g.-Bacillus anthracis, Yersinia Pestis, Variola major, Francisella tularensis, Clostridium botulinum, Filoviruses, Arenaviruses.

2. **Category-B:** Microorganisms that are moderately easy to disseminate and cause moderate morbidity, but usually low mortality. Toxins in this category can cause mortality. E.g.- Brucella spp, Burkholderia mallei, Burkholderia pseudomallei, Coxiella burnetti, Cryptosporidium parvum, Escherichia coli O157:H7, Salmonella spp, Shigella spp, Vibrio cholera, Chlamydia psittaci, Rickettsia prowazekii, Alpha virus, Epsilon toxin, Ricin (Ricin Communis), Staphylococcus enterotoxin B.

3. **Category-C:** Emerging Pathogens that could be engineered for mass dissemination are available, are relatively easy to produce and have potential for high morbidity and mortality.

E.g. – Hantavirus, Nipah virus,, Tick borne hemorrhagic fever virus, Tick borne encephalitis virus, Yellow fever virus, Mycobacterium tuberculosis⁹.

The large number of microbes involved in bioterrorist act will practically limit the development of a database to be used in the forensic investigations.

Forensic investigation

Once a crime (and scene) is identified, evidence collection and analysis ensued. There are existing protocols for sample collection and handling, analytical methods, epidemiology practices, and chain of custody procedures for attribution. Yet, to date, many of these have not been rigorously validated for microbial forensics applications. If identification, collection, handling, and preserving the samples are not performed efficaciously, subsequent analyses could be compromised. Biological specimens must be handled properly to preserve bacterial, viral, or toxin viability and integrity. Each case could present a unique scenario, with regard to the types, quantities, and matrices of the evidence such that no single-sample and no single-recovery procedure will apply. Thus, a "tool kit" approach is warranted. Yet, some general practices need to be formalized and fully validated. Also, flexibility in protocols should be considered such as with sample types to be encountered, not all scenarios can be predetermined. Stringent standard operating collection and preservation protocols may be too restrictive and actually hinder effective sample collection. Bulk collection processes have different demands than collecting trace materials. The collection of live microbes requires different strategies and practices than that for dead microbes. In fact, some collection and storage procedures may actually kill the microorganism, thus rendering the sample unculturable. Culturing, when possible, can be used to identify the microorganism, as well as

propagate material, so that forensic genetic attribution analyses can be conducted. Toxins will require altogether different protocols. Over the past 20 years, the forensic community has concentrated its efforts in forensic biology on molecular biology analysis. Developments in the field of molecular biology make possible forensic analyses once not thought feasible. DNA/RNA typing will figure prominently in the cadre of analytical tools for microbial identification and characterization purposes. Further, the extraction and recovery of minute quantities of nucleic acids from dilute samples and complex matrices are very significant issues. In addition, because the PCR is fundamental to most molecular biology assays, it will be necessary to remove inhibitors that co purify with nucleic acids. Inhibitors are likely to be in many samples due to environmental contamination⁷.

Microbial laboratory assay

The laboratory will help in determining the species, serotype, phage type and genetic profile of the isolated evidence sample. These strains are compared with reference culture and strains that were picked up as evidence. The various isolates thus compared will determine whether they are from the same lineage or conversely to at least to confirm an independent origin⁵. This evidence may not be sufficient to demonstrate that the microbes are from the same source or lineage. Also the natural outbreaks can sometimes involve multiple strains which is quite difficult in precisely pointing out the source.

Advanced technologies like the culture and speciation of isolates, phenotyping, phage typing, fatty acid composition analysis and genetic characterization which are collaborated with the conventional technique will help in detection. Newer techniques like the micro assays and isotope analysis are also important. Multilocus variable number of tandem repeats analysis which was used to identify the B. anthracis investigation in 2001 in the USA can also be employed. Other technique that are utilized include microsatellite and minisatellite loci and real time polymerase chain reaction (PCR)².

Microbial forensics is powered by genomics which assist in the design of gene based diagnostic tests and guiding interpretation. The genomics of Salmonella typhimurium, Escherichia coli, and B. anthracis are sequenced which are helpful in detection of the agent. Bioinformatics (software) is important in finding genetically related organisms represented in database and ascribing statistical confidence limit on matches².

Role of Law enforcement agencies in Bioterrorism

The bioterrorist attack is classified into overt and covert. The difference between them is that an overt attack is often recognized immediately; while a covert attack is not evident for some time. Covert biological attacks are by their nature very difficult to discover. Complicating factors include the background of commonly occurring food borne illness and a large number of infectious diseases⁹.

The development of programmes and training of staff of law enforcement agency, laboratory, and other public health scientists in handling and processing samples in accordance to forensic microbiological criteria is of utmost importance. In addition, the staff should be trained in scientific basis of identification and molecular characterization of microbes and also establish and maintain repositories and database

containing isolates of diverse temporal and geographic origins⁸.

The Law enforcement agencies must be prepared to counter any biological attack. The basic issues that arise in the preparation of microorganisms, the preparation of toxins, the approach for weaponization, dispersal of biothreat agent and synthetic biology should be closely monitored. It is because of the easy availability, low cost of development, easy access to technology and information all possible threat cannot be detected or ruled out. The Governments and the public should work together to meet the needs of biosecurity. Increased awareness and an early detection of threats is the key to facilitate investigation and attribution as well as deterring some potential criminals⁹.

Conclusion

Incidents of bioterrorist attacks will increase in the years to come. To combat and to counter such an attack is the prime focus in the near future. Lack of preparedness in such a field will result in the rapid spread of the infectious agent throughout the country and by the time such an attack is recognized, it would be difficult to recognize the culprit and would have caused devastating damage to health and economy of a country. Emphasis should be laid on building the traditional forensic laboratory in lines with international guidelines to detect all the potential pathogens which are likely to be used by bioterrorists and the use of software during the forensic microbial investigation. The ability to pick up the microbial evidence and recognition of a strain at the genomic level will indicate whether it was from a natural source or was processed or cultured for a bioterrorist attack. This new concept of microbial forensics will be well recognized in the near future.

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Legal issues related to banking frauds in India

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1. Introduction

Klynveld Peat Marwick Goerdeler (KPMG) India Fraud Survey Report 2008 showed that more than 80 per cent of respondents recognize fraud as a problem and 70 per cent believe it to increase over the next two years¹. The Then Union Finance Minister P. Chidambaram said that banks in India lost about Rs 1,078 crore due to frauds, including credit card frauds, in 2007. While the total number of frauds as reported by banks is increasing, there is a reduction in the total amount involved over the last three years. Rising economic offences in banks, the number of bank frauds have gone up from 12,374 in 2005 to 22,280 in 2007. However, the total amount involved in frauds declined from Rs 1,385.91 crore to Rs 1,077.84 crore during the same period. Loss to public sector banks was Rs 793 crore due to around 3,000 frauds, followed by Rs 224 crore to private banks in over 12,000 frauds and Rs 60.75 crore to foreign banks in more than 7,000 cases last year².

Incidence of frauds, dacoities, robberies, etc., in banks is a matter of great concern. While the primary responsibility for preventing frauds lies with the banks themselves, the Reserve Bank of India (RBI) has been advising banks from time to time about the major fraud prone areas and the safeguards necessary for the prevention of frauds. The Reserve Bank has also been circulating to banks, the details of frauds of an ingenious nature, not reported earlier so that banks could introduce necessary safeguards/preventive measures by way of appropriate procedures and internal checks.

Banks are also being advised about the details of unscrupulous borrowers and related parties who have perpetuated frauds on banks so that banks could exercise caution while dealing with them³.

2. Concept of fraud in common law⁴

Fraud as a concept not only involves criminal but civil liability as well. In legal parlance, a mere false statement cannot be said to amount to fraud. Fraud is said to be committed when one person causes another to act on a false belief by a representation, which she/he does not believe to be true.

Thus a person may not have definite knowledge/belief that a particular statement is not true⁵. Fraud is any dishonest act and behaviour by which one person gains or intends to gain advantage over another person. Fraud causes loss to the victim directly or indirectly. Fraud has not been described or discussed clearly in The Indian Penal Code (IPC) but sections dealing with cheating. Concealment, forgery, counterfeiting and breach of trust which lead to the act of fraud have been discussed. There is no offence known to common law as "fraud". Fraud is a generic term for a type of criminal offence, of which the elements are variable, including the non-violent dishonest obtaining of some economic advantage or causing

some economic loss. Serious fraud is simply fraud on a large and complex scale, involving large or substantial sums of money⁶. The term "fraud" has not been defined in the IPC but in the Indian Contract Act, 1872. "Fraud" is defined in Section 17 of the Indian Contract Act, 1872, and is as follows: "Fraud means and includes any of the following acts committed by a party to a contract, or with his connivance, or by his agent, with intent to deceive another party thereto or his agent, or to induce him to enter the contract:

- The suggestion, as to a fact, of that which is not true, by one who does not believe it to be true;
- The active concealment of a fact by one having knowledge or belief of the fact;
- A promise made without any intention of performing it;
- Any other act fitted to deceive; and
- Any such act or omission as the law specially declares to be fraudulent.

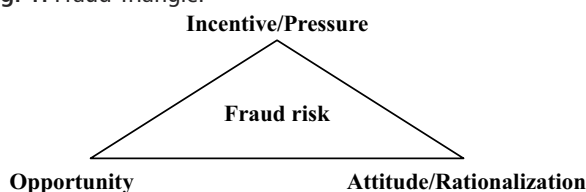
A mere silence as to facts likely to affect the willingness of a person to enter into a contract is not fraud, unless the circumstances of the case are such that, regard being had to them, it is the duty of the person keeping silence is, in itself, equivalent to speech"⁷.

Fraud is a phenomenon, which cannot be eliminated, but it needs to be managed. Many a times an organization doesn't disclose the fraud as it outs the company's reputation at risk. Frauds are not new for the corporate world. Nowhere in the world fraud can be avoided and hence, the banks are no exceptions. It is a human tendency of taking risk to commit the frauds if he finds suitable opportunities. So it is wise to expect the occurrence of frauds. If the fraud is expected, efforts can be concentrated on the areas which are fraud prone. Fraud is the game of two-the rule makers and the rule breakers. Whoever is strong in the anticipation of the situations wins the game of frauds. According to estimates, India is losing a whopping \$ 40 bn per year because of corporate frauds, which is more than 4% of the country's gross domestic product. The dual impact of two concerns, unethical behavior of employees and inadequacy of the anti-fraud measures, leads to an environment where both inclination and opportunity co-exist. This could mean that organizations in India that remain passive in their approach to deal with frauds may be a perfect breeding ground for frauds.

3. Conditions for fraud in Global Era

Three conditions of fraud arising from fraudulent financial reporting and misappropriations of assets are described in Section 5135.012 of the Canadian Institute of Chartered Accountants Assurance Handbook titled "The auditor's responsibility to consider fraud and error"⁸. As shown in Figure 1, these three conditions are referred to as the fraud triangle.

Fig. 1: Fraud Triangle.



4. Frauds in banks

Bank fraud is the use of fraudulent means to obtain money, assets, or other property owned or held by a financial institution. In many instances, the bank fraud is a criminal offense.

While specific elements of a particular banking fraud law vary between jurisdictions, the term bank fraud applies to actions that employ a scheme or artifice, as opposed to bank robbery or theft. For this reason the bank fraud is sometimes considered a white-collar crime. Banking Frauds constitute a considerable percentage of white-collar offences being probed by the police. Unlike ordinary thefts and robberies, the amount misappropriated in these crimes runs into lakhs and crores of rupees. Bank fraud is a federal crime in many countries, defined as planning to obtain property or money from any federally insured financial institution.

4.1 Frauds in Indian Banks

The number of bank frauds in India is substantial. It is increasing with the passage of time. All the major operational areas in banking represent a good opportunity for fraudsters with growing incidence being reported under deposit, loan and inter-branch accounting transactions, including remittances. The Ketan Parekh fraud is the most recent and biggest of a series of frauds and direct attacks on the systems and procedures of banking in India in the late 1990s. Coming after a similar banking and capitals market fraud involving Harshad Mehta in 1991, it has exposed the glaring lacunae in the existing Indian banking regulatory and supervisory framework⁷.

The nature of fraud perpetuated by Ketan Parekh lies in the abuse of the banking system in India to channelise money illegitimately into the stock market. Parekh acquired funds fraudulently over a long period of time from various commercial and co-operative banks through the issuance of large-value pay-orders, which are of the same nature as demand drafts, without the actual cash to back them up or any reciprocal pay-in of funds. The fraud consequently becomes a statement on how the nexus between bankers, corporate bodies, promoters of companies, auditors and stock brokers, in the absence of alert and diligent supervision, can trigger a systemic crisis in the capital markets and which can potentially induce a banking crisis as well.

5. Classification of frauds

In order to have uniformity in reporting, frauds have been classified as under, based mainly on the provisions of the IPC³:

- i) Misappropriation and criminal breach of trust.
- ii) Fraudulent encashment through forged instruments, manipulation of books of account or through fictitious accounts and conversion of property.
- iii) Unauthorized credit facilities extended for reward or for illegal gratification.
- iv) Negligence and cash shortages.

- v) Cheating and forgery.
- vi) Irregularities in foreign exchange transactions.
- vii) Any other type of fraud not coming under the specific heads as above.

Bank fraud is a big business in today's world. With more educational qualifications, banking becoming impersonal and increase in banking sector have give rise to this white-collar crime. The banking fraud can be classified as⁹:

- i) Fraud by insiders
- ii) Fraud by others

5.1. Fraud by Insiders

5.1.1. Rogue traders: A rogue trader is a highly placed insider nominally authorized to invest sizeable funds on behalf of the bank; this trader secretly makes progressively more aggressive and risky investments using the bank's money, when one investment goes bad, the rogue trader engages in further market speculation in the hope of a quick profit which would hide or cover the loss.

5.1.2. Fraudulent loans: One way to remove money from a bank is to take out a loan, a practice bankers would be more than willing to encourage if they know that the money will be repaid in full with interest.

5.1.3. Wire fraud: Wire transfer networks such as the international, interbank fund transfer system are tempting as targets as a transfer, once made, is difficult or impossible to reverse.

5.1.4. Forged or fraudulent documents: Forged documents are often used to conceal other thefts; banks tend to count their money meticulously so every penny must be accounted for.

5.1.5. Uninsured deposits: There are a number of cases each year where the bank itself turns out to be uninsured or not licensed to operate at all.

5.1.6. Theft of identity: Dishonest bank personnel have been known to disclose depositors' personal information for use in theft of identity frauds.

5.1.7. Demand draft fraud: Demand draft (DD) fraud is usually done by one or more dishonest bank employees that is the Bunko Banker. They remove few DD leaves or DD books from stock and write them like a regular DD.

5.2. Fraud by Others

5.2.1. Forgery and altered cheques: Thieves have altered cheques to change the name (in order to deposit cheques intended for payment to someone else) or the amount on the face of a cheque (a few strokes of a pen can change 100.00 into 100,000.00, although such a large figure may raise some eyebrows).

5.2.2. Stolen cheques: Some fraudsters obtain access to facilities handling large amounts of cheques, such as a mailroom or post office or the offices of a tax authority (receiving many cheques) or a corporate payroll or a social or veterans' benefit office (issuing many cheques).

5.2.3. Accounting fraud: In order to hide serious financial problems, some businesses have been known to use fraudulent book-keeping to overstate sales and income, inflate the worth of the company's assets or state a profit when the company is operating at a loss.

5.2.4. Bill discounting fraud: Essentially a confidence trick, a fraudster uses a company at their disposal to gain confidence with a bank, by appearing as a genuine, profitable customer.

5.2.5. Cheque kiting: Cheque kiting exploits a system in which, when a cheque is deposited to a bank account, the money is made available immediately even though it is not removed from the account on which the cheque is drawn until the cheque actually clears.

5.2.6. Credit card fraud: Credit card fraud is widespread as a

means of stealing from banks, merchants and clients. A credit card is made of three plastic sheet of polyvinyl chloride.

5.2.7. Counterfeit credit cards are known as white plastics

5.2.7.1. Booster cheques: A booster cheque is a fraudulent or bad cheque used to make a payment to a credit card account in order to "bust out" or raise the amount of available credit on otherwise-legitimate credit cards.

5.2.7.2. Stolen payment cards: Often, the first indication that a victim's wallet has been stolen is a phone call from a credit card issuer asking if the person has gone on a spending spree the simplest form of this theft involves stealing the card itself and charging a number of high-ticket items to it in the first few minutes or hours before it is reported as stolen.

5.2.7.3. Duplication or skimming of card information: This takes a number of forms, ranging from a dishonest merchant copying clients credit card numbers for later misuse (or a thief using carbon copies from old mechanical card imprint machines to steal the info) to the use of tampered credit or debit card readers to copy the magnetic stripe from a payment card while a hidden camera captures the numbers on the face of the card.

5.2.7.4. Impersonation and theft of identity: Theft of identity has become an increasing problem the scam operates by obtaining information about a victim, then using the information to apply for identity cards, accounts and credit in that person's name.

5.2.7.5. Fraudulent loan applications: These take a number of forms varying from individuals using false information to hide a credit history filled with financial problems and unpaid loans to corporations using accounting fraud to overstate profits in order to make a risky loan appear to be a sound investment for the bank.

5.2.7.6. Phishing and Internet fraud: Phishing operates by sending forged e-mail, impersonating an online bank, auction or payment site the e-mail directs the user to a forged web site which is designed to look like the login to the legitimate site but which claims that the user must update personal info.

5.2.7.7. Money laundering: The term "money laundering" dates back to the days of Al Capone Money laundering has since been used to describe any scheme by which the true origin of funds is hidden or concealed.

5.2.7.8. Forged currency notes: Paper currency is the usual mode of exchange of money at the personal level, though in business, cheques and drafts are also used considerably. Bank note has been defined in Section 489A. If forgery of currency notes could be done successfully then it could on one hand made the forger millionaire and the other hand destroy the economy of the nation.

6. Legal framework

The weakness of criminal law and criminal jurisprudence is bit large in the administration of justice in India. The common law pressure of the justice delivery system on account of 'proof beyond doubt' is very heavy especially in the offences relating to finance. The nation is suffering from a serious 'crisis of confidence'. No one can repose faith in others including entities and institutions. In such a situation, the banks and financial institutions can hardly grow. Such an atmosphere inflicts serious injury to the production and distribution system.

Though followers of Bentham were bent upon experimenting utilitarianism in the prescription of Indian legal system right from the days of first Law Commission headed by Lord Macaulay, the codification of Indian laws was systematically based upon the British Common law system.

Fraud simpliciter did not find its place in the definition of any offence in the IPC, 1860. Of course, following the Common law structure, some definitions and some offences were culled out from the realm of fraud.

A person is said to do a thing fraudulently, under this Act, if he does the thing with the intent to defraud but not otherwise¹⁰. Such a definition doesn't take us far except that intention is the key factor in acting fraudulently. Naturally, any act fraudulently done is not an offence. The fraud becomes offence when it becomes cheating. Whoever, by deceiving any person, fraudulently or dishonestly induces the person so deceived to deliver any property to any person, or to consent that any person shall retain any property or intentionally induces the person so deceived to do or omit to do anything which he would not do or omit if he was not so deceived, and which act or omission causes or likely to cause damage or harm to that person in body, mind, reputation or property, is said to "cheat"¹¹.

The other fraud-driven offences are cheating by impersonation¹², breach of trust by a clerk or servant¹³, breach of trust by a public servant, banker, merchant factor, broker, attorney or an agent¹⁴, forgery¹⁵, making of a false document¹⁶, forgery of valuable security, will, etc.¹⁷, forgery for purpose of cheating¹⁸, using as genuine a forged document¹⁹.

6.1 UMBRELLA ACTS: It covers a broad area of control. Under this Act includes these:

6.1.1. Reserve Bank of India Act, 1934 (Governs the Reserve Bank Functions): The RBI started functioning from April 1, 1935 under the RBI Act, 1934. It was a private shareholders' institution until January, 1949, after which it became a state-owned institution under the Reserve Bank (Transfer to Public Ownership) of India Act, 1948, and started central banking functions. The Preamble to the RBI Act states: Whereas it is expedient to constitute a Reserve Bank for India to regulate the issue of bank notes and the keeping of reserves with a view to securing monetary stability in India and generally to operate the currency and the credit system of the country to its advantage.

The objective of the RBI is to promote the development of financial infrastructure of markets and also to maintain stable payments system and monetary stability so that financial transactions can be safely and efficiently executed.

6.1.2. Banking Regulation Act, 1949 (Governs the Financial Sector): As per Section 5(c) of Banking Regulation Act, 1949 a "Banking Company" means any company which transacts the business of banking in India. As per Section 5(b) of Banking Regulation Act, 1949, banking means the accepting, for the purpose of lending or investment, of deposits of money from the public, repayable on demand or otherwise, and withdrawable by cheque, draft, and order or otherwise. As per Section 5(d) of Banking Regulation Act, 1949, company means any company as defined in Section 3 of the Companies Act, 1956 and includes a foreign company within the meaning of Section 591 of that Act. As per section 51 of Banking Regulation Act, 1949, certain provisions of the Banking Regulation Act are also applicable to the State Bank of India, any corresponding new bank, a regional rural bank and any subsidiary bank.

6.2. ACTS GOVERNING SPECIFIC FUNCTIONS: These functions are related to very specific in nature. These include:
6.2.1. Public Debt Act, 1944/Government Securities Act (Proposed) (Governs Government Debt Market): An Act to consolidate and amend the law relating to Government Securities and to the management by the Reserve Bank of India of the public debt of (the Government). Whereas it is expedient to consolidate and amend the law relating to

Government securities and to the management by the Reserve Bank of India of the public debt of (the Government).

6.2.2. Securities Contract (Regulation) Act, 1956 (Regulates Government Securities Market): An Act to prevent undesirable transactions in securities by regulating the business of dealing therein, by providing for certain other matters connected therewith.

6.2.3. Indian Coinage Act, 1906 (Governs Currency and Coins): An Act to consolidate and amend the law relating to Coinage and the Mint. The Government of India has the sole right to mint coins. The responsibility for coinage vests with the Government of India in terms of the Coinage Act, 1906 as amended from time to time. The designing and minting of coins in various denominations is also the responsibility of the Government of India. Coins are minted at the four India Government Mints at Mumbai, Alipore (Kolkata), Saifabad (Hyderabad), Cheralpally (Hyderabad) and Noida (UP).

6.2.4. Foreign Exchange Regulation Act, 1973/Foreign Exchange Management Act, 1999 (Governs Trade and Foreign Exchange Market): Foreign Exchange Regulation Act, 1973 an Act to consolidate and amend the law regulating certain payments, dealings in foreign exchange and securities, transactions indirectly affecting foreign exchange and the import and export of currency, for the conservation of the foreign exchange resources of the country and the proper utilisation thereof in the interests of the economic development of the country.

Foreign Exchange Management Act, 1999 an Act to consolidate and amend the law relating to foreign exchange with the objective of facilitating external trade and payments and for promoting the orderly development and maintenance of foreign exchange market in India.

6.3. ACTS GOVERNING BANKING OPERATIONS: These Acts is related to govern banking operations. Those include the following Acts:

6.3.1. Companies Act, 1956 (Governs Banks as Companies): An Act to consolidate and amend the law relating to companies and certain other associations. This is the basic law which governs the creation, continuation, the winding up of companies and also the relationships between the shareholders, the company, the public and the government. Coupled with other statutes dealing with corporate entities, this is an extremely important piece of legislation.

6.3.2. Banking Companies (Acquisition and Transfer of Undertakings) Act, 1970/1980 (Relates to Nationalization of Banks):

6.3.2.1. Banking Companies (Acquisition and Transfer of Undertakings) Act, 1970: An Act to provide for the acquisition and transfer of the undertakings of certain banking companies, having regard to their size, resources, coverage and organization, in order to control the heights of the economy and to meet progressively and serve better, the needs of development of the economy in conformity with national policy and objectives and for matter connected therewith or incidental thereto.

6.3.2.2. The Banking Companies (Acquisition and Transfer of Undertakings) Act, 1980: An Act to provide for the acquisition and transfer of the undertakings of certain banking companies, having regard to their size, resources, coverage and organization, in order further to control the heights of the economy, to meet progressively, and serve better, the needs of the development of the economy and to promote the welfare of the people, in conformity with the policy of the State towards securing the principles laid down in clauses (b) and (c) of article 39 of the Constitution and for matters connected therewith or incidental thereto.

6.3.3. Bankers' Books Evidence Act: The Bankers' Books Evidence Act, 1891 Act is an Act to amend the Law of Evidence with respect to Bankers' Books. Whereas it is expedient to amend the Law of Evidence with respect to Bankers' Books; It is hereby enacted as follows: (1) This Act may be called the Bankers' Books Evidence Act, 1891. (2) It extends to the whole of India [except the State of Jammu and Kashmir].

6.3.4. Banking Secrecy Act: Congress passed the Bank Secrecy Act (BSA) in 1970 as the first laws to fight money laundering in the United States. The BSA requires businesses to keep records and file reports that are determined to have a high degree of usefulness in criminal, tax, and regulatory matters. The documents filed by businesses under the BSA requirements are heavily used by law enforcement agencies, both domestic and international to identify, detect and deter money laundering whether it is in furtherance of a criminal enterprise, terrorism, tax evasion or other unlawful activity.

The Internal Revenue Service is a partner in the U.S. National Money Laundering Strategy. The IRS seeks to achieve a balance between enforcement of the money laundering laws and education. This page provides links to information about specific BSA requirements to assist with education and compliance with the law.

6.3.5. Negotiable Instruments Act, 1881: The Negotiable Instruments Act was passed in 1881. Some provisions of the Act have become redundant due to passage of time, change in methods of doing business and technology changes. However, the basic principles of the Act are still valid and the Act has stood test of time. The Act extends to the whole of India. There is no doubt that the Act is to regulate commercial transactions and was drafted to suit requirements of business conditions then prevailing.

6.4. ACTS GOVERNING INDIVIDUAL INSTITUTIONS: These types of Acts govern individual institutions. These Acts are following:

6.4.1. State Bank of India Act, 1954: An Act to constitute a State Bank for India, to transfer to it the undertaking of the Imperial Bank of India and to provide for other matters, connected therewith or incidental thereto.

6.4.2. The Industrial Development Bank (Transfer of Undertaking and Repeal) Act, 2003: An Act to provide for the transfer and vesting of the undertaking of the Industrial Development Bank of India to, and in, the Company to be formed and registered as a Company under the Companies Act, 1956 to carry on banking business and for matters connected therewith or incidental thereto and also to repeal the IDBI Bank Limited Act, 1964.

6.4.3. The Industrial Finance Corporation (Transfer of Undertaking and Repeal) Act, 1993: An Act to provide for the transfer and vesting of the under- taking of the Industrial Finance Corporation of India to and in the Company to be formed and registered as a Company under the Companies Act, 1956, and for matters connected therewith or incidental thereto and also to repeal the Industrial Finance Corporation Act, 1948.

6.4.4. National Bank for Agriculture and Rural Development Act: An Act to establish a bank to be known as the National Bank for Agriculture and Rural Development for providing credit for the promotion of agriculture, small-scale industries, cottage and village industries, handicrafts and other rural crafts and other allied economic activities in rural areas with a view to promoting integrated rural development and securing prosperity of rural areas, and for matters connected therewith or incidental thereto.

6.4.5. National Housing Bank Act: The Preamble of the National Housing Bank Act, 1987 describes the basic functions

of the National Housing Bank (NHB) as "to operate as a principal agency to promote housing finance institutions both at local and regional levels and to provide financial and other support to such institutions and for matters connected therewith or incidental thereto" NHB ensures a sound and healthy housing finance system in India through effective regulation and supervision of housing finance institutions.

6.4.6. Deposit Insurance and Credit Guarantee Corporation Act: The Deposit Insurance and Credit Guarantee Corporation Act, 1961 to provide for the establishment of a corporation for the purpose of insurance of deposits (and guaranteeing of credit facilities) and for other matters connected therewith or incidental thereto.

7. Conclusions

Over the last few years there have been an alarming increase in the number of disruptions in the Indian Banks due to insufficient governance. The fraud reiterates the fact that banking functions now have broader ramifications and a failure of the banking system can, in turn, de-stabilize the entirety of the financial system. It makes a strong case to regulate the whole gamut of banking transactions rather than only banks as deposit taking institutions.

At present, when the banking frauds are posing a big threat to India, all the stakeholders must come together to fight the menace of these crimes and contraventions. In India a number of laws related to prevent banking frauds are mainly regulated by RBI but problem is that there is no proper implementation of those laws. The banks must spread public awareness in this regard amongst the public so that banking frauds can be prevented. However, preventing banking frauds is not the sole problem of banks alone. It is a big threat and it requires a coordinated and cooperative action on the part of the banks, customers and the law enforcement machinery.

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10. Section 25 of the Indian Penal Code, 1860.
11. Section 415 of the Indian Penal Code, 1860.
12. Section 416 of the Indian Penal Code, 1860.
13. Section 408 of the Indian Penal Code, 1860.
14. Section 409 of the Indian Penal Code states, "Whoever, being in any manner entrusted with the property, or with any domination over property in his capacity of a public servant or in the way of his business as a banker, merchant, factor, broker, attorney or agent commits criminal breach of trust in respect of that property, shall be punished with imprisonment for life or with imprisonment of either description for a term which may extend to ten years and shall also be liable to fine".
15. Section 463 of the Indian Penal Code, 1860 which stipulates as follows, "whosoever makes any false document or false electronic record or a part of a document or electronic record with intent to cause damage or injury, to the public or to any person, or to support any claim or title, or cause any person to part with the property, or to enter into any express or implied contract, with the or intent to commit fraud or that fraud may be committed, commits forgery".
16. Section 464 of the Indian Penal Code, 1860.
17. Section 467 of the Indian Penal Code, 1860.
18. Section 468 of the Indian Penal Code, 1860.
19. Section 474 of the Indian Penal Code, 1860.

A comparison of the methods for the recording of lip prints

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Abstract

This is a comparative study on the different methods of recording lip prints. Six methods have been compared. Out of these, previous workers have used four methods. These are photography, lipstick-paper method, lipstick-paper-cardboard method and lipstick-cellophane method. Two methods using dental impression materials to make three-dimensional casts of the lips have been used in this study for the first time. Parameters such as print contrast, level of technical skill required and time taken have been considered. The best was found to be the lipstick-cellophane method as it gave prints of good clarity, was not time-consuming, was simple and inexpensive.

Key words

Cheiloscopy, Lip prints, lipstick-paper method, lipstick-paper-cardboard method, lipstick-cellophane method.

Introduction

Cheiloscopy, the study of lip prints is an upcoming tool for the identification of an individual. The grooves are present on the red part, or the vermilion border of the lips¹. These grooves are also known as sulci labiorum rubrum².

Yasuo Tsuchihashi in 1974 published a study on the lip print patterns of Japanese people. The lip prints were classified into six types, according to the shape and course of grooves.³
Type I: Clear-cut grooves running vertically across the lip
Type I': The grooves are straight but disappear halfway instead of covering the entire breadth of the lip.

Type II: The grooves fork in their course

Type III: The grooves intersect

Type IV: The grooves are reticular

Type V: The grooves do not fall into any of the types I to IV and cannot be differentiated morphologically.

Much work has been done on cheiloscopy in other countries such as Poland and the United States of America, to the extent that lip prints were accepted as a method to prove identity in courts of law^{4,5,6}.

Studies on Indian subjects, however, has only recently gone under way and much work still remains to be done before Indian courts accept cheiloscopy evidence. One aspect that needs to be developed is to discover a quick, simple yet reliable technique to record lip prints. Over the years various workers have used a variety of methods to record the prints. This study undertook the task of comparing some of these methods as well as attempting to discover better procedures, which would enhance print visibility.

Tsuchihashi Y in 1974 took photographs of the lips in order to record the prints. He took half-size photographs with a Medical Camera and enlarged to double size, thus obtaining life-size images³.

Vahanwalla and Parekh in 2000 in their study applied lipstick on the lips then took the print on a paper. The centre portion of the lips was dabbed first and then pressed uniformly to the right and left corners⁷.

Manipady in 2002 used a slight modification of the previous method, where the paper used to take the prints was well supported by cardboard⁸.

Sivapathasundharam, Prakash and Sivakumar in 2001 also used lipstick, but the print was taken on a strip of cellophane tape glued on one side. This was then stuck on white paper to serve as a permanent record of the print⁹.

Materials and methods

Method I: Photography

Materials

1. Digital photographic camera
2. Tissue paper

Procedure

The subject was given tissue paper to dry the lips to obtain a clear image. The subject was asked to open the mouth slightly and a close-up photograph was taken of the lips. A colour print of the image was obtained.

Method II: Lipstick and paper

Materials

1. Lipstick of a bright red colour and non-glossy
2. White bond paper

Procedure

Lipstick was applied on the lips and the subject was asked to rub the upper and lower lips together to spread the lipstick evenly. The subject was asked to open the mouth slightly. A strip of paper was cut and pressed on to the lips starting from the centre and moving towards the left then the right corners.

Method III: Lipstick and cardboard supported with paper

Materials

1. Lipstick
2. White bond paper
3. Cardboard
4. Glue

Procedure

Strips of paper were cut and stuck on to cardboard. The steps of the previous method were repeated using the supported paper.

Method IV: Lipstick and cellophane tape

Materials

1. Lipstick
2. White bond paper
3. Cellophane tape glued on one side

Procedure

Lipstick was applied on the lips and the subject was asked to rub the upper and lower lips together to spread the lipstick evenly. The subject was asked to open the mouth slightly. A strip of cellophane tape was cut and applied on to the lower lip with gentle pressure for a few seconds. Then the tape was lifted from one end to the other and stuck on to a piece of paper. The above steps were repeated for the upper lip.

Method V: Alginate (irreversible hydrocolloid) cast

Materials

1. Irreversible hydrocolloid impression material (alginate)
2. Dental stone – type III and IV (high strength)
3. Dental plaster
4. Self cure acrylic with monomer
5. Modelling wax
6. Petroleum jelly
7. Rubber bowl
8. Mixing spatula
9. Measuring scoop
10. Diamond trimmer
11. Carbide bur
12. Water indelible ink
13. Water
14. Resin tray

Procedure

The subject was asked to clean and dry the lips and petroleum jelly was applied. The alginate was mixed with water in a ratio of 40 ml : 15 g in a rubber bowl. It was loaded into the resin tray and placed over the lips. After 2 minutes the impression was gently removed. Dental stone was mixed and poured into the impression and left to set for 30 minutes. The cast was separated from the impression and the grooves were examined.

METHOD VI: Elastomeric impression material cast

Materials: same as for the previous method except for:

1. Elastomeric impression material (polyvinyl siloxane with putty)
2. Applicating gun

Procedure

The subject was asked to clean and dry the lips and petroleum jelly was applied. The light body elastomeric impression material was applied on to the lips with an applicating gun. Simultaneously, an assistant mixed the putty, kneading it with bare fingers. The resin tray was loaded with putty and placed over the light body material, taking care not to apply any undue pressure. After 5-7 minutes the impression was removed and dental stone was poured into it (similar to the previous method). After the setting of the cast, it was separated and the grooves were examined.

Results

Table: Comparing the six methods

Method	Clarity	Technical difficulty	Time
I	CC	DDD	TT
II	CC	DD	TTT
III	CCC	DD	TTT
IV	CCC	DDD	TTT
V	CC	D	T
VI	CCC	D	T

1. Clarity of the lip print was measured as: Poor (C)
Acceptable (C C)
Good (C C C)
2. The level of technical difficulty: Special training and skill needed (D)
3-4 attempts to obtain acceptable lip print (D D)
1 – 2 attempts to obtain acceptable lip print (D D D)
3. Time taken per lip print: More than one hour (T)
Less than one hour, more than five minutes (T T)
Less than five minutes (T T T)

Conclusion

Considering the various parameters, digital photography (method I) appears to be a good method especially where cooperation by the subject may not be adequate. The visibility of the print is not quite as good, however as the other methods. Another drawback is the question of whether such evidence would be admissible in a court of law.

Both the dental impression materials (methods V and VI) gave excellent quality three-dimensional casts of the lips. The level of technical skill required, however, is too high for either to be used as a universal method. The time consumed and cost factors are also major drawbacks.

Among the lipstick methods, the ones that used paper to directly record the prints (methods II and III) were found to be liable to frequent smudging of the print.

The lipstick-cellophane method (method IV) combined the advantages of being simple and quick and of providing lip prints with good visibility and clarity. The cost was also minimal as the materials used were inexpensive and the lip prints could be stored easily for prolonged periods without damage. Therefore it is the lipstick-cellophane method that is recommended as the method of choice, especially when recording a large number of lip prints.

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Medicolegal significance of maduramycin poisoning

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Abstract

From Forensic toxicological perspective, maduramycin an ionophore which is normally used in cattle fed poultry litter as an anticoccidial agent, could be placed in the category of an ideal homicidal agent. Human fatality due to maduramycin toxicity is a rare phenomenon. Here we present a case report where a group of youth consumed maduramycin in the form of sweet (halwa) in the night of Shivratri in an inebriated state, confusing maduramycin with that of suji-an important ingredient in the preparation of sweet (halwa). Toxicity was so severe that 4 out of 7 youths who consumed, succumbed even on timely treatment. The clinical features were that of rhabdomyolysis and polyneuropathy. Autopsy of 2 cases were conducted in the department of forensic medicine, PGIMER, Chandigarh which showed generalised internal congestion, myositis and multiple petechial haemorrhages in brain, lungs and heart.

Keywords

Maduramycin, ionophore, homicidal agents, myositis, anticoccidial agent

Introduction

Crime detection agencies all over the globe are in constant search of methods which can potentially disguise the fatality to be that of natural/accidental. Since time immemorial, various toxicological agents have been used as homicidal agents utilizing their physical and chemical properties by which they pass through various detective tests. Some of the potential homicidal agents have been documented in literature with Thallium and Sodium fluoroacetate being the ideal one¹. The agent under consideration over here is maduramycin, an ionophor derived from the fungus *Actinomadura rubra* which is commonly used as anticoccidial agent in poultry feed². They are not used therapeutically in humans. Maduramycin acts by affecting cation transport across the cell membrane. They abolish the gradients of Ca^{2++} , Mg^{2++} , K^+ , and Na^+ causing cell death³. They are highly toxic for mammals and birds due to its good oral absorption. Clinicopathological effects of ionophore poisoning are the result of its effect on excitable tissues such as cardiac muscle, skeletal muscle, smooth muscle, and the nervous system⁴.

Case report

A group of seven young males working in a poultry farm had cannabis on the shivratri night and there after decided to prepare a sweetdish (halwa). They started the preparation by mixing the ingredients such as suji etc. Owing to insufficient

quantity of suji, one of them went inside the dark room and brought maduramycin powder instead of suji. Victims alleged that they did not realize accidental mixing even while consumption. This was followed by gastric discomfort and vomiting in early morning for which they were hospitalized in civil hospital. Four were discharged on the next day and one died after four days. Remaining two were then referred to higher centre in Patiala, out of which one died on fifth day. Remaining one and four others discharged previously were referred to PGIMER, Chandigarh on sixth day. Out of these five, two died. These being medicolegal cases, the postmortem were conducted by the department of Forensic Medicine, PGIMER.

Clinical details

The main presenting complaint in all these cases was excessive sweating over face, muscular pain and weakness along with signs of musculoneuropathy. Investigation showed myoglobulinuria, elevated creatinine phosphokinase MM levels, mild metabolic acidosis, hyperkalemia, hypocalcemia and thus diagnosed as rhabdomyolysis leading to acute renal failure.

Biochemical profile

	CASE 1	CASE 2
Serum pottasium	6.2 mmol/l	6.2 mmol/l
Serum calcium	2 mmol/l	1.8 mmol/l
Creatininephos-phokinase(MM)	92200 U/L	163250 U/L
Blood urea	24.9 mmol/l	12.5 mmol/l
Serum creatinine	150 micromol/l	100 micromol/l
Blood Ph	7.25	7.24
Serum bicarbonates	16 mmol/l	20 mmol/l

Autopsy findings

Grossly, the findings were congestion of all internal organs, myositis in both lower limbs, petechial hemorrhages were present in the brain parenchyma, over surface of both lungs, over pericardium and ventricular surface of heart. One of the case showed collapsed left lung. Stomach contained yellowish thick paste like material with sweetish odour, walls were highly congested with hemorrhagic spots at places. Viscera was sent for chemical examination along with sample of maduramycin to confirm this poison.

Discussion

The prime candidate for the most effective weapon in homicidal poisoning is the chemical with greatest lethality, no

specific antidote, which mimics natural disease and has least likelihood of detection. It should be easily accessible and easily administered along with food and beverages without raising any suspicion. In this category, thallium and sodium fluoroacetate (compound 1080) have been documented in various literatures¹. Our case study on maduramycin toxicity is probably the first of its kind where an anticoccidial agent routinely used in poultry farms had such a lethal effect when ingested accidentally by humans. Maduramycin toxicity has been reported in mammals such as horses, rabbits, turkeys, guinea fowl, Japanese quail, calves⁵⁻⁸. Maduramycin, an ionophor satisfies all the desired features by which it can be placed in the category of ideal homicidal poison. It can be detected by liquid chromatography with atomic absorption spectrometry⁹ which is not readily available in most of the forensic science laboratories.

Conclusion

Criminal mind is always on a look out for duping the legal authorities. Maduramycin poisoning is one of those perfect examples which can easily evade the eyes of investigation. One can imagine the lethal toxicity of maduramycin that despite being given the best possible treatment, death occurred in four out of seven cases. Testing these agents without having prior knowledge of its intake even in well equipped laboratory is somewhat difficult. These unsuspected cases of poisoning usually go unnoticed even in forensic toxicology labs. Homicidal poisoning using this kind of agent has to be kept in mind by the forensic community while dealing with such cases, where only nonspecific clinical as well as autopsy features are noticed.

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Extensive and unusual distribution of atherosclerosis

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Abstract

Although atherosclerosis is unevenly distributed, abdominal aorta is more extensively involved than thoracic aorta. However, in hypertensive patients, lesion of the carotid, cerebral, and basilar arteries are more common. We report a case of extensive and unusual distribution of atherosclerosis in 60-years male with history of hypertension since five years. In this the atherosclerosis with calcification was present in the complete aorta and its branches, coronary, carotids, vertebral, basilar and cerebral arteries. Even the smaller branches of the circle of Willis were calcified and beaded in appearance due to the atherosclerosis. But the extensive and advanced lesions were more common in the thoracic aorta near arch rather than the abdominal aorta. The fatty streak was present in almost all other vessels including renal, splenic, femoral and axillary's arteries. Such an extensive and unusual distribution of atherosclerosis in an individual case is rare and not reported previously.

Keywords

Atherosclerosis; extent; severity; unusual distribution.

Introduction

Atherosclerosis is a progressive pathologic condition that is unevenly distributed geographically as well as anatomically. Epidemiological studies have linked the incidence of atherosclerosis with high serum cholesterol levels and in turn to life style, particularly dietary habits in most person. Other risk factors include hypertension, cigarette smoking, diabetes, and sedentary life style. Although atherosclerosis is unevenly distributed, the abdominal aorta and iliacs is the commonest site of involvement. The abdominal aorta is much more involved than thoracic aorta and the lesions tend to be much more prominent around the ostia of its major branches¹. In the characteristic distribution of atherosclerotic plaques in humans the abdominal aorta is usually much more involved

than the thoracic aorta. In descending order after the lower abdominal aorta, the most heavily involved vessels are the coronaries arteries, the popliteal arteries, the internal carotid arteries, and the vessels of the circle of Willis². In the present case we report a case in which there was unusual distribution of atherosclerosis.

Case report

60-years male was brought death in the casualty with severe chest pain. As per the investigating authority, the deceased was a known case of hypertension since 5 yrs and was on conservative treatment. The deceased was operated for hernia two month back. He was a smoker for about 35 years. The body was sent to mortuary for medicolegal autopsy.

On autopsy, externally the body was well built with scar of operation in right inguinal region. Internally, heart weighs 600 gms with fatty deposition. Left coronary was completely obliterated by atherosclerosis one cm away from its origin. Right coronary was obliterated to the extent of 40% of its lumen. Complete aorta with its branches at arch and iliacs were thickened and showed multiple atheromatous plaques. [Fig 1]. But the calcified and ulcerated plaques were more common in the thoracic aorta, especially near arch as compared to abdominal aorta. [Fig 2]. Only the fatty streaks were present in the renal, splenic and mesenteric arteries. The visceral organs were congested. Brain was congested and oedematous. Cerebral arteries were thickened and had calcified plaques. The small vessels of the circle of Willis were tortuous and calcified in the form of beaded fashion. The carotids, vertebral, and basilar arteries showed calcified plaques [Fig 3]. Vessels of upper and lower extremities were devoid of any atheromatous plaques but the femoral, axillary and popliteal arteries showed fatty streaks. On histopathological examination, all other blood vessels where there were no obvious gross pathological findings showed evidence of fatty streaks with proliferation of smooth muscle cells in the tunica media, suggestive of hypertension. The kidneys showed feature of benign nephrosclerosis.

Fig. 1: Complete aorta and its branches at arch and iliacs showing multiple atheromatous plaques.

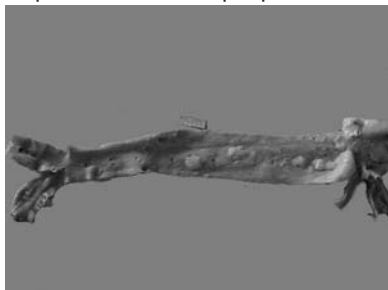


Fig. 2: Arch of aorta showing more advanced lesion of atherosclerosis: calcified and ulcerated plaques.

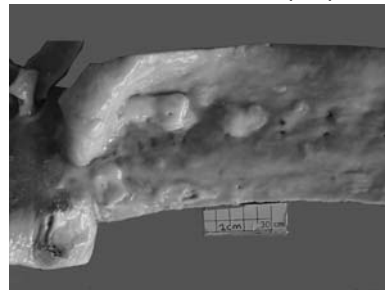
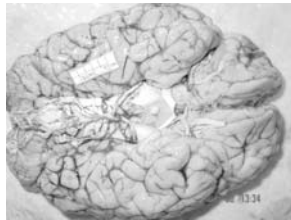


Fig. 3: Base of brain showing calcified atherosclerotic lesion in carotids, vertebral, basilar arteries and circle of Willis.



Discussion

Atherosclerosis, the principal cause of death in western civilization is a progressive disease process that generally begins in childhood and has clinical manifestations in the middle to late adulthood. Despite the fact that the term "atherosclerosis" is derived from the Greek "arthero" (gruel or porridge) and "sclerosis" (hardening), it is important to note that there may be great variability in the relative amounts of the tissue formed by each of these processes in the lesions. The intima is the site at which the lesions of atherosclerosis form. Wolinsky and Glagov have observed that the abdominal aorta in humans lacks vasa vasorum in its outermost aspects and have suggested that this may be one of the reasons the abdominal aorta is particularly vulnerable to atherogenesis.³ Atherosclerosis appears in the aorta in the 3rd decade before the coronary arteries, and much later in the vertebral and intracranial cerebral arteries. Reason for the difference in susceptibility of various segment of the arterial tree and the non-uniform distribution of lesion are not known⁴.

The exact cause of atherosclerosis is not known. Very little is known of the mechanisms which influence where and when plaques develop. Detailed postmortem studies at different ages indicate that atheromatous lesions progress from small and inconsequential fatty streaks to large and complicated lesions. Careful studies of postmortem material have shown that these lesions often occur close to arterial bifurcations, sites at which turbulent blood flow normally occurs⁵. The atherosclerotic lesions tend to be particularly severe in the area of vascular stress, such as the points of bifurcation or around the orifice of a branch¹. It has been suggested that the severity of lesion formation in a given artery may be related in part to the particular nature of the characteristics of the blood flow in the artery, and that rheological forces play a major role in determining the localisation, extent, and severity of lesions in susceptible individuals⁴.

The basic lesions of atherosclerosis are fatty streaks in the intima and fibro-fatty plaques. Yellow fatty streaks are common postmortem findings in the intima of the aorta and large elastic arteries at all ages from infancy onwards. Of the medium sized vessels, the coronary and cerebral vessels are the commonly involved. The atherosclerotic plaques are characteristically seen in the aorta. The thoracic aorta is less severely affected than the abdominal aorta, where advanced lesions are particularly common below the origin of the renal arteries¹. The abdominal aorta is involved earliest and most severely by atherosclerotic lesion,⁴ though smaller lesions may be seen in descending thoracic aorta and aortic arch. The major branches of the aorta around ostia are often severely involved, especially the iliac, femoral, carotid, coronary, and cerebral arteries⁶. The aortic arch tends to be spared, except when the patient has underlying syphilitic aortitis². But in the present case, the thoracic aorta is more severely affected than the abdominal aorta and the advanced lesions were more common in the thoracic aorta, near arch of aorta and its bifurcation. Moreover in terms of severity and extent of atherosclerotic lesion, after aorta and its main branches, it was

found in coronaries, vessels of circle of Willis, carotids, and basilar and vertebral arteries.

In the coronaries arteries, raised lesions are most prominent in the main stems, just a short distance beyond the ostia. In the cervical and cerebral arteries, it first appears in the base of brain in the carotid, basilar and vertebral arteries⁴. The vessels of the circle of the Willis were least involved due to atherosclerosis, but in hypertensive patient, lesion of the carotid, cerebral, and basilar arteries are more common³. In the present case, left coronary was completely obliterated at its main trunk and right coronary also showed partial obliteration due to atherosclerosis. The carotid, basilar, vertebral and cerebral arteries were thick cord like with calcification of the fibrous plaques. The smaller branches of circle of Willis were calcified and beaded in appearance.

As similar to the present case, more atherosclerosis is noticed in the lower than in the upper limbs. In the lower limbs, the severity decreases peripherally and is particularly common in the femoral and popliteal artery⁴. Vessels of the upper extremities, mesenteric and renal arteries are usually spared, except at their ostia². Such distribution of atherosclerosis was also seen in present case; and fatty streaks were found in almost all the vessels where fibrous plaques were not present including renal, splenic, mesenteric, axillary, femoral and popliteal artery.

Thus in the present case, atherosclerotic lesion was present in almost all the arteries ranging from big to small sized arteries i.e. from aorta and its branches to coronary, carotids, vertebral, basilar, cerebral arteries, and circle of Willis. But an extensive and advanced lesion of atherosclerosis was present in the thoracic aorta near arch of aorta in contrast to abdominal aorta. The fatty streak was present in almost all other vessels including renal, splenic, femoral and axillary's arteries. Such an extensive and unusual distribution of atherosclerosis in an individual case is not reported previously.

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Evaluation of non-metric traits of supraorbital region in sexual dimorphism: A study in 60 adult human skulls

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Sex determination is one of the essential prerequisites for identification of an individual. The skull is probably the second best area of the skeleton for determining sex following pelvis. Diverse techniques for sexing crania are based either on visually determinable descriptive features of the cranium or on exact measurements of various parts of cranium and their ratios. Inferring from observations based on morphological indicators depends largely upon the experience of the observer. In the present study, skulls of 60 individuals of known sex (30 of either) of Indian Punjab region were studied. A series of three non metric traits of supraorbital region (glabella development, superciliary ridge development, zygomatic trigone development) were taken for the study and their significance in sex determination was established. The statistical method used in the present study is Logit and Probit regression methods. After applying this method 91.5% of the skulls were correctly classified.

Key words

Sex, non metric, supraorbital,

Sex is usually one of the easiest determinations from skeletal material and one of the most reliable if essential parts of skeleton are present and in good condition. Most of criteria for determining sex pertain to the pelvis and the skull¹. Forensic Anthropologists have at their command a variety of indicators of sex to aid them in their identification efforts, albeit with rare exceptions they are applicable to the post – adolescent period only. An overlap in the distribution of the two sexes is always present so only the extremes of shape are reliable indicators of sex. One can never feel 100% sure that a small fraction of the skeletons of unknowns is correctly sexed, no matter how many skeletal characters are taken into consideration². Recognizable sex differences do not appear until after puberty (15 and 20 years)³. Skull is probably the second best area of the skeleton for determining the sex following the pelvis.

As the child moves from puberty into adulthood, the resulting differences are most noticeable in the orbital borders, supraorbital ridges, mastoid processes, occipital crest (especially its medial protuberance), malar bones and chin. Anyone who works with skulls develops an eye for these details and soon becomes able to make a tentative attribution of sex on this basis alone². A long standing argument also centers on whether morphological (i.e. visual or morphoscopic) or morphometric traits are more subjective and depends on the experience of the investigator. Despite the proliferation of osteometric techniques for the assessment of both race and sex, morphologically based approaches should be considered the method of choice⁴.

In sexing a skull the impression often is the deciding factor: a large skull is generally male, a small skull female. The supraorbital ridges are almost invariably, much more strongly developed in males than in females. Glabella is large in males and small in females⁵. Larnach and Freedman⁸ described in

their study on aboriginal crania from Coastal New South Wales that the zygomatic trigone of frontal bone and malar tuberosity were among the seven characters which showed maximum contrast between the sexes.

Visual indicators of sex are traditionally scored on an ordinal categorical scale. Logistic and Probit regression models are commonly used statistical tools for the analysis of ordinal categorical data⁶.

Material and methods

60 dry skulls of adult individuals of Punjabi origin were used as a material for the present study. Out of these 60 skulls, 30 skulls were of females and 30 skulls were of males. The material was procured from the Departments of Anatomy and Forensic Medicine of Govt. Medical College, Patiala.

Inclusion Criteria

- The skulls of known sex were considered for the study.
- The study was done on skulls in which supraorbital region was intact.
- The study was done on skulls in which spheno-occipital junction was synostosed.

Exclusion Criteria

- The skulls with physical damage or loss of part (s), apparent deformity, defect or disease were excluded.
- The juvenile skulls, in which spheno-occipital junction was not synostosed and senile skulls, in which skull was edentulous with wasted alveolar processes were also excluded.

A series of 3 non metric traits of supraorbital region were studied

(Photograph 1). These were selected from the system of sexing and population affinity system proposed by Larnach and Freedman⁷ and Larnach and Macintosh⁸. According to these methods traits were studied by comparing them with standardized casts and sketches prepared by Australian National University and were classified as small, medium or large.

1. Glabella development

Glabella development was classified into grades by inspection and by overlapping the glabella of the skull with the diagrammatic sketches of the glabella given by Martin⁹ (1928) (Fig.1).

GRADES	1	2	3
Glabella development	< Martin 4	Martin 4	> Martin 4

2. Superciliary ridge development

Superciliary ridge development was studied by inspection and by comparing each skull with the standardized castes of these traits (Photograph 2).

GRADES	1	2	3
Superciliary ridge development	Small	Medium	Large

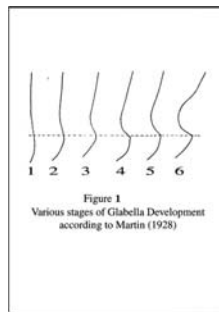
Table 1:

Glabella development	Sex	Male	Female
	Grade 1 <Martin 4	83.33%	90%
	Grade 2 Martin 4	3.33%	6.67%
	Grade 3 >Martin 4	13.33%	3.33%

Table 2:

Superciliary ridge development	Sex	Male	Female
	Large	66.67%	3.33%
	Medium	30%	16.67%
	Small	3.33%	80%

Fig. 1:



3. Zygomatic trigone development

Also known as trigonum supraorbitale. It is defined as the part included between the outer part of the margo supraorbitalis (supraorbital margin) and the anterior prominent part of temporal ridge. It varies in development from a triangular depressed field to an extremely prominent bulbous projection. Zygomatic trigone development was studied by inspection and palpation and by comparing each skull with the standardized castes of these traits (Photograph 3).

GRADES	1	2	3
Zygomatic trigone development	Slight	Medium	Large

Statistical Analysis

The non metric traits were recorded and were then subjected to the following statistical computations:

1. Logistic regression method
2. Probit regression method

Observations

Non Metric Traits

Three non metric traits were studied and following observations were made:

1. Glabella Development

Table 4: Variables in Equation

	B	S.E.	Wald	df	Sig.	Exp (B)
Zygomatic trigone development	-2.943	1.156	6.484	1	0.011	0.053
Glabella development	-0.935	0.972	0.924	1	0.336	0.393
Superciliary ridge development	-3.007	0.842	12.741	1	0.000	0.049
Constant	13.381	4.116	10.569	1	0.001	647467.904

Table 3:

Zygomatic trigone development	Sex	Male	Female
	Large	63.33%	6.67%
	Medium	36.67%	53.33%
	Small	0%	40%

Photograph 1:



2. Superciliary Ridge Development
3. Zygomatic Trigone Development

Statistical analysis of non metric traits of the supraorbital region by logistic regression method

Statistical analysis of non metric traits of the supraorbital region by probit regression method

After applying Probit Model to the non metric readings of the supraorbital region, following results were obtained:

Discussion

In the present study, all non metric traits when put together have been found to be quite reliable in the determination of sex from the skulls. But these findings are in contradiction to the findings of Carpenter¹⁰ who had concluded in his study that non metric variables are non significant in sex and race discrimination and should be used to supplement other osteological measurements and observations. The differences in result could be due to usage of different variables in two studies. Celbis et al¹¹ had affirmed in his study that morphological assessment is less complex than metric analysis and is the initial preference when a skeleton is presented to an anthropologist. Gualdi Russo et al¹² had stated in his study that non metric traits are fundamental when a study of ancient populations is conducted on fragmentary or poorly preserved material. The results of present study for the non metric traits have been compared with other authors and discussed under the following headings.

Table 5: Classification Table

Observed		Predicted		
		0 Male	1 Female	% age correct
Sex	Male	27	3	90
	Female	2	27	93.1
Overall % age				91.5

1. Glabella Development

The glabellar region above the nasion seems to be an ideal place for investigation since it is morphologically diverse and it is also well preserved in both forensic and archaeological remains. Therefore, the glabellar variation is relatively easy to assess, especially when observation is accompanied by a set of prototype images of the region.

Larnach & Macintosh in their consecutive studies in 1966 and in 1970 had shown striking differences in two sexes in the prominence of glabella. In the present study, glabella development has not been found to be significant in sex differentiation and both males and females have less development of glabella in Punjabi skulls, whereas in Australian Aboriginals glabella is more developed.

Celbis et al¹¹, Funayama et al¹⁴, Schiwy – Bochat¹⁵ and Graw et al¹⁶ had concluded in their studies that there is a potential for sexual dimorphism in the supranasal (glabellar) region, but in the present study, glabella development when taken alone has not been found to be reliable in sex determination in this geographical region.

2. Superciliary Ridge Development

Keen¹⁷ has stated that supraorbital ridges are so important in sexual differentiation that they must be included in any list

Table 7: Classification Table

		Predicted			%age correct
		Sex			
Actual		0 Male	1 Female	Total	
Sex	Male	27	3	30	90.0
	Female	2	28	30	93.3
Total		29	31	60	91.67

Thus, 91.67% of the skulls were correctly classified by using the above method.

of identifying characteristics. He had found out considerable sex differences in the supraorbital ridges in African Negroes.

Larnach and Macintosh in their consecutive studies in 1966 and in 1970 had shown striking differences in two sexes in the prominence of superciliary ridges. In the present study also, superciliary ridge development has been found out to be highly significant in differentiating between male and female skulls.

From the above table, it can be stated that both the skulls of Punjabi males and females have been found to be closer to the skulls of Queensland series (Australian aboriginals).

Inoue et al¹⁸, Krogman⁵ and Graw¹⁶ had concluded in their studies that supraorbital ridges are almost invariably much more developed in males than in females. The present study is in agreement with their studies.

Various authors have stated the following sex differences in the superciliary ridges or supraorbital ridges:

Thus, it is clear from all the above studies that superciliary ridge development is very important in sexual diagnosis from skulls.

Table 6:

Variable	Coefficient	Standard Error	b/St.Er.	P[Z > z]	Mean of X
Constant	7.667038090	2.2286622	3.440	0.0006	-
Zygomatic trigone development	-1.663674150	0.60549541	-2.748	0.0060	-14.533333
Glabella development	-0.5398570623	0.56993474	-0.947	0.3435	1.2166667
Superciliary ridge development	-1.721794897	-0.44138668	-3.901	0.0001	1.9333333

Table 8:

Author	Population studied	Glabella Development (Present study compared to earlier reported data)					
		Male			Female		
		Grade 1	Grade 2	Grade 3	Grade 1	Grade 2	Grade 3
Larnach and Macintosh ⁸	Coastal New South Wales Series	23%	32.3%	44.7%	88.2%	11.8%	0%
Larnach and Macintosh ¹³	Queensland Series	22%	51.5%	26.5%	72.4%	27.6%	0%
Present study	Punjabi skulls	83.33%	3.33%	13.33%	90%	6.67%	3.33%

Table 10:

Author	Population studied	Superciliary Ridge Development (Present study compared to earlier reported data)					
		Male			Female		
		Large	Medium	Small	Large	Medium	Small
Keen ¹⁷	Cape colored population (African Agro)	24%	64%	24%	0%	58%	42%
Larnach and Macintosh ⁸	Coastal New South Wales Series	44.6%	40%	15.4%	1.9%	7.7%	90.4%
Larnach and Macintosh ¹³	Queensland Series	47.8%	33.3%	18.9%	0%	10.6%	89.4%
Present study	Punjabi skulls	66.67%	30%	3.33%	3.33%	16.67%	80%

Table 11:

Authors	Year	Male	Female
Camps ³	1976	Large	Small
Kerley ¹	1977	Brow ridges large	Small
Krogman ⁵	1978	Supraorbital ridges are more strongly developed. Heavy supraorbital ridges	Trace or slight supraorbital ridges
Inoue ¹⁸	1990	More developed	Less developed
Bass ¹⁹	1995	Supraorbital ridges are more prominent	Less prominent
Hsiao et al ²⁰	1996	More prominent	Less prominent
Roberts ²¹	1997	Supraorbital ridges prominent	Less prominent
Briggs ²²	1998	Supraorbital ridges are better defined	Small to medium
Present study		Superciliary ridge development is large	Superciliary ridge development is small

Table 12:

Author	Population studied	Zygomatic trigone Development (Present study compared to earlier reported data)					
		Male			Female		
		Medium	Slight	Large	Medium	Slight	Large
Larnach and Macintosh ¹¹	Coastal New South Wales Series	62.5%	26.6%	10.9%	3.8%	25%	71.2%
Larnach and Macintosh ¹⁵	Queensland Series	40.6%	43.5%	15.9%	6.4%	40.4%	53.2%
Present study	Punjabi skulls	63.33%	36.67%	0%	6.67%	53.33%	40%

3. Zygomatic Trigone Development

Larnach and Macintosh concluded from their successive studies in 1966 and in 1970 that zygomatic trigone development was medium to large in males whereas females show slight to medium development in Australian aboriginal crania.

In the present study also, zygomatic trigone development was medium to large in male skulls whereas female skulls show slight to medium development. Thus, zygomatic trigone development is also significant in sexual dimorphism.

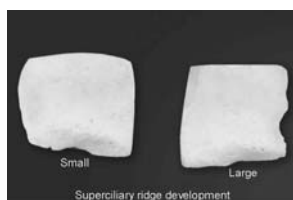
From the above table, it can be seen that skulls of Punjabi males are closer to the male skulls of Coastal New South Wales series whereas skulls of Punjabi females are closer to female skulls of Queensland series. It can also be concluded that zygomatic trigone development is more in skulls of Punjabi individuals as compared to skulls of Australian aboriginals. However it is pertinent to state here that no casts of this region were available for the above non metric traits and observations were done using Australian standards.

Logistic and Probit regression method results

In the present study, Logistic and Probit regression methods were applied to the non metric traits of the supraorbital region (glabella development, superciliary ridge development and zygomatic trigone development) and 91.5% of the skulls were correctly classified.

The results of non metric traits can be compared with the study of Konigsberg and Hens⁶. They used 5 sex indicators in their study out of which one was superciliary arch form which has also been used in the present study and found out that

Photograph 2:



81% of the skulls were correctly classified by logistic regression method and 83% of the skulls were correctly classified by cumulative probit model. Thus, the results obtained in the present study are much better than those of Konigsberg and Hens⁶.

Thus, the study of single regions of skulls i.e. the supraorbital region will be more helpful in determining sex from fragmentary crania.

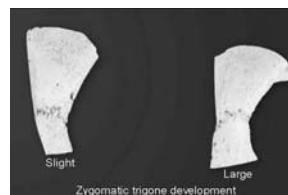
In the present study, it is seen that the accuracy of sex determination of the skulls obtained by morphological methods has been found out to be quite reliable. These results are in agreement with the study of Meindl et al²³ who had found in his study that cranial discriminant functions were less accurate than the simple observational methods employed in the study.

Summary and conclusion

The present study also established the following facts:

1. The present study showed that superciliary ridge development, zygomatic trigone development was more in male skulls as compared to female skulls and hence are reliable in sex determination. Glabella was less developed in both male and female skulls. Hence it was less helpful in sex determination but in combination all the non metric traits provided high accuracy in sexual dimorphism from skulls.
2. Both logistic and probit regression methods were able to classify correctly 91.5% of the skulls. As the probit regression analysis has come to almost the same conclusions as logistic regression analysis, hence it is

Photograph 3:



concluded that either one of the methods can be used for statistical analysis of non metric traits.

3. Accuracy of sex determination depends at least partly upon the statistical method employed. Therefore stringent statistical techniques need to be employed to obtain reliable effects. Probit and Logistic regression methods are used for ordinal categorical data.
4. For non metric study, standardized casts should be used as in case of present study standardized casts prepared by Australian National University have been used. Furthermore, an effort should be made to prepare standardized casts for the Indian population for better and more reliable results.

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Psychological autopsy-A need of the future

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Abstract

The "psychological autopsy" is a procedure for investigating a person's death by reconstructing what the person thought, how he felt when he was alive prior to his/her death & afterwards died. This reconstruction is based upon various information gathered from personal documents, police reports, medical records and face-to-face interviews with families, friends and others who were in direct touch with the person prior to his death. Although it has been widely used all over the world for helping death investigations and other purposes, but in our country the idea is still in its infancy & only limited to sporadic research activities. We propose a systematic and standardized approach for development of psychological autopsy in our country, which will be of immense help in complete investigation of deaths especially in suicide cases.

Keywords

Psychological autopsy, forensic, suicide, investigation, legal issues.

Introduction

"Psychological Autopsy"-although contains the word 'autopsy' but in reality it has nothing to do with the pathological autopsy which a forensic pathologist performs. The psychological autopsy is a retrospective death analysis of an individual's death by reconstructing his thoughts, feelings and actions preceding his or her death. This information is gathered from personal documents, police reports, medical records, and face-to-face interviews with families, friends and others who remained in touch with the person before his/her death. Various names have been coined for it like psychiatric autopsy, retrospective death assessment, reconstructive evaluation and equivocal death analysis.

The first modern psychological autopsy study was conducted by Eli Robbins et al in 1956-57 in the Washington University, USA; in which they investigated 134 cases of suicides¹. Later Edwin Shneidman coined the term 'psychological autopsy', while working in the Los Angeles Suicide Prevention centre, where he developed a method to help the medical examiner's office to investigate whether a person had died by way of suicide or accident¹. Various studies of psychological autopsy had been conducted in different countries having diverse cultures²⁻⁵.

At the beginning, psychological autopsies involved isolated cases only and were merely concerned with clinical analysis after occurrence of a death. Analyzing series of consecutive cases soon confirmed a prevalence of mental disorders such as mood disorders, substance abuse and suicidal behavior etc. in at least 90% of cases, irrespective of age or sex^{1,6}.

Purpose and need of psychological autopsy

In our country, there have been many studies which are done in a retrospective manner to have deep insight into the predisposing factors for suicide⁷. These studies are mainly done for research purposes in post-graduate curriculum or for making preventive strategies for specific groups like exam.-going students, geriatric age-group, disabled etc. There had been hardly a report of such psychological autopsy study which has been conducted to help the investigating officer in solving of a crime scene. We are, therefore, looking into the prospects of incorporating psychological autopsy study as an essential part of the investigation and developing a methodology for the same.

The idea of a psychological autopsy is to discover the state of mind of the victim preceding death, as it may be helpful to solve criminal cases; settle insurance claims etc. Therefore it may be useful in the following instances⁸:

A. The psychological autopsy studies are used to determine the manner of death in equivocal deaths⁹. Equivocal deaths are those in which it is unclear that whether the manner is suicide, homicide or accident and the circumstances surrounding death can be interpreted in more than one way. It is observed that in many cases of deaths, the circumstances are confusing and misleading. The professional conducting the psychological autopsy compiles information retrospectively about the behavior and psychiatric state of the deceased that is not always accessible to the investigating officer. Thus, the psychological autopsy helps in the crime reconstruction and prevents the misinterpretation of a case of accident into suicide, or a case of homicide into suicide etc. Few examples in which it can be used are listed below:

- In cases of Insurance Liability, when the insurance company will not pay death benefits due to a clause excluding suicide yet there is reason to suspect the death may have been an accident or even a homicide.
- Multiple stab wounds
- Multiple Gun shot wounds
- Drowning
- Drug Overdoses
- In cases of Auto-erotic Deaths such as accidental asphyxial deaths from the cases of suicidal hanging.

B. The psychological autopsy determines the trigger and the predisposing factors for suicide and also answers about why that person chose that particular place, time and method of suicide. Thus it can be used by investigating officer for identifying the persons who were responsible for death of the victim and whether they can be treated as abettor of crime or not.

C. The psychological autopsy gathers the statistical information which can be used for improving databases. It helps in identifying and treating vulnerable patients. It will also help in identifying behavior patterns, which seem to accompany different degree of suicidal intent.

D. The psychological autopsy can be used as a handy tool to

settle estate cases in which there is doubt about the mental state and the testamentary capacity of the deceased is under scrutiny. It will help the Court of Law to decide whether deceased was in state of sound disposing mind or not, prior to his death.

E. It can also be used to help the relatives of the deceased to combat with their grief and sorrow by conducting interviews with the family, relatives or friends of the deceased and to retrieve the information which can be helpful in their grief counseling.

Methodology

There is no consensus on the exact procedure for conducting a psychological autopsy. The psychological autopsy study requires a forensic and psychiatry professional to go into each and every detail of the person's final days. For this they can use any or all of the following sources^{10,11}.

- Face-to-face interview with the family members, relatives, friends, colleagues or any other person, whoever is found suitable.
- Interviews with eyewitnesses or police officers at the scene.
- Autopsy reports (which may reveal things about the victim e.g. substance abuse which even close friends did not know)
- An examination of the death scene, by visiting the scene or via photographs.
- Type of general books the victim read, music preferred or videogames played
- Scientific books or journals read by him.
- Correspondences associated or suicide note found with the victim.
- Behavior patterns noted by others, especially unusual recent behavior
- Records of school, phone, employment
- Medical, psychiatric history records of the deceased as well as his family
- History of medication, if any.
- History of alcohol or substance abuse.
- Any reported account of recent encounters with odd incidents.
- Reports about conflict in relationships or other stressors (life events that precipitated a loss of hope)
- Changes in 'Wills' or name of nominee in bank accounts, fixed deposits or life insurance policies.

Hence we propose that a detailed psychological autopsy report may be prepared in following format:

- Personal Information such as name, age, address, gender, marital status, family, occupation, religion, personal interests.
- Brief history of the case.
- Details of Death Scene Report.
- Findings from the Autopsy Report.
- Toxicological Analysis Report of viscera, gastric lavage or any other specimen preserved for the purpose.
- A final reconstruction of the incident leading to death.
- Victim's medical and psychiatry history, if any and the treatment received.
- Family's medical and psychiatric history.
- Details of sexual/ legal/religious history.
- Occupational history (successes/failures)
- Relationship history
- Victim's stress reaction patterns.
- Recent stressors in victim's life.
- Role of alcohol or drugs in lifestyle.

- Fantasies/dreams/night-time disorders/intuitions
- Changes in victim's habits or routines in the days immediately prior to his death.
- Signs of preparation for ending life.
- Previous suicide attempts.
- Victim's familiarity with death methods/accessibility
- How others react to the death (surprise, grief, indifference etc.)
- Suicide note/ audios/ videos or any communication about the motive of suicide.
- Assessment of intention and motive.

After assessing the above details, finally a detailed description is made about the person's past life and the days just before death.

Special considerations

There are few situations of suspected suicide in which the following criteria must also be looked upon by the person conducting the psychological autopsy¹²:

- a. Gun shot
 - (1) The victim's knowledge, experience, and handling/ training with firearms.
 - (2) The victim's history of handling weapons recklessly or cautiously.
 - (3) The victim's prior firearms accidents.
 - (4) The victim's recent purchase of a firearm.
- b. Drug Overdose
 - (1) The victim's knowledge of drugs and their potential dangers (prescribed or street drugs and their amount).
 - (2) Was the victim ever seen under the influence of drugs?
 - (3) Was there a history of prior overdoses and how were they treated?
 - (4) Was the victim careless in the use of medications, taking more than prescribed?
 - (5) How did the victim keep track of pill intake?
 - (6) What were other sources of pills?
 - (7) What was his or her behavior under the influence of drugs?
- c. Hanging or Asphyxial Deaths
 - (1) Explore for any activity of sexual involvement.
 - (2) How was the victim clothed?
 - (3) When found, state if pornographic material or sexual apparatus was nearby.
 - (4) State the victim's known sexual activity (deviance, reading material, interests, knowledge of asphyxia techniques and experience with rope).
- d. Jumping, Drowning, Vehicular death
 - (1) State the reason for the victim to be at the place of death.
 - (2) With respect to the specific method, state his or her habitual behavior.

Ethical issues

The psychological autopsy study involves interview with the family and friends of the deceased who are already in anxious state and extremely vulnerable due to the traumatic experience of the sudden death of their relative. So they should be dealt very carefully and sensitively¹³. There have been discussions and doubts about whether the psychological autopsy is of any benefit to survivors of the deceased or not. There also have been questions regarding the timing of the interview. These ethical aspects are generally tended to be overlooked by the person conducting the study.

However, Beskow et al concluded in their study that most of the persons were themselves ready and eager to participate and undertake the questionnaire. They also concluded that although a shorter time interval between death and the interview enhances the therapeutic potential of the study but it also increases the risk of psychological harm. So they proposed a period of 9 weeks as the ideal time between death and interviewing process¹⁴.

The ethical problem about the interviewing personnel is the continuous exposure of his subconscious and psyche to grief and sorrow of the relatives. The emotional impact due to such kind of negative feelings should also be kept in mind.

Recommendations

Although as we have described earlier that the psychological autopsy studies have been used in different countries for diverse circumstances, but in our country the development in this field is in the stage of infancy. The psychological autopsy study has been limited to only a few retrospective studies in cases of suicides. The scope and the procedure for the psychological autopsy should be meticulously worked out by considering all the factors that are involved in the death of the individual. Some of the steps that can be taken towards this approach are:

1. Standardized Methodology

The psychological autopsy should have a rigorous and standardized approach in its implementation, particularly in the interview process with friends and relatives of the victim. A specific set of questionnaire should be formatted so as to cover all the aspects of individual's life and death. The scientific data collected should be evaluated on systematic, appropriate and validated psychometric scales approved by a board of experts.

2. Control Cases

In the past, most of the studies were based on "case" analysis without including control groups. Studies using psychological autopsy should be based on comparison with sufficient number of control subjects, which are suitably matched with suicide subjects according to proper scientific criteria in order to fulfill the objectives and test the hypotheses of the study. The information regarding the controls should be taken from the next of their kin to avoid information bias as the controls will be living and the cases are deceased.

3. Ethical Considerations

An interview should be preceded by a phone call, letter or any other method of correspondence, for prior appointment. The refusal of the relatives to take part in the interview should be fully respected and they should be given autonomy to decide when they are ready to go through the process and about the time and place where they want the interview to be conducted. They should be interviewed only after obtaining their informed consent. The questions should be formed in a respectful and understanding manner towards the deceased so as not to enhance the grief of the relative.

The care should be taken that the information should only be retrieved from the relative, which they knew about the deceased. There should not be any revelation of the facts which the deceased might have chosen to hide from other persons. The repeated emotional impact upon the interviewing personnel should also be taken into consideration so that his inner thoughts and feelings about life should not get tampered with. The negativism associated with the study should be reinforced with the positive life experience.

4. Training of Health Professionals

The mental health professionals may have excellent interviewing skills but they do not have the adequate knowledge of various aspects of forensic sciences such as ballistics, toxicology, pharmacology etc. Also they do not have the full understanding of pathological autopsy. The vice-versa applies to the forensic science person and to the forensic pathologist. So there should be a proper training curriculum for the person to perform a psychological autopsy. The personnel should have a multidisciplinary training of crime scene investigations, pathological autopsy, forensic psychiatry, medicolegal laws, basic forensic science and toxicology. The curriculum should be got approved by Medical Council of India as well as government so that the person completing the training will be eligible for conducting psychological autopsy and his expert opinion will be considered as valid wherever necessary.

There could be a simpler approach by making the investigation of a case of equivocal death by a team of professionals including a police officer, a forensic pathologist, a forensic science expert and a psychiatrist. In this way the case will be probed thoroughly by the team completing all the aspects of investigation and with the coordination of each other.

5. Postvention Therapy of the Survivors

A well managed psychological autopsy could serve as a therapeutic tool for the relatives and friends of the deceased by giving them an opportunity to unburden themselves, when the person conducting the psychological autopsy approaches and listen to the bereaved. For this purpose, the interviewing process should be performed by experienced Doctors or psychologists or psychiatrists, capable of helping the mourning relatives and friends of a suicide, manage their emotions and go through the bereavement process.

6. Target Specific Population Categories

In few specific population groups e.g. the teenagers and the old, homosexuals, divorcees, widows, widowers, physically handicapped persons, alcohol or drug abusers, mentally ill etc. the prevention, identification and treatment of the predisposing factors should be more as they are much prone to commit suicide as compared to normal population. Thus they will benefit from better evaluation of suicide risk due to knowledge gained by psychological autopsy studies. Eventually the subjects who have attempted suicide without fatal outcome can be targeted as part of a general prevention program.

Conclusion

We recommend that if psychological autopsy is incorporated in our existing system of investigation of death, it will be of immense help to the police, court, relatives, insurance officers, falsely accused persons, researchers & social welfare department to name a few. The psychological autopsy will be of great help in answering a number of unanswered questions, whether legally, personally or for research purposes.

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A case report of anesthetic and operative death due to negligence of Doctor

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Abstract

Anaesthetic deaths are very rare. Anaesthetic deaths may be divided into two groups.

- A. Deaths which occur during the administration of an anaesthetic but which are not due to anaesthetic.
- B. Deaths which are the direct results of the administration of an anaesthetic.

The effects of anaesthetic agents are they relieve pain and cause progressive cerebral depression.

In the present case a female patient aged about 28 years posted for L.S.C.S on 09-11-2009 without anesthetist. The surgeon administered Spinal anesthesia and do caesarian section. Patient was shifted to postoperative ward and examine the surgeon, she has not recovered from anesthesia, not responding any stimuli, immediately patient was shifted to private hospital at Kadapa and then shifted to CMC Velure. There the specialists examine the patient and gave their opinion. On 18.11.2009 they were admitted the patient in RIMS Hospital, Kadapa. Patient was in deep coma. On 21-11-2009 at 4:45A.M. patient was died. Postmortem conducted on 22-11-2009 at 1:30P.M P.M.E No: 479/09, Cr No: 176/09 U/s 304(A) IPC S.I of Police, Proddatur II town P.S.

Key words

Anaesthetic agents, Local, Spinal, General Anaesthesia, Complications of Anaesthesia.

Introduction

Anaesthetic deaths are very rare. Only one in ten thousand persons die totally as a result of anesthetic. Deaths during diagnostic and operative procedures for into 5 categories.

1. **Deaths due to underlying disease:** The first group includes deaths occurring because of an underlying disease process that necessitated the operative/diagnostic procedures. These deaths are not due to the procedures being carried out.
2. **Disruption of a vital organ during a procedure:** The second group of deaths are due to inadvertent mechanical disruption of a vital organ during a procedure e.g. the surgeon while going through the sternum, inadvertently punctures the heart.
3. **Air embolism occurring during surgery:** This occurs most commonly in surgery of the
 - A. Central nervous system or
 - B. During laminectomy procedure
4. **Anesthetic related deaths:** Examples of such deaths are
 - A. Intubation of the oesophagus
 - B. Administering the wrong gases.
 - C. Drug over dose.
 - D. Allergic reactions to iodine based dyes.

5. Malignant hyperthermia

- A. When occurs is usually associated with halogenated anesthetic and succinylcholine.
- B. Characterized by a rapid rise in body temperature and a two – to – three fold increase in total body oxygen.

Case history

In the present case a female patient aged about 28 years posted for L.S.C.S on 09-11-2009 without anesthetist. The surgeon administered Spinal anesthesia and do caesarian section. Patient was shifted to postoperative ward and examine the surgeon, she has not recovered from anesthesia, not responding any stimuli, immediately patient was shifted to private hospital at Kadapa and then shifted to CMC Velure. There the specialists examine the patient and gave their opinion. On 18.11.2009 they were admitted the patient in RIMS Hospital, Kadapa. Patient was in deep coma. On 21-11-2009 at 4:45A.M. patient was died. Postmortem conducted on 22-11-2009 at 1:30P.M P.M.E No: 479/09, Cr No: 176/09 U/s 304(A) IPC S.I of Police, Proddatur II town P.S.

Autopsy findings

Anti mortem Injuries

1. A healed operated sutured wound on front of middle of level abdomen transverse in position (wound of cesarean section operation) 15 cm in length with 9 intact suture abdominal wall depth. No evidence of any pus or infection.
2. Internally on opening the abdomen lower part of uterus is bulky measuring 13x13cm with transfers suture 6 in number in its lower part no pus. Blood clots present in the uterine cavity.

Cause of Death: Hypoxia and other complications followed by anaesthesia and surgery.

Discussion

Anaesthetic agents: They relieve pain and cause progressive cerebral depression.

Factors precipitate anaesthetic deaths

1. Physiological factors – Insufficient O₂ supply, blood supply.
2. Pharmacological factors – Toxic or untoward effects of anaesthetic agents and anesthetic techniques.
3. Mechanical factors – injury from defective machines, electrocution burn, explosion.
4. Malfunctioning – Defective / faulty the instruments, appliances etc..

Causes of death due to general anaesthesia

1. Overdose of anaesthetic agents – particularly in case of combination therapy.

2. Giving anaesthesia to wrong patients.
3. wrong connection in the gas machine – may cause undesirable dangerous mixing of gases.
4. From hypoxia due to -
 - a) Respiratory depression.
 - b) Hypoventilation
 - c) Excessive muscle relaxation
 - d) Laryngeal spasm from inhalation of vomit's.
5. Precipitation of myocardial ischaemia – from use of agents like intravenous pentothal which causes depression action of heart, dilation of blood vessels, lowering of blood pressure and reduction of coronary circulation.
6. From wrong posture of the patient – paralysis of a limb or a part.
7. Faulty anaesthetic equipments.
8. Failure to recognize or apprehend empanelling danger during monitoring of vital signs.
9. Misuse of anaesthetic agents.
10. Unexpected and unexplainable reasons.

Surgical reasons for "Operation table (OT) deaths".

1. Due to injury or disease.
2. Due to any disease other than the disease for which the operation is carried out.
3. Death due to undiagnosed pre – existing disease.
4. Accidental surgical procedure – cutting of bigger vessels, injury to vital organs, air passage etc...
5. Surgical complication – shock, haemorrhage, embolism etc...
6. Accidental mechanical – electrocution from leaking cautery diathermy machine.

Anaesthetic deaths are categorized stage – wise

- A. Death occurring during administration of anaesthetic agents but not due to the anesthetic agents
 1. Death from the disease or the injuries for which the operation was being under taken, through anaesthetic agent precipitated it. At times it becomes difficult to isolate the percentage of combination of the disease or injury and the anaesthetic agent to death.
 2. Death from the disease other than that for which the operation was being undertaken – existence of some disease was known before head but surgical procedure had to be undertaken for some other disease or injury, however operation or anaesthetic agent has precipitated death.
 3. Death from some undiagnosed pre – existing condition other than that for which operation was undertaken – pre- existing undiagnosed disease could have been a contributory factor in causation of death.
 4. Surgical shock and exhaustion – due to under prolonged procedure poor pre-operative condition etc.
 5. Surgical mishaps – during administration of anaesthesia, error or incompetence in the heart of the surgeon causing injury to bigger blood vessels, rupture of aneurysm etc, due to failure of equipments etc.
- B. Death due to direct effect of administration of anaesthetic agents.
 1. During anaesthetic procedure:
 - a) From deficiency in technical skill – mishaps during intubation, bronchoscopy etc.
 - b) From technical mishaps from poor designing of equipments faulty mixing of o₂ and anaesthetic – explosion or fire from electric spark from diathermy electrode, faulty electric appliances, static electricity, X-Ray apparatus etc.

- c) From improper judgement – wrong decision due to lack in decision making skill or lapses in the training.
- d) Failure to appreciate or recognize impending danger from the monitor and failure to respond accordingly.

2. Due to anaesthetic over dose: Particularly when used in combination.
3. Due to inadequate supply of o₂.
4. Due to acute neurogenic cardio – vascular failure.
5. Hypovolaemia.
6. Cardiac arrest
7. Cardiac arrhythmias.
8. Dimension myocardial contractibility.

What exhibits should be preserved during autopsy for further examination in a case of suspected/ alleged anaesthetic deaths

1. For toxicological examination -
 - a) One full lung – immediately sealed in a container.
 - b) Fat from mesentery.
 - c) Skeletal muscle.
 - d) Brain at least 100 gms
 - e) Liver – atleast 100gms.
 - f) Kidney – at least 100gms.
 - g) Urine – After collection immediately refrigerated.
 - h) Alveolar air – collected under water with a larynx and needle puncturing the lungs before – opening the thoracic cavity.
 - i) Gaseous from heart, blood vessels before cutting themes open under water.
2. For grouping and cross matching – blood.
3. For bacteriological examination – blood, exudate if any
4. For histological examination – samples from all organs.

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Lip prints (Cheiloscopy) - A review

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Abstract

Establishing a personal identification is a difficult process. Dental, fingerprint and DNA comparisons are probably the most common technique used in this context, allowing fast and secure identification process. Forensic methodology could serve as a very important tool in the field of oral medicine, diagnosis & radiology. The external surface of lips has many elevation and depression forming a characteristic pattern called lip prints, it is also known as cheiloscopy. The lip prints are unique and distinguishable for every individual like fingerprints. Lip prints are helpful in forensic investigation that deals with identification of a victim in the court of law. More researches need to be conducted in this field with regards to confirmation of uniqueness, and the collection and interpretation of evidence.

Keywords

Forensic Dentistry, Cheiloscopy, Grooves, Sex Determination, Age Determination.

Introduction

The mouth has fittingly been identified as the organ system, "where it all begins". The forensic odontology is one of the most unexplored and intriguing branch of forensic medicine. For many years its importance was not recognized, as very few people were aware of forensic aspect of odontology¹. The study of teeth and jaw as evidence in law and justice is called FORENSIC DENTISTRY. Personal identification is necessary for unknown person as well as for living individuals for criminal investigations². There are many techniques for personal identification. Suzuki et al (1970) made detailed investigation of measurement of lips, color of rugae, its differentiation from a blood stain and the method for its extraction to obtain full data for forensic identification³. Forensic odontology is that branch of forensic medicine, which proposes to apply dental knowledge to the solution of legal and criminal problems¹.

The study of lip prints is called "Cheiloscopy". The forensic application of lip prints has been studied mostly by Japanese. Study of lip prints has been a subject of French doctoral thesis appears to be genotypically determined, unchanged from birth. The lip prints are unique and distinguishable for every individual like finger prints¹.

Historical overview

The earliest case in history was that of Lollia Paulina in 49 A.D^{1,4}. Soon after her marriage to Claudis, the emperor of Rome. Agrippina, his first wife feared that Lollia would always

catch her husband's attention. Hence, she sent her soldiers to kill Lollia. The dead body was identified by her teeth, which has certain distinctive characteristics⁴.

The earliest reported case in India in 1193 was that of "Raja Chel Chandra", Father of Kannauj, whose body was badly mutilated in the battle field and was identified by his false anterior teeth^{1,5}.

The forensic dentistry began in 1850, in recognizing the culprit, who was hung for the murder of the German philanthropist "George Parkman" in Boston^{1,6}.

"Fisher R" in 1902 was the first anthropologist to describe the furrows on the red part of the human lips^{2,7}. In 1932 "Edmond Locard", one of France's greatest criminologists acknowledged the importance of cheiloscopy². In 1950, "Synder LM" reported in his book "Homicide investigation" mentioned the use of lip prints in identification^{2,8}. In 1960 "Santos" suggested that the fissures and criss-cross lines in the lips could be divided into simple and compound groups and each group could be further divided into 8 subtypes. In 1970 "Suzuki K and Tsuchihashi Y" conducted a study on 280 Japanese individuals and named the grooves existing on Labiorum rubrorum as "Sulci Labiorum" and the lip prints consisting of grooves as "Figura Linearum Labiorum rubrorum"³. Mc Donnell in 1972 conducted a study on lip prints between two identical twins and reported that two identical twins seemed to be indistinguishable by every other means but their lip prints were different². In 1974 "Tsuchihashi Y" studied the lips and their value in identification & investigation.

"Cottone JA" in 1981 reported in his book "outline of forensic dentistry", that cheiloscopy is one of the special techniques used for personal identification².

In 1990, "Kasprzak J" studied the importance of cheiloscopy in forensic investigation recently². "Vahanwala SP" et al 2000 studied on 100 individuals and concluded as combination of lip patterns, quadrant wise of individual is unique but all the quadrants having different patterns were common in male, whereas same pattern in all quadrant in female². In 2001 "Moenssens A" stated that lip print identification may appear in the field of literature which require a little research to support the methodology for collection and comparison of lip prints². Caldas MI et al 2006 described two unusual techniques in detail such as cheiloscopy and palatoscopy⁹. It is known that due to their special feature both lip grooves palate rugae can be used successfully in human identification. In 2008 "Mishra G" reviewed the importance of cheiloscopy in forensic science identification².

Classification

- I) According to Martin Santos 19679 classified the lip prints into 2 groups they are:
 - i) SIMPLE
 - ii) COMPOUND

- i) SIMPLE: Are formed only by one element. This element can be
 - Straight line (R-1)
 - A curve (C-2)
 - An angular form (A-3)
 - Sinusoidal (S-4);
- ii) COMPOUND: are formed by several elements. They can be Bifurcated (B-5) Trifurcated (T-6) or Anomalous (An-7).

II) Suzuki and Tsuchihashi 1970^{3,9} classified the lip prints into 5 types

CLASSIFICATION	GROOVE TYPE
Type I	Complete vertical
Type I	Incomplete vertical
Type II	Branched
Type III	Intersected
Type IV	Reticular pattern
Type V	Irregular

III) Renaud in 1973 classified the lip print as⁹

He studied the lips into two halves such as left and right and every groove has a number. A formula is then elaborated using capital letters to describe the upper lip left (L) and right (R) sides, and small letters to classify each groove in the lower lip, it is done the other way around, using capital letter to classify the grooves and small letters to separate left from right sides.

CLASSIFICATION	GROOVE TYPE
A	Complete Vertical
B	Incomplete vertical
C	Complete bifurcated
D	Incomplete bifurcated
E	Complete branched
F	Incomplete branched
G	Reticular pattern
H	X or coma form
I	Horizontal
J	Other forms (ellipse, triangle)

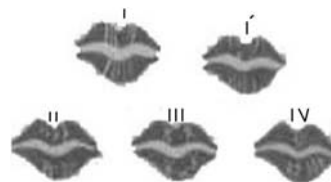
IV) Afchar-Bayat 1979 classified into six-types of groove organization, They are⁹

CLASSIFICATION	GROOVE TYPE
A1	Vertical and straight grooves, covering the whole lip
A2	Vertical and straight grooves, but not covering the whole lip
B1	Straight branched grooves
B2	Angulated branched grooves
C	Converging grooves
D	Reticular pattern grooves
E	Other grooves

V) Vahanwala – Parekh 2000 classified the lip pattern¹⁰ as

LIP –PATTERN	REGION OF OCCURRENCE	PREDOMINANTLY SEEN IN
a. Type I & type II	1st quadrant (right upper lip)	Female
b. Type II	2nd quadrant (left upper lip)	Male
d. Type III	Never occurs in lower lip	If so then only in male
e. varied patterns	In all quadrants	Male
f. Same (a like)	In all quadrants	female

Fig.: Types of lip pattern according to Suzuki



Discussion

The traditional method for personal identification include anthropometry, finger prints, sex determination, estimation of age, measurement of height, identification with a specific individual and differentiation by blood groups. A common site at the crime scene is the basking of an order by an investigating officer that nobody should touch any object in the area so that the finger prints on any such object remain intact¹¹. Theory of uniqueness used in the analysis of finger prints and also in the lip prints of an individual. Suzuki et al 1970 mentioned that the lip patterns were remaining unchanged over a person's lifetime in identical twins³.

There are numerous variations and combinations of lip patterns. Suzuki 1970, categorized into 5 varieties broadly such as vertical, intersected, branched, reticular and undetermined³.

In 1974 Tsuchihashi, mentioned the personal identification by means of lip prints by subsequently having wrinkles, fissure and grooves on the lips. These grooves in the lip prints were named Labiorum rubrorum as "Sulci Labiorum" and the lip prints consisting of grooves as "Figura Linearum Labiorum rubrorum"¹¹.

Tsuchihashi 1974, studied in their investigation as lips had no inflammatory disease, trauma, malformation, deformity and scars. It is difficult to decide the patterns of lip prints when inflammation is present on lip however after healing the lip prints reassumed its own pattern in healthy pattern indicates the permanence of the lip prints¹¹.

The lip prints being uniform throughout the life and, can be used to verify the presence and absence of the person at the time of crime, provided there has been consumption of beverage, drinks, usage of cloths, tissue etc at the crime scene.

Lip marks have been observed on a drinking glass with individuals without lip stick and such suspected individuals compared with the evidence of item was found. This could give conclusive evidence on the presence or absence of the individual and should be admissible even in the court of law.

Vahanwala (2000) described the lip prints as characteristic of an individual and be holding a potential to be recognized as a mark of identification like the finger prints which remain unchanged over a individual lifetime¹.

Shivpathasundharam B et al 2001 stated the lip prints are similar to finger prints, they disappear when lips are stretched and reappear when the lip muscles are relaxed. This uniqueness depends upon the type of a manner by which the lip muscles relax to produce particular patterns¹².

Castello A et al in 2002 studied the latent lip prints on paper and developed with Sudan black can be used as potential DNA source for identification. Latent prints at a crime scene is required increasingly simpler, more sensitive and effective manner¹³.

Vahanwala et al in 2005 described the lip prints are like finger prints and recognition of the sex of an individual and can be matched with the prints of prime suspect helps in the personal identification¹⁰.

Progress in research in this area will contribute not nearly

to its direct use in personal identification in forensic medicine and odontology, but also open up with a new field that can contribute to investigation and identification.

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