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From Editor's Desk

JIAFM

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I feel immense pleasure to present before you the first issue of 2010. I assure you about the quality of research papers and quality of printing in future issues. Your valuable suggestions are always encouraging me and I heartily welcome for future suggestions. On behalf of Executive Committee of IAFM for the years 2010-2011, I took resolution to further improve the quality and status of our Journal. We always learn from mistakes and try to improve upon these. I am thankful to the advertisers who have provided additional financial resources for improving the quality of this issue.

Dr. Mukesh Yadav
Editor

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Editor

Editorial**In the Defense of Medical Profession: SC Observations**

Hon'ble SC on almost all the occasions adopted a balanced approach in deciding with cases of medical negligence by keeping interest of society intact and also given desired protection to the members of the medical profession. SC recently observed in **Kusum Sharma & Others vs. Batra Hospital & Medical Research Centre & Others, Civil Appeal No.1385 of 2001, decided on 10th February 2010** that the law of negligence has to be applied according to the facts and circumstances of the individual case.

No one can ignore the fact that the medicine is not an exact science involving precision and every surgical operation involves uncalculated risks and merely because a complication had ensued, it does not mean that the hospital or the doctor was guilty of negligence. A medical practitioner is not expected to achieve success in every case that he treats. The duty of the Doctor like that of other professional men is to exercise reasonable skill and care.

A doctor is not negligent, if he is acting in accordance with a practice accepted as proper by a reasonable body of medical men skilled in that particular art, merely because there is a body of such opinion that takes a contrary view.

Where there are **two different schools of medical practice**, both having recognition among practitioners, it is not negligent for a practitioner to follow one in preference to the other finds favour in law.

Medical science has conferred great benefits on mankind, but these benefits are attended by considerable risks. Every surgical operation is attended by risks. **We cannot take the benefits without taking risks.** Every advancement in technique is also attended by risks.

In **Jacob Mathew v. State of Punjab & Another (2005) 6 SCC 1**, SC observed that "25.....At times, the professional is confronted with making a choice between the devil and the deep sea and he has to choose the lesser evil. The medical professional is often called upon to adopt a procedure which involves higher element of risk, but which he honestly believes as providing greater chances of success for the patient rather than a procedure involving lesser risk but higher chances of failure. Which course is more appropriate to follow, would **depend on the facts and circumstances of a given case.**

A doctor faced with an emergency ordinarily tries his best to redeem the patient out of his suffering. He does not gain anything by acting with negligence or by omitting to do an act. Obviously, therefore, it will be for the complainant to clearly make out a case of negligence before a medical practitioner is charged with or proceeded against criminally.

Hon'ble SC in **Jacob Mathew's case** of 2005 very aptly observed that a surgeon with shaky hands under fear of legal action cannot perform a successful operation and a quivering physician cannot administer the end-dose of medicine to his patient. Doctors in complicated cases have to take chance even if the rate of survival is low.

It is a matter of common knowledge that after happening of some unfortunate event, there is a marked tendency to look for a human factor to blame for an untoward event, a tendency which is closely linked with the **desire to punish**. Things have gone wrong and, therefore, somebody must be found to answer for it. **A professional deserves total protection. The Indian Penal Code** has taken care to ensure that people who act in good faith should not be punished. **Sections 88, 92 and 370 of the Indian Penal Code** give adequate protection to the professional and particularly medical professionals.

But we should be doing a **disservice to the community at large** if, we were to impose liability on hospitals and doctors for everything that happens to go wrong. Doctors would be led to

think more of their own safety than of the good of their patients. Initiative would be stifled and confidence shaken. A proper sense of proportion requires us to have regard to the conditions in which hospitals and doctors have to work. We must insist on due care for the patient at every point, but we must not condemn as negligence that which is only a misadventure.

On scrutiny of the leading cases of medical negligence both in India and other countries especially United Kingdom, some basic principles emerge in dealing with the cases of medical negligence. While deciding whether the medical professional is guilty of medical negligence following well known principles must be kept in view:

- i. Negligence is the breach of a duty exercised by omission to do something which a reasonable man, guided by those considerations which ordinarily regulate the conduct of human affairs, would do, or doing something which a prudent and reasonable man would not do.
- ii. Negligence is an essential ingredient of the offence. The negligence to be established by the prosecution must be culpable or gross and not the negligence merely based upon an error of judgment.
- iii. The medical professional is expected to bring a reasonable degree of skill and knowledge and must exercise a reasonable degree of care. Neither the very highest nor a very low degree of care and competence judged in the light of the particular circumstances of each case is what the law requires.
- iv. A medical practitioner would be liable only where his conduct fell below that of the standards of a reasonably competent practitioner in his field.
- v. In the realm of diagnosis and treatment there is scope for genuine difference of opinion and one professional doctor is clearly not negligent merely because his conclusion differs from that of other professional doctor.
- vi. The medical professional is often called upon to adopt a procedure which involves higher element of risk, but which he honestly believes as providing greater chances of success for the patient rather than a procedure involving lesser risk but higher chances of failure. Just because a professional looking to the gravity of illness has taken higher element of risk to redeem the patient out of his/her suffering which did not yield the desired result may not amount to negligence.
- vii. Negligence cannot be attributed to a doctor so long as he performs his duties with reasonable skill and competence. Merely because the doctor chooses one course of action in preference to the other one available, he would not be liable if the course of action chosen by him was acceptable to the medical profession.
- viii. It would not be conducive to the efficiency of the medical profession if no Doctor could administer medicine without a halter round his neck.
- ix. It is our bounden duty and obligation of the civil society to ensure that the medical professionals are not unnecessary harassed or humiliated so that they can perform their professional duties without fear and apprehension.
- x. The medical practitioners at times also have to be saved from such a class of complainants who use criminal process as a tool for pressurizing the medical professionals/hospitals particularly private hospitals or clinics for extracting uncalled for compensation. Such malicious proceedings deserve to be discarded against the medical practitioners.

The medical professionals are entitled to get protection so long as they perform their duties with reasonable skill and competence and in the interest of the patients. The interest and welfare of the patients have to be paramount for the medical professionals.

SC further observed that “In our considered view, the **forementioned principles must be kept in view while deciding the cases of medical negligence. We should not be understood to have held that doctors can never be prosecuted for medical negligence. As long as the doctors have performed their duties and exercised an ordinary degree of professional skill and competence, they cannot be held guilty of medical negligence. It is imperative that the doctors must be able to perform their professional duties with free mind.**

Mukesh Yadav
Editor

Original research paper

A Study on Lip Print Types among the People of Kerala

*Dr. Annie J. Verghese, **Dr. M. Somasekar, ***Dr. Umesh Babu R

Abstract

Cheiloscopy, the study of lip prints is an upcoming tool for the identification of persons. The lip print of every person is unique and can be used to fix personal identity. Previous work done on the subject also reveals that lip prints show differences according to the race and the ethnic origins of a person.

This study was taken up to determine the predominant lip print type in Kerala population. 50 male and 50 female subjects of Kerala origin were included in the study and the middle 1 cm of the lower lip was taken as the study area. The lip prints were recorded by applying lipstick on the lips, then cellophane tape was applied on the lips and the prints were taken. These prints were studied and classified according to Tsuchihashi's classification of Type I (complete vertical grooves), Type I' (incomplete vertical grooves), Type II (forking grooves), Type III (intersecting grooves), Type IV (reticular grooves) and Type V (undetermined grooves). The predominant type in each quadrant was noted and the percentage was calculated. It was found that Type IV (reticular grooves) was the predominant pattern.

Key Words: Cheiloscopy, Kerala Population, Lip Prints, Reticular Type

Introduction:

The grooves present on the human lips are unique to each person and can be used to determine identity. The study of these grooves or furrows present on the red part or the vermilion border of the human lips is known as cheiloscopy. [1] This biological phenomenon was first noted by anthropologists. R. Fischer was the first to describe it in 1902. [2] In countries such as Poland and USA, cheiloscopy has been used to identify criminals. [3, 4] 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: [5]

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.

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It was found that Type III was the predominant pattern (31.3% males and 33.3 % females). [5] In India, various studies have shown that the patterns formed reveal a population-wise dominance, that is, a particular population will show predominance of a particular lip print type. This is a potentially useful tool for identification. Vahanwalla and Parekh in 2000 on their study in Mumbai, reported that type I was dominant in females in the lower lips and that males tended to have different patterns in all quadrants and that females tended to have same patterns in all the quadrants. [6]

Sivapathasundharam, Ajay and Sivakumar in 2001 studied the incidence of particular lip print patterns in the Indo-Dravidian population and found that Type III was predominant. [7]

Manipady in his dissertation in Manipal, 2002 studied Indian and Chinese population and found that Type II was of the highest incidence among the Indian as well as the Chinese. Utsuno et al in 2005 have studied the characteristics of lip prints from cadavers with various causes of death. [8] Coward in 2007 has studied the stability of lip print patterns over a period of time. He took the prints of 85 subjects and studied them over a period of seven (7) months and showed that that lip prints remained unchanged. He also claimed that eight (8) was the number of matching features required to prove concurrence. [9] For the purpose of determination of the sex of the person from lip prints, Gondivkar SM et al in 2009 have studied 70 each male and female subjects in Maharashtra and were able to predict the sex with a high degree of accuracy. [10] The previous work done on the subject shows that different racial and ethnic groups show differences in the predominant lip

print pattern. The present study was undertaken to determine the predominant lip print type in the Kerala population of India.

Materials and Methods:

1. Lipstick of a bright red colour and non-glossy
2. Transparent cellophane tape, glued on one side
3. Scissors
4. White bond paper

The subjects were 50 males and 50 females whose family origins were from Kerala. The subjects were aged more than 25 years and less than 40 years. Those with any disease or deformity of the lips were excluded from the study.

Procedure:

The subject was asked to open the mouth and lipstick was applied in a single motion, evenly on the lips. The subject was asked to gently rub his/her lips together to spread the lipstick evenly. A strip of cellophane tape, 10 cm long was cut with scissors. The subject was asked to open the mouth slightly, and to keep the mouth stationary during the procedure. The glued portion of the cellophane tape was applied on the lower lip. It was held in place, applying gentle and even pressure for a few seconds. Then the tape was carefully lifted from the lip, from one end to the other, avoiding any smudging of the print. The strip of cellophane was stuck on to a piece of white bond paper.

The subject's serial number was written on the back to serve as a record. The middle one cm of the lower lip print was marked on the print with a pencil, which was the area to be studied, as this is the part most frequently found at a crime scene. This part was further divided along the centre to form left and right quadrants.

The predominant type of grooves in each quadrant was noted and the grooves were classified according to Tsuchihashi's classification from types I to V. The frequency of each type of lip print was tabulated and the percentage of each type was calculated.

Results:

Table No. 1: Percentage of lip print types in males and females (*Left Quadrant, **Right Quadrant)

Type	Percentage			
	Male		Female	
	*L.Q.	**R.Q.	*L.Q.	**R.Q.
I	13	9	16.5	9.5
I'	16	18	14	22
II	14	16.5	12	10
III	24	21.5	22.5	21
IV	32	33	34.5	33.5
V	1	2	0.5	4

Table No. 2: Age-wise distribution of cases

Age group (in years)	Number of cases
18 – 23	19
24 – 29	23
30 – 35	42
36 – 40	16

Discussion:

It was observed that Type IV was the most frequently observed in both the sexes and in both the quadrants. Other works on Indian subjects have yielded varying results. Vahanwalla and Parekh in their study in Mumbai found that Type I was the most frequent. [6] Sivapathasundharam, Prakash and Sivakumar studied the lip prints of Indo-Dravidian population and noted that Type III was predominant. [7] Manipady compared Indian and Chinese individuals and found that the incidence of Type II was the highest among Indians. These studies reveal that lip prints show racial differences which can be a useful adjunct to identification of the person.

The present study revealed that the middle portion of the lower lip shows Type IV (reticular) as the predominant type. Cheiloscopy is a relatively new field among the large number of identification tools available to the forensic expert. Work on this subject has already elicited useful information such as that lip prints are unique to an individual and can be used to fix the identity of a person; that they remain stable over time and that lip prints show gender differences. [6, 8, 9]

Further work on the subject can help to make cheiloscopy a practical reality at the ground level of the forensic identification process.

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Original research paper

Trends of Poisoning in Faridkot region of Punjab- A retrospective study of one year

*Dr SS Sandhu, **Dr JS Dalal,

Abstract

Since immemorial times, poisonous substances have been reported to be adversely affecting human life, both in terms of morbidity and mortality. Evolution in fields like agriculture, industry etc has made wide and easy availability of various poisonous substances.

The present study is a retrospective study of one year which is related to poisoning cases that were admitted in the emergency department of G.G. S. Medical College, Faridkot from 1st January 1996 to 31st December 1996. The analysis of the data revealed that out of 78 patients admitted in the hospital, 31 patients died. The maximum incidence was seen in the age group of 21-30 years with males outnumbering the females. The commonest poison used was organophosphorus group of compounds.

Key Words: Poisoning, Deaths, Trends, OrganoPhosphorus, Aluminium Phosphide, DDT

Introduction:

Poisons were known to antiquity. References to the poisons are found in the oldest Egyptian, Babylonian, Hebrew and Greek records. The ancient Indian Scriptures contain references to the poisoning of kings, the doings of professional poisoners and of widespread organized poisoning in prehistoric times. In those times, cases of poisoning the portions of stomach and heart were put on fire and the nature of flame and sound were noted to determine the nature of poison. [1]

Orfila, Professor of Chemistry and Legal Medicine at Paris is considered as the Father of Modern Toxicology. In the Nineteen Century, Orfila brought precise chemical method in to toxicology. [2]

The problem is getting worse with time as newer drugs and chemicals are developed in vast numbers. Today there are more than 9 million natural and synthetic chemicals, and the list keeps growing inexorably. However, less than 3000 of these cause more than 95% of the reported cases of poisoning.

The commonest agents in India appear to be pesticides (organophosphates, carbamates, chlorinated, hydrocarbons, and pyrethroids), sedative drugs, chemicals (corrosive and copper sulfate), alcohol, plant toxins and house hold poisons (mostly cleaning agents of late, aluminium phosphide has begun to emerge as a major player in the toxicological field, particularly in the some northern Indian states. [3]

The first treatise on Indian Medicine was the Agnivesa Charaka Samhita, supposed to have been composed about the seventh century BC. It lays down an elaborate code regarding the training, duties, privileges and social status of physicians. It can be considered as the origin of medical ethics. It also gives a detail description of various poisons, symptoms, signs and treatments of poisoning. [2]

The Greek Philosopher Socrates was executed by the State through the use of hemlock, plant poison. A Chinese Materia medica of about 3000 B.C. gives information on poisons. [1]

The first textbook on poison was written in 1814 by Matthew Joseph Orfila, a Spanish chemist, who is considered to be the Father of Toxicology. Orfila extracted arsenic from human tissues using a procedure for identification, developed several years before by James Marsh. This evidence was used in the court (1840) to convict Marie Lefarge of a homicidal poisoning. This was the first time that the toxicological data had been as evidence in the trial. [2]

In ancient India, the poisons –arsenic, aconite and opium –were known. They were used by women to get rid of oppressive husbands. The Mahabharata, which is usually ascribed to the fifth or sixth century B.C., mentions that Bhim Sen, the Hindu Samson, was poisoned by his cousin Duryodhan

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whom he had defeated in a duel. In a semi-historical legend of mid-India, it is narrated that the grandfather of Asoka, sent to the latter monarch in the guise of a present, a fascinating girl who was 'poison'-maiden fed on poison until she was so saturated with venom that her embrace would prove fatal to an ordinary mortal. [2]

The word "Toxicology" is derived from the Greek word 'Toxicon' which was used as a poisonous substance to arrowheads.

The substance inflicting toxic effect may be a drug, an insecticide or pesticide or any chemical substance in the environment (Methyl isocyanate leakage at the Union Carbide Plant in Bhopal in 1984 resulted in high mortality and morbidity).

Material and Methods:

The present study was conducted in the Department of Forensic Medicine, G.G.S. Medical College's, Emergency Wing attached to G.G.S. Medical College, Faridkot from 01.01.1996 to 31.12.1996 to know the trend of poisoning in the Faridkot region as per hospital records. 78 cases were studied, out of which 31 cases died. The study is conducted under the following heads:

1. Month wise distribution
2. Poison wise distribution
3. Monthly income
4. Occupational Status
5. Age wise distribution
6. Sex wise distribution
7. Area wise distribution

DeathsObservations:Table No. 1 : Month wise distribution			
01.01.96 to 31.12.96			
Sr. No.	Month	No. of Cases (%)	Deaths (%)
1	January	4 (5.13)	2 (2.56)
2	February	1 (1.28)	0 (0.00)
3	March	3 (3.85)	3 (3.85)
4	April	3 (3.85)	1 (1.28)
5	May	7 (8.97)	2 (2.56)
6	June	8 (10.26)	3 (3.85)
	July	12 (15.38)	6 (7.69)
8	August	19 (24.36)	3 (3.85)
9	September	9 (11.54)	3 (3.85)
10	October	7 (8.97)	4 (5.13)
11	November	3 (3.85)	2 (2.56)
12	December	2 (2.56)	2 (2.56)
	Total	78 (100.00)	31 (39.74)

Table No. 7 : Area wise distribution			
01.01.96 to 31.12.96			
Sr. No.	Area Wise	No. of Cases (%)	Deaths (%)
1	Rural	53 (67.95)	21 (26.92)
2	Urban	25 (32.05)	10 (12.82)
	Total	78 (100.00)	31 (39.74)

Table No. 2: Poison wise Distribution			
01.01.96 to 31.12.96			
Sr. No.	Name of Poison	No. of Cases (%)	Deaths (%)
1	O.P.C.	30 (38.46)	23 (29.49)
2	Aluminium Phosphide	3 (3.85)	3 (3.85)
3	DDT	6 (7.69)	0 (0.00)
4	Spray Poisoning	22 (28.21)	0 (0.00)
5	Insecticide Poisoning	2 (2.56)	0 (0.00)
6	Endosulphase Poisoning	2 (2.56)	2 (2.56)
7	Drug Poisoning	2 (2.56)	0 (0.00)
8	Alcohol Poisoning	3 (3.85)	1 (1.28)
9	Rat Poisoning	1 (1.28)	1 (1.28)
10	Rogor Poisoning	1 (1.28)	1 (1.28)
11	Quick Phos	0 (0.00)	0 (0.00)
12	Lice Killing Poisoning	0 (0.00)	0 (0.00)
13	Unknown Poisoning	6 (7.69)	0 (0.00)
	Total	78 (100.00)	31 (39.74)

Table No. 3 (Showing Monthly Income)			
Sr. No.	Family Income Rupees/ Month	01.01.96 to 31.12.96	
		No. of Cases (%)	Deaths(%)
1	300	1 (1.28)	0 (0.00)
2	500	20 (25.64)	6 (7.69)
3	600	20 (25.64)	9 (11.54)
4	650	1 (1.28)	0 (0.00)
5	700	17 (21.79)	5 (6.41)
6	800	10 (12.82)	3 (3.85)
7	900	2 (2.56)	3 (3.85)
8	950	1 (1.28)	1 (1.28)
9	1000	1 (1.28)	1 (1.28)
10	1100	1 (1.28)	1 (1.28)
11	1200	2 (2.56)	0 (0.00)
12	1300	1 (1.28)	0 (0.00)
13	1500	0 (0.00)	1 (1.28)
14	1750	1 (1.28)	1 (1.28)
15	2000	0 (0.00)	0 (0.00)
	Total	78 (100.00)	31 (39.74)

Table No. 4 Showing Occupational Status			
Sr. No.	Occupation Status	01.01.96 to 31.12.96	
		No. of Cases (%)	Deaths (%)
	Agricultural	30 (38.46)	10 (12.82)
2	Labourer	43 (55.13)	17 (21.79)
3	Service	4 (5.13)	3 (3.85)
4	Shop Keeper	1 (1.28)	1 (1.28)
5	Students	0 (0.00)	0 (0.00)
6	Unemployed	0 (0.00)	0 (0.00)
	Total	78 (100.00)	31 (39.74)

Table No. 5 Showing Age wise Distribution			
01.01.96 to 31.12.96			
Sr. No.	Age Wise	No. of Cases (%)	Deaths (%)
1	0-10	1 (1.28)	0 (0.00)
2	11 to 20	23 (29.49)	6 (7.69)
3	21 to 30	39 (50.00)	15 (19.23)
4	31 to 40	10 (12.82)	7 (8.97)
5	41 to 50	5 (6.41)	3 (3.85)
	Total	78 (100.00)	31 (39.74)

Table No. 6: Sex Wise Distribution			
01.01.96 to 31.12.96			
Sr. No.	Sex Wise	No. of Cases (%)	Deaths (%)
1	Male	58 (74.36)	21 (26.92)
2	Female	20 (25.64)	10 (12.82)
	Total	78 (100.00)	31 (39.74)

Discussion:

With the green revolution in the State of Punjab, insecticides gained the number one in poisoning status (6). This study shows that poisoning is the commonest cause of agricultural accidental poisoning/Suicidal poisoning in the region of Punjab and rural population is more prone to poisoning due to occupational hazards.

78 cases of poisoning were brought to the Emergency Department of G.G.S. Medical College, Faridkot from 01.01.1996 to 31.12.1996, out of which 31 cases died. This means 39.74% was the mortality rate which was very high.

23 patients died due to OPC poisoning (29.49%), which is highest followed by Endosulphate/Aluminium Phosphide (6.41%). 17 labourers died (21.79%) followed by agriculturist (12.82%). Out of four (4) Service men (PGS) three (3) cases died which constitute 3.85% followed by shopkeepers 1.28%. 15 cases died in the age group of 21-30 years (19.23%) followed by the age group of 31-40 years (8.97%). Males dominated the list with 21 deaths (26.92%).

Rural population tops the list with 21 deaths (26.92%). Lower income group (Rs. 500 to 600 pm) is more affected (19.23 %), and the persons with income from Rs. 1000 to Rs. 2000 per month is the least affected (5.12%).

Conclusion:

It is the ugly mark on face of humanity that the persons who work hard i.e. Agriculturist and Laborer are most sufferer of poisoning whatever cause it may be. A number of non-fatal cases have been recorded in persons handling fruits sprayed with an organic phosphorus insecticide. A number of accidental deaths through contamination and leakage of these compounds to edible commodities have also been recorded (Kerala food poisoning cases in India). Workers engaged in the manufacturing, packing, or spraying are at special risk of accidental poisoning. [4]

When we know from different studies that rural males are most prone to poisoning probably due to occupational hazard being one of the factors, extension education should be focused on this group for prevention. [7]

It is clearly evident from the above figures that the agriculture and related profession that plays pivotal role in these cases of poisoning. So it is the duty of general public, N.G.O's, Government and Doctors to educate this venerable portion of society.

OPCs, Aluminium Phosphide and other spray poisonings can be restricted by having a control on their sale and distribution. The preventive and educational measures can be more effectively designed and implemented if epidemiological data derived from the poison information centers are utilized [10]. Young adults can be checked by Psychological counseling by talking their problems sympathetically and on humanitarian grounds.

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Original research paper

A study of fingerprints in relation to gender and blood group

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Abstract

Fingerprint evidence is undoubtedly the most reliable and acceptable evidence till date in the court of law. Due to the immense potential of fingerprints as an effective method of identification an attempt has been made in the present work to analyze their correlation with gender and blood group of an individual. This prospective study was carried out over a period of 2 months among 200 medical students (100 male & 100 female) belonging to the age group 18- 25 of Kasturba Medical College, Mangalore, India. Results show that each finger print is unique; loops are the most commonly occurring fingerprint pattern while arches are the least common. Males have a higher incidence of whorls and females have a higher incidence of loops. Loops are predominant in blood group A, B, AB and O in both Rh positive and Rh negative individuals except in O negative where whorls are more common. We can conclude that there is an association between distribution of fingerprint patterns, blood group and gender and thus prediction of gender and blood group of a person is possible based on his fingerprint pattern.

Key Words: Fingerprints, Gender, Blood Groups

Introduction:

Identity is a set of physical characteristics, functional or psychic, normal or pathological that defines an individual. Recently, there has been an increased interest in biometric technologies that is human identification based on one's individual features. The various identification data used are fingerprints, handwriting, bite marks, DNA fingerprinting etc. [1] Fingerprints are constant and individualistic and form the most reliable criteria for identification. [2], [3]

A fingerprint is an impression of the friction ridges of all part of the finger. A friction ridge is a raised portion of the epidermis on the digits or on the palmar and plantar skin, consisting of one or more connected ridge units of friction ridge skin. Fingerprints may be deposited in natural secretions from the eccrine glands present in friction ridge skin or they may be made by ink or other contaminants transferred from the peaks of friction skin ridges to a relatively smooth surface.

Fingerprint patterns are genotypically determined and remain unchanged from birth till death. [4] Fingerprints collected at a crime scene can be used to identify suspects, victims and other persons who touched the surface, fingerprint scans can be used to validate electronic registration, cashless catering and library access especially in schools and colleges.

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The secretions in the fingerprints contain residues various chemicals and their metabolites which can be detected and used for the forensic purposes. [2]

Due to the immense potential of fingerprints as an effective method of identification an attempt has been made in the present work to analyze their correlation with gender and blood group of an individual. This correlation between fingerprint pattern and these parameters may help in using fingerprints as an important aid in sex and blood group determination and vice versa, thus, enhancing the authenticity of fingerprints in detection of crime and criminals.

Materials and Methods:

After obtaining clearance from institutional ethics committee, this prospective study was carried out over a period of two months among medical students of Kasturba Medical College, Mangalore. Total 200 students (100 male & 100 female) belonging to the age group 18- 25 voluntarily participated in the study.

Students with permanent scars on their fingers or thumbs, with any hand deformities due to injury, birth defect or disease, those having worn fingerprints, extra, webbed or bandaged fingers, were excluded from the study.

Each subject was asked to wash his hands thoroughly with soap and water and dry them using a towel. He was then asked to press his fingertip on the stamp pad and then to the paper to transfer the fingerprint impression. The same method was repeated for all the fingers of both hands. In this way, the plain fingerprints of all the ten digits were taken separately on the respective blocks on the same sheet of paper. Care was taken to avoid sliding of fingers to prevent smudging of the print. After the fingerprints were

acquired, details such as name, sex and age were noted. The details of their blood group were noted from their college identity cards. Each subject was assigned a serial number. The fingerprint patterns were studied with the help of a magnifying lens and were identified as: Loops, Whorls and Arches based on the appearance of ridge lines

according to Henry's system of classification. This system assigns each finger a number according to the order in which it is located in the hand, beginning with the right thumb as number one and ending with the left little finger as number 10. The distribution of dermatoglyphic fingertip patterns in both hands of individuals and its relationship with gender and different ABO and Rh blood groups was evaluated and analysed statistically.

Results

A total of 200 subjects participated in the study out of which 100 were males and 100 were females. Majority of the subjects, 71(35.5%), in the study belonged to blood group O; followed by blood group B, A and AB which were 64 (32%), 56 (28%) and 9(4.5%) respectively. While blood groups A and B were found to be the most common (equally predominant) among males, blood group O was the most commonly seen blood group in females. (Table No. 1)

Maximum 192 (96%) subjects in the study were Rh positive, of which 69(34.5%) belonged to blood group O, 61(30.5%) belonged to blood group B, 53 (26.5%) subjects had blood group A while only 9(4.5%) had blood group AB. Among Rh negative individuals, 3(1.5%) belonged to blood group A, 3(1.5%) to blood group B and 2(1.5%) belonged to blood group O. None of the subjects showed blood group AB negative. (Table No. 2)

Table No. 2 : Distribution of subjects according to Rh factor

Blood Group	Rh positive	Rh negative
A	53(26.5%)	3(1.5%)
B	61(30.5%)	3(1.5%)
AB	9(4.5%)	0
O	69(34.5%)	2(1%)
Total	192(96%)	8(4%)

Fingerprint pattern analyses showed that, loops were the most common pattern in the study 1221(60.95%), followed by whorls 649(32.55%) while arches were present in a smaller percentage (6.5%) of the study group. (Table No. 3)

Table No. 3: General distributions of primary finger print patterns in all fingers of both hands

Pattern of finger-print	Number	Percentage
Loops	1221	60.95%
Whorls	649	32.55%
Arches	130	6.5%
Total	2000	100%

Frequency of loops was highest in both the Rh-positive and Rh- negative subjects of ABO blood groups except O negative blood group where whorls predominate. Incidence of loops varied between 45% (in 'O' negatives) to 80% (in 'A' negatives). Among the subject of different blood groups, blood group A showed highest loops (Rh +ve 63.2% and Rh -ve 80. %). Whorls showed moderate frequency ranging between 10% (in 'A' negatives) to 55% (in 'O' negatives). Arches were least common ranging from 1.11% (in 'AB' positives) to 10% (in 'A' negatives). (Table No.4)

Frequency of loops was found to be higher in females (52.42%) than in males (47.58%) whereas whorls were more frequent in males (55.78%) as compared to females (44.22%). 44.61% of arches were present in males and 55.38% in females. (Table No. 5)

Acknowledgement:

Our Sincere thanks to Kasturba Medical College, Mangalore, India for funding this project and to students of Kasturba Medical College, Mangalore for voluntarily participating in the study.

Table No. 5 Distribution of Pattern of Fingerprints among Males and Females

Type	Male	Female
Loops	581(47.58%)	640(52.42%)
Whorls	362(55.78%)	287(44.22%)
Arches	58(44.61%)	72(55.38%)

Discussion and Conclusion:

The purpose of classifying fingerprints is that they can be filed and retrieved when needed. The various classification systems used throughout the world are based on the pattern of friction ridges seen on pulp of terminal part of all the ten fingers. Single-finger files are kept only for a limited number of known criminals. Consequently, for the most part, it is impossible to make identification from fingerprint files on the basis of a single print found at the scene of a crime. These patterns fall into three general classes called **arches**, **loops**, and **whorls**.

Arches are the simplest patterns and also the rarest. There are two types: plain arches and tented arches. In both types the ridge lines flow into the print from one side, rise in the middle of the pattern, and flow out to the other side of the print. Loops are formed by ridge lines that flow in from one side of the print, sweep up in the center like a tented arch, and then curve back around and flow out or tend to flow out on the side from where they entered. Loops are designated as being either radial or ulnar, depending on which side of the finger the lines enter. The loop is the most common of all the patterns. There are four different whorl patterns: the plain whorl, the central pocket loop, the double loop, and the accidental whorl. Their common features are that

they have at least two deltas and one or more of the ridge lines curves around the core to

form a circle or spiral or other rounded, constantly curving form. The accidental whorl can be any pattern or combination of patterns that does not fit into any of the above classifications. The term "**Composite**" is used to describe such patterns. Positive identification using fingerprints can be established only if 16 to 20 points of similarity exist in the minutiae. [3, 4, 5]

The present study shows that there is an association between distribution of fingerprint patterns, blood group and gender. Majority of the subjects in the study belonged to blood group O; followed by blood group B, A and AB. Majority of subjects (96%) were Rh positive while only 4 % were Rh negative. The general distribution pattern of the primary fingerprint was of the same order in individuals with A, B, AB and O blood groups i.e high frequency of loops, moderate of whorls and low of arches. This is in accordance with the study conducted by Bharadwaja et al. [6] Similar findings were seen in Rh-positive and Rh-negative individuals except in blood group O negative where whorls predominated. Bharadwaja et al conducted a study during 2000-2001 on 300 medical students with different ABO blood groups in Rajasthan which revealed that individuals with blood group A have more of loops, while that of blood group AB had more of whorls. [6] In the present study it was found that blood group A had a higher frequency of loops but Blood group AB was not associated with a predominance of whorls as was seen in the above mentioned study. Present study also revealed that whorls were more common in blood group O (consistent with the study conducted by Sharma et al), [7] and arches in blood group A.

While blood groups A and B were found to be the most common (equally predominant) among males, blood group O was the most commonly seen blood group in females. The present study also reveals that frequency of loops is greater in females as compared to a higher frequency of whorls in males. Arches were found to be more frequent in females. A thorough search of literature

has not revealed any previous studies emphasizing on the relation between fingerprints and gender.

The findings of the study can be concluded as follows:

- Each fingerprint is unique hence it can be very effectively used as an evidence for identification in the court of law.
- Loops are the most commonly occurring fingerprint pattern and Arches are the least common.
- Blood group O positive is the most common and A negative is the rarest.
- Loops are predominant in blood group A, B, AB and O in both Rh positive and Rh negative indi-

viduals except in O negative where whorls are more common.

- Whorls are more common in blood group O negative.
- Loops and arches are maximum seen in blood group A while whorls are more common in blood group O.
- Blood groups A and B were found to be the most common (equally predominant) among males, blood group O was the most commonly seen blood group in females.
- Males have a higher incidence of whorls and females have a higher incidence of loops.

Thus prediction of gender and blood group of a person is possible based on his fingerprint pattern. Similar studies should be conducted on a larger sample so as to increase the accuracy of prediction.

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Table No. 1
Distribution of subjects according to sex and blood groups

Sex	A	B	AB	O	Total
Male	33 (16.5%)	33 (16.5%)	4 (2%)	30 (15%)	100
Female	23 (11.5%)	31 (15.5%)	5 (2.5%)	41 (20.5%)	100
Total	56 (28%)	64 (32%)	9 (4.5%)	71 (35.5%)	200

Table No. 4
Distribution of pattern of fingerprints among A, B, O and Rh blood groups

Type of finger print	Blood Group A		Blood Group B		Blood Group AB		Blood Group O	
	Rh+ve	Rh-ve	Rh+ve	Rh-ve	Rh+ve	Rh-ve	Rh+ve	Rh-ve
Loops	335 (63.2%)	24 (80%)	383 (62.79%)	23 (76.67%)	62 (68.87%)	0	385 (55.79%)	9 (45%)
Whorls	168 (31.7%)	3 (10%)	188 (30.82%)	6 (20%)	27 (30%)	0	246 (35.65%)	11 (55%)
Arches	27 (5.09%)	3 (10%)	39 (6.39%)	1 (3.33%)	1 (1.11%)	0	59 (8.6%)	0
Total	530	30	610	30	90	0	690	20

Original research paper

Pregnancy-related deaths: A Three-year retrospective study

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Abstract

Over 600000 maternal deaths occur each year worldwide. In India, many women die due to pregnancy-related complications. The present study was undertaken with a view to determine factors causing maternal deaths, to recognize cause of death and to discuss the utility of autopsy record as a useful and adjunct data source for ascertainment of maternal deaths. A total 21 pregnancy-related deaths occurring during 2004 to 2006 were studied and their age ranged from 21 year to 35 year. It was observed that maximum numbers of deaths were recorded in the age group of 21-25 years (52.38%). Analyzing the pregnancy outcome, live birth to child were given by 9 females and 1 died during abortion. Hemorrhage remains leading cause of death (38.09%) followed by indirect causes (23.80%), undetermined (19.04%), sepsis (9.52%) and postpartum pre-eclamptic shock (9.52%). Death records remain an important source of maternal deaths however, using only death certificate suffers from drawback because many times cause of death is not mentioned, especially if death incurred medicolegal autopsy. Under such circumstances review of autopsy reports may prove useful in the ascertainment of maternal deaths and elucidating the emerging trends.

Key Words: Pregnancy, Maternal Mortality, Death, Autopsy

Introduction

Over 600000 maternal deaths occur each year worldwide. [1] In India, many women dies due to pregnancy-related complications and those who survive suffer from severe maternal morbidity. [2] Maternal death rate in India was 1000 per 100000 live births in 1959 and it decreased to 301 per 100000 live births in 2003. [3] Albeit, the risk of death from complications of pregnancy has decreased during past few decades, it continues to haunt Obstetricians. Maternal death has been used traditionally as a measure of quality of health care in a community. [4]

It is hard to find precise reporting of maternal death because this requires information about deaths among women of reproductive age, pregnancy status at or near the time of death and the medical cause of death. All three components can be difficult to measure accurately, especially in settings where deaths are not comprehensively reported. [5]

The Forensic Pathologist plays a crucial role in identifying these cases and identifying the cause of death. Review of autopsy reports can prove to be one of the useful sources to identify pregnancy-related deaths and elucidating the emerging trends.

The present study was undertaken with a view to determine factors causing maternal deaths, to recognize cause of death and to discuss the utility of autopsy record as a useful and adjunct data source for ascertainment of maternal deaths.

Methods:

All medicolegal cases referred to Dept. of Forensic Medicine, Govt. Medical College, Nagpur over the 3-year period i.e. from January 2004 to December 2006 were reviewed for identification of maternal deaths. We include all cases of deaths resulting from medical cause related to pregnancy that occur during pregnancy, at delivery or within 42 days of delivery or termination. During this period, total 21 cases were autopsied. The cases were analyzed in respect to maternal age, past medical history, previous pregnancies, pregnancy outcome, antenatal care, and gestational age, place of delivery, maternal autopsy findings and cause of death.

Results:

A total 21 pregnancy-related deaths occurring during 2004 to 2006 were identified. Their age ranged from 21 year to 35 year with mean age of 26.47 year. It was observed that maximum numbers of deaths were recorded in the age group of 21-25 years (52.38%) (Table No. 1). Analyzing the pregnancy outcome (Table 2), live birth to child was given by nine females and one died during abortion. The obstetrical characteristics of maternal deaths are mentioned in Table No. 3. Table No. 4 gives gestational age of women who were undelivered. Four deaths occur in immediate to first day period after delivery (Table No. 5). In eight patients, no significant past history could be known whereas eight fe-

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males were having pre-eclampsia, four anemias, one each had rheumatic heart disease and sickle cell disease (Table No. 6). Two patients had history of tuberculosis whereas three female had history of previous abortion. Table No. 7 provides cause of death. Hemorrhage remains leading cause of death (38.09%) followed by indirect causes (23.80%), undetermined (19.04%), sepsis (9.52%) and postpartum pre-eclamptic shock (9.52%).

Discussion:

Complete and accurate identification of all deaths associated with pregnancy is a critical first step in the prevention of such deaths. Only by having a clear understanding of the changing trends and the magnitude of pregnancy-related mortality can be comprehensive prevention strategies be formulated to prevent these unanticipated deaths among women. [6] The obstetrical practice and the risk profile of pregnancy women have changed over the years, particularly in developed world. [7]

Thromboembolism remains the leading cause of maternal death in developed countries followed by pregnancy-induced hypertension or pre-eclampsia and eclampsia. [5] The Maryland study reported the cause of maternal deaths as – pre-eclampsia/eclampsia (22.2%), postpartum hemorrhage/obstetric shock (22.2%), pulmonary complications (14%), blood clot &/or amniotic fluid embolism (8.1%) and anesthesia-related complications (5.2%). [8]

Analyzing the cause of death in the present study, hemorrhage remains the most common cause followed by indirect causes and sepsis. The findings are in accordance with Khosla et al & Sinha. [2, 9] In spite of obtaining adequate history, clinical record wherever applicable, adequate microscopy and toxicological screening, the cause of death could not be ascertained in four cases. The reasons remain speculative. Amongst these cases, two cases died before delivery and two cases died after delivery. Hemorrhage accounted for eight deaths and amongst them, five manifests disseminated intravascular coagulation (DIC).

DIC is a consumption coagulopathy and is a key contributor to primary postpartum hemorrhage. About 50% individuals with DIC are obstetric patients having complications of pregnancy. Because of hypercoagulable state in pregnancy, presence of any provocative factor (such as abruptio placenta, sepsis, liquor amnii embolism, severe pre-eclampsia, eclampsia & HELLP syndrome etc) can easily upset the normal balance culminating into disseminated intravascular coagulopathy. [10] Other causes of hemorrhage in present study were retained placenta and rupture of uterus and are in accordance with Patel et al and Sengupta et al. [11, 12]

Hypertensive disorder in pregnancy, especially pre-eclampsia, increases perinatal mortality rate by five folds. [13] Pre-eclampsia is characterized by hypertension, proteinuria and oedema. Eclampsia is the occurrence of generalized convulsions during pregnancy, labor or within seven days of delivery. Two cases exhibits feature of postpartum pre-eclamptic shock. In such state, severe postpartum hypotension in patients with pre-eclampsia can occur and result in maternal death. The cause of this syndrome remains unclear however postpartum hypotension was unrelated to blood loss and gross autopsy examination failed to reveal cause of death. Such cases demonstrate ischemic damage to major organs as a result of acute and prolonged hypotension.

Kidneys show swelling of glomerular endothelial cells with occasional occlusion of the capillary lumens. The liver may show periportal hemorrhage and infarction and the vessels may be hyalinized or thrombosed. In more than 50% of cases, subendocardial “flame” hemorrhages may be evident. [5, 14] These cases demonstrate the necessity for obstetricians to be aware of the possibilities for such complications among patients with pre-eclampsia. Moreover, attendants of such patient may entangle obstetricians and legal suit for compensation may be filed for providing below standard of care because of unexplained nature of death.

Pulmonary disease and cardiac disorders are considered as significant contributor to maternal mortality. In the present series, we have noted two deaths by pulmonary tuberculosis and one by rheumatic heart disease. In a study conducted by Venkatraman et al and Yadav et al, rheumatic heart disease constitutes the commonest cause of heart disease in pregnancy and accounted for 83% and 95% respectively. [15, 16]

During pregnancy, pulmonary tuberculosis is more common as compared to extra-pulmonary tuberculosis. Tuberculosis has important implications for both mother and child. The stress of pregnancy, especially in association with poor nutritional status, immuno-deficient state, and co-existent diseases, flares up tuberculosis. [17]

According to WHO, maternal death means “death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and the site of pregnancy, from any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental causes”. Death records remain an important source of maternal deaths. Using death certificate as sole source suffers from drawback because many times cause of death is not mentioned, especially if death incurred medico-legal autopsy. Often only cardio-respiratory arrest was furnished as a cause of death. In past, studies had shown that physicians completing death records following a maternal death fail to report that the woman

was pregnant or had recent pregnancy in 50% or more of these cases. [18]

Such mistakes may result in misclassification of the underlying cause of death. If such deaths are not identified as maternal deaths then they may not be included in the calculation of maternal mortality rates. Therefore traditional system of collecting data on maternal mortality cannot identify all pregnancy-related deaths. The Maryland study showed that only a small proportion of pregnancy-associated deaths can be identified from death certificate alone and that comprehensive identification of pregnancy-associated death requires collection of data from additional sources, including autopsy records and linkage of death records with birth and fetal death record. [19] Thus the use of multiple data sources substantially enhances pregnancy mortality surveillance. [6] Review of autopsy reports may prove to be useful approach in increasing the ascertainment of maternal deaths.

Conclusion:

Maternal death is a measure of quality of health care in a community. Though, the risk of death from complications of pregnancy has decreased during past few decades in India, it continues to remain higher than developed countries. It was observed that maximum numbers of deaths were recorded in the age group of 21-25 years (52.38%). Hemorrhage remains the leading cause of death followed by indirect causes, sepsis and postpartum pre-eclamptic shock. In 19.04% cases, no cause of death could be determined. The forensic pathologist plays a crucial role in identifying maternal deaths and labeling cause of death. Review of autopsy reports can prove to be one of the useful sources to identify pregnancy-related deaths and elucidating the emerging trends.

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Table No. 1**Distribution of Cases According to Age Group**

Age group (years)	No. of cases
21-25	11 (52.38%)
26-30	8 (38.09%)
31-35	2 (9.52%)

Table No. 2 Pregnancy Outcome

Pregnancy outcome	No. of cases
Live birth	9 (42.85%)
Abortion	1 (4.76%)
Undelivered	11 (52.38%)

Table No. 3: Obstetrical Characteristics

Prenatal care
<ul style="list-style-type: none"> Received – 14 cases (66.66%) Not-received – 7 cases (33.33%)
Gravidity
<ul style="list-style-type: none"> Primiparous – 12 cases (57.14%) Multiparous – 9 cases (42.85%)
Mode of delivery (n = 9)
<ul style="list-style-type: none"> Vaginal – 6 cases (66.66%) Cesarean – 3 cases (33.33%)
Place of delivery (n = 9)
<ul style="list-style-type: none"> Hospital – 7 cases (77.77%) Home – 2 cases (22.22%) Post-tubectomy – 4 cases (19.04%)

Table No. 4: Period of Gestation in Undelivered Subjects (n = 11)

Gestation period	No. of cases
12 weeks	2 (18.18%)
24 weeks	1 (9.09%)
32 weeks	6 (54.54%)
36 weeks	2 (18.18%)

Table No. 5: Death of Patients after Delivery (n = 9)

Period	No. of cases
Immediate	2 (22.22%)
Day 1	2 (22.22%)
Day 2	1 (11.11%)
Day 4	1 (11.11%)
Day 5	1 (11.11%)
Day 10	1 (11.11%)
Day 30	1 (11.11%)

Table No. 6: Past Medical History

History	No. of cases
Not significant	8 (38.09%)
Eclampsia	8 (38.09%)
Anemia	4 (19.04%)
Rheumatic heart disease	1 (4.76%)
Tuberculosis	2 (9.52%)
Sickle cell disease	1 (4.76%)
Abortion	3 (14.28%)

Table No. 7: Cause of Death

Cause of death	No. of cases
Hemorrhage:	8 (38.09%)
<ul style="list-style-type: none"> Rupture of uterus – 1 case Retained placenta - 2 cases DIC – 5 cases 	
<ul style="list-style-type: none"> Sepsis 	2 (9.52%)
<ul style="list-style-type: none"> Postpartum pre-eclamptic shock 	2 (9.52%)
<ul style="list-style-type: none"> Undetermined 	4 (19.04%)
Other indirect causes	5 (23.80%)
<ul style="list-style-type: none"> Tuberculosis – 2 cases Meningitis – 1 case Sickle cell disease – 1 case Rheumatic heart disease - 1 case 	

Original research paper

Renal Pathological Changes in Poisonous Snake Bite

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Abstract

There are more than 3000 species of snakes in the world but only about 350 are venomous. With approximately 10000 deaths occurring annually in India, a large proportion of snake bites occur when people work barefoot in the fields or while walking at night or early morning through fields or along roads.

Although, nearly all snakes with medical relevance can induce nephropathy, leading to Acute Renal Failure (ARF), it is unusual except with bites by Russell's Viper, E. Carinatus and members of the genera Crotalus and Bothrops. In India, ARF is mostly associated with Russell's Viper and E. Carinatus bites. The incidence of ARF following Russell's Viper or E. Carinatus bites is 13-32% in India.

A histopathological study was conducted on renal autopsy specimens from those subjects who were admitted to IPGME&R and SNP Hospital, Kolkata as a result of development of acute renal failure following poisonous snake bite. Acute tubular necrosis (100%) and Acute cortical necrosis (25%) were the most significant renal histopathological changes. Glomerular lesions were also present in 30% of cases.

Key Words: Snake Bite, Renal Histopathological Change, Acute Tubular Necrosis, Cortical Necrosis, Acute Renal Failure

Introduction:

Snake bite poisoning is known to man since antiquity. References to snake bite are found in the oldest medical writings. While the precise figures for global snake bite epidemiology is not available, best estimates suggest that there are more than 2.5 million venomous snake bites annually, with greater than 125000 deaths. The risk is highest in the tropics and West Africa, predominantly among rural population.

Snake venoms are a mixture of complex toxins that may be independent, synergistic or antagonistic. The major groups of toxins are: neurotoxins, myotoxins, haemotoxins and nephrotoxins. It is important to understand that the actual mixture of toxins in the venom will vary by individual species and also by age and season.

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Equally, the quantity of venom injected in a bite is highly variable. Ineffective or 'dry bites', account for more than 50% of all bites.

The most prevalent areas for Russell's Viper, E. Carinatus and members of the genera Crotalus and Bothrops snakes are Asia and South America. Snake bite by these can induce nephropathy leading to Acute Renal Failure (ARF). In India, ARF is mostly associated with Russell's Viper and E. Carinatus bites. In our Country, the incidence of ARF following Russell's Viper or E. Carinatus bites is 13-32%. [1]

Materials and Methods:

A prospective study was conducted on 20 lethal cases of snake bite who were referred from the peripheral districts of West Bengal to IPGME&R and SNP Hospital, Kolkata for peritoneal and/or hemodialysis as a result of development of ARF following snake bite. The period of study is from Sept.'09 to Jan.'10. The victims were 14 males and 6 females; average age was 31.2 years, the youngest subject was 8 years old and the oldest 62 years old. Only those cases that developed ARF following snake bite were included in the study.

During postmortem examination, the kidneys were collected and preserved in 10% buffered formalin. After standard tissue processing, 3 micron sections were made and were stained by H&E. The slides were then studied under light microscope to detect glomerular and tubular changes.

Observation:

Histopathological changes revealed Acute tubular necrosis and Cortical necrosis as the predominant finding along with glomerular changes in a few cases. Acute tubular necrosis(100%) and Cortical necrosis(25%) were the most significant histopathological changes. Extensive tubular necrosis was seen in all cases of cortical necrosis.

Based on the extent of necrosis and medium sized vessel involvement by thrombosis, cortical necrosis was classified as Diffuse, Focal and Patchy. In our cases only patchy cortical necrosis was present.

Grossly the kidneys were swollen, having a slightly oedematous pale appearance. Cortices were pale and medulla congested with a sharp demarcation at the corticomedullary junction.

Light microscopic changes of acute tubular necrosis were:

- 1) Tubules were dilated and lined by flattened epithelium.
- 2) Cloudy degeneration of tubular epithelium along with frank necrosis and desquamation of necrotic cells from the basement membrane into the lumen in most of the cases.
- 3) Hyaline casts were seen in tubular lumen in a few cases.
- 4) Interstitial oedema, haemorrhage and inflammatory cell infiltration in some cases.

Findings that were present in cases of acute cortical necrosis were:

- 1) Fibrin thrombi in the arterioles in few cases.
- 2) Patchy necrosis of glomerular and tubular elements in some cases.

Glomerular lesions were present in 30% of cases. Glomeruli were enlarged and glomerular tufts were hypercellular. Proliferative glomerulonephritis was present in one case and other cases showed mild mesangial proliferation and diffuse glomerular hypercellularity. Balloning dilatation of glomerular capillary loops, endothelial cell swelling and glomerular hypercellularity was the most significant findings.

Discussion:

Several mechanisms including haemorrhage, hypotension, haemolysis, haemoglobinuria, rhabdomyolysis and disseminated intravascular coagulation (DIC) as well as the direct effect of the venom have been incriminated in the pathogenesis of snake bite-related nephropathy. Among all these mechanisms, the cytotoxic effect of the venom on the kidney is considered to play a major role in the pathogenesis of ARF. [2]

Raab and Kaiser observed a significant increase in urinary alkaline phosphatase and aminopeptidase activities following administration of *Agkistrodon piscivorus* venom in rats and attributed this to the effect of the venom on the tubular epithelial cells. [2] Hypotension, due to bleeding or other factors

such as release of bradykinin or depression of the vasomotor centre, can produce circulatory collapse and ischaemic tubular necrosis. [3, 4, 5]

The presence of fibrin thrombi in renal microvasculature and in the glomerular capillaries, together with the finding of microangiopathic haemolytic anaemia and thrombocytopenia in subjects with cortical necrosis strongly suggests that DIC plays an important role in the pathogenesis of snake bite induced renal changes. [6]

There is evidence that renal blood flow diminishes substantially in toxic acute tubular necrosis, apparently as a result of arteriolar vasoconstriction. Many investigators believe that tubular obstructive casts also play an important role in the pathogenesis of ARF. This obstruction would increase intratubular pressure, contributing to the backleak of tubular fluid in the interstitium through damaged tubular epithelium. This tubular backleak causes interstitial oedema which further impairs renal function.

Viperine snake venom contains proteases, aminoacid esterases and non-enzymatic protein haemorrhagins as their constituents. [7] With small doses of the venom, the procoagulant action predominates and intravascular coagulation and cortical necrosis results. Consumptive coagulopathy and bleeding diathesis results with higher doses. [8] Primary excessive fibrinolysis is rarely observed. [9]

The presence of glomerular lesion in envenomated subjects aroused curiosity and controversy over the past few decades. In 1960, Stein Beck [10] described patients who developed nephrotic syndrome following poisonous snake bite. However, the histopathology was not described. Sant Puraundare [11, 12, 13] and Tembe and Sant [13] described toxic proliferative glomerulitis with proliferation and swelling of endothelial cells in 6 and 3 cases respectively.

In their experimental studies too (rabbit and Bonnet monkeys) injection of *Echis carinata* venom produced endothelial swelling (25%) and proliferation (30%). The earliest changes were seen by them within 12 hours of envenomation. However, sections studied by them appear to be 6 microns in thickness, the ideal section thickness for studying renal histopathological changes being 2-3 microns. This is due to the fact that increased thickness of the tissue sections would give an erroneous impression of proliferation due to layering of nuclei.

Though it is believed that it is difficult to assess renal tubular and glomerular changes from autopsy specimen due to postmortem cellular autolysis, utmost care has been taken during our study to exclude this artefactual finding.



Fig.1 Cut section of the kidney showing Pale cortex and congested medulla

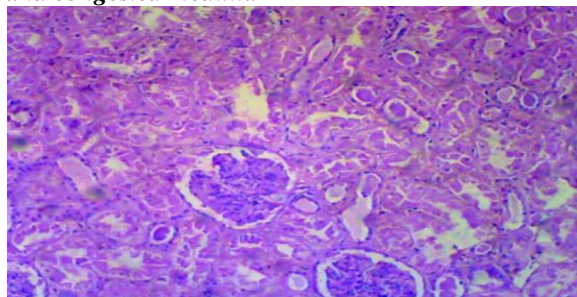


Fig.2 Acute tubular necrosis showing hyaline casts in tubular lumina. [HE X 100]

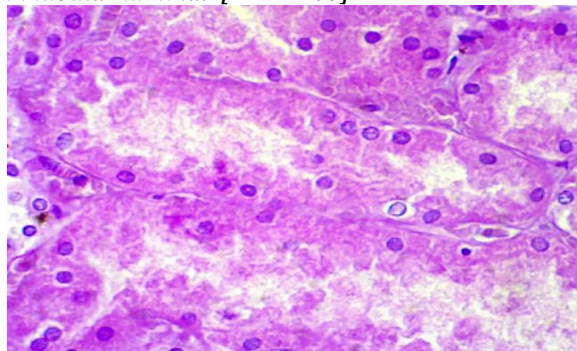


Fig.3 Acute tubular necrosis showing dilatation & sloughing of lining epithelium of tubules [HE X 400]

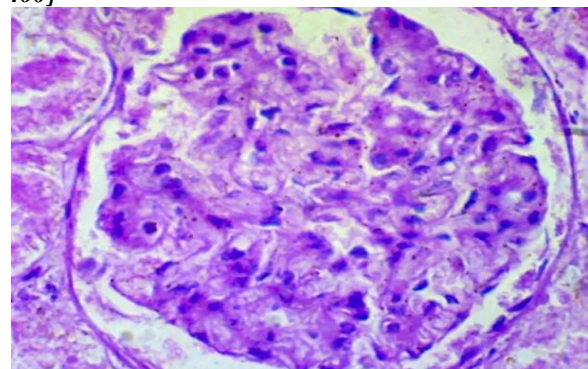


Fig.4 Enlarged glomerulus with hyper-cellular glomerular tuft [HE X 400]

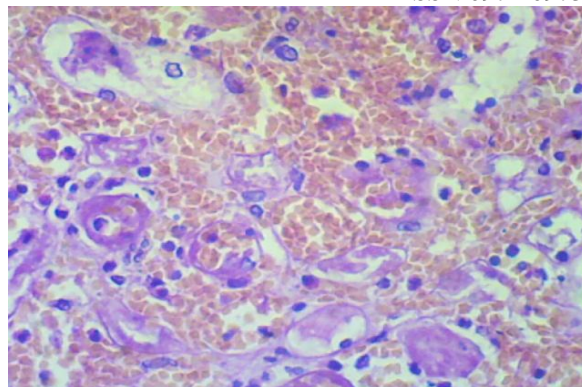


Fig.5 Renal infarct showing necrosis of tubules [HE X 400]

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Original research paper

Gastric Contents in Respiratory Tract

A Diagnostic Dilemma at Autopsy

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Abstract

Gastric contents in the respiratory tract are commonly found at postmortem in acute alcoholism, occasionally during a fit of epilepsy and in dead bodies that have started decomposing. Quite infrequently it may be found in fresh bodies that have undergone sudden unexpected and unattended death leading to a dilemma as to the real cause of death with dearth of any other substantial evidence. Dead body of a 36-year-old lady was brought for postmortem examination with history of unattended and unexpected death while taking bath after her afternoon meal. On gross and histopathological examination, there was no significant finding in the cardiovascular system but respiratory tract contained gastric contents with histopathology confirming vegetable matter in the terminal bronchioles. The conflicting literature on the difference between antemortem aspiration and postmortem spill of gastric contents into the respiratory tract led to a dilemma as to the real cause of death in present case. Dilemmas of the case with difficulties in diagnosis are being presented herewith.

Key Words: Forensic pathology, sudden death, respiratory aspiration, gastric contents, choking

Introduction:

Sudden death can be both natural and unnatural. In sudden natural deaths, the immediate cause of death is usually found in the cardiovascular system [45-50%] followed by the respiratory system [10-15%]. [1] In the respiratory system, choking from mechanical obstruction is one of the causes for sudden and unexplained death. This mechanical obstruction is common due to foreign bodies, food bolus, hemorrhages or acute obstructive lesions.

Regurgitated stomach contents resulting into choking is not a common entity and literature available on death from such choking is also not forthcoming.

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In cases of sudden death, finding of gastric contents in air passages is by no means as significant as the presence of freshly swallowed food.

Gastric contents are commonly found in the larynx, trachea and bronchi at autopsy when no other evidence of aspiration exists and when there is a clear and unconnected cause of death.

Gastric contents in the air passages may reach there from spontaneous agonal regurgitation or during pumping of chest and abdomen during resuscitation attempts. This makes the finding of gastric contents in the respiratory tract less significant. [2]

The finding of small amounts of food material in the airway at autopsy does not indicate that the individual choked to death. One can attribute a death to aspiration only if the air passage below the level of larynx is completely occluded by food. It is rarely seen in medico-legal autopsies and is most common in patients who have impaired functioning of central nervous system. [3]

A large proportion of deaths from choking occur before any possible hypoxic manifestations have time to take effect. These fatalities might be attributed to cardiac arrest, either purely neurogenic or accelerated by excess catecholamine release from the adrenaline response. [2]

Aspiration of vomit, as a cause of death, must be used with great caution unless there is an antemortem medical witness to it. The major exception, however, is acute alcohol intoxication, where if copious inhalation of stomach contents right down to

the secondary bronchi is confirmed, then in the absence of significant natural disease, injury or other toxicity, choking associated with a high blood alcohol level may reasonably be incriminated as the cause. However, it is not an autopsy diagnosis to be made lightly. [2]

Case:

Dead body of a 36-year-old unmarried lady was brought for postmortem examination to the mortuary of Karnataka Lingayat Education Society's [KLES] Dr. Prabhakar Kore Hospital and Medical Research Centre, Belgaum. The lady was brought dead to the casualty of the hospital. The deceased was unmarried and was living with her elder sister. History elicitation revealed that the deceased had gone to the bathroom to wash clothes and take bath at around 3:30 pm, about two-and-a-half hours after taking her lunch. When she did not come out for long, her sister became anxious and knocked on the bathroom door but there was no reply. She then called her neighbors and broke open the bathroom window, as the door was bolted from inside, to find her sister lying on the floor in prone position, without clothes. Considering her to be unconscious but alive, she was rushed to the hospital at around 4:30 pm where the duty doctor declared her as 'brought dead'. On inquiring about the use of geyser, it was stated that there was no electricity at home and so there was no question of her using the electric geyser and getting electrocuted. The tap was closed and the clothes had been washed. The deceased hadn't taken her bath as her body was dry. There was no vomitus on the floor too.

The postmortem was started at 8:40 pm on the same day. There was no history of previous episodes of unconsciousness or being on any medication currently. She had a history of pain in epigastrium and bouts of regurgitation off and on for which she had taken medicines long back. The deceased was unmarried (unusual for her age in this country) and the possibility of suicide using poison was also kept in mind.

External examination was essentially negative with no significant finding. Postmortem lividity was of the usual bluish red color but with a dark hue. The finger nails had violet nail paint on them and hence, bluish discoloration of finger nails could not be ascertained.

Internal examination did not reveal any significant finding in the cranial, chest and abdominal cavity. Heart did not show any sign of recent ischemia and coronaries were grossly patent. Yellowish green fluid was present in the whole respiratory tract similar to that present in the stomach. Left lung was adherent to the chest wall and it weighed 120g more than right lung which weighed 310g. All the viscera were congested. The uterus grossly appeared non-

gravid with the ovaries showing no sign of a corpus luteum.

Viscera were sent for chemical analysis [whole stomach and piece of small intestine with contents, piece of liver and half of each kidney, blood] to rule out poisoning; tissues from all the organs [whole heart, both lungs, liver, half of each kidney, whole spleen, piece of each cerebral hemisphere, both cerebellar hemispheres with brain stem, whole pancreas, both supra-renal glands and uterus with both fallopian tubes and ovaries] were taken for histopathology and splenic swab was collected under sterile and aseptic precautions for microbiological examination. Opinion regarding the cause of death was deferred for receipt of these laboratory reports.

The laboratory investigations were essentially negative. There was no evidence of recent or old myocardial infarction at histopathology. It, however, showed the presence of vegetable matter in the terminal bronchioles in sections taken from all the lobes of both lungs as well as in some alveoli. There was very mild inflammatory reaction associated around the foci of vegetable matter in the bronchioles as well as the alveoli. At many places, the alveoli were expanded with broken septa. Histopathology of uterus with fallopian tubes and ovaries was unremarkable. Keeping in mind the history of the case and gross postmortem findings as well as the findings of microscopic examination, the dilemma was either to label the case as one of death from choking due to aspiration of gastric contents or consider it as a negative autopsy. A good amount of literature search was done and considering the significant microscopic findings [& no other positive finding], the opinion regarding cause of death was given as "choking from aspiration of gastric contents".

Discussion:

The number of deaths that are not medically attended and are thus brought for postmortem examination is not small in a country like India. Many a times, bodies are brought for examination due to suspicion of manner of death contrary to the reality. It is these sudden natural or unnatural deaths that are of concern to a forensic pathologist because they can easily be excluded/diagnosed resulting in proper administration of justice.

In the present case, there was no macroscopic demonstrable lesion to explain sudden death in the 36-year-old lady. No positive finding was observed except for the presence of gastric contents in the entire respiratory tract. This was an unusual finding considering the fact that decomposition had not set in [postmortem was done within 4-5 hours of death; body having been kept in refrigerator till then] and so it cannot be easily overlooked as a postmortem artifact. The possibility of deceased dying from recent myocardial infarction could not be substantiated due

to lack of any evidence. Even if the patient had suffered from myocardial ischemia, it did not have manifested because of sudden death within minutes. In such a scenario, without any other evidence towards a cause of death, death can only be attributed to the aspiration of gastric contents with the backdrop of conflicting medical literature.

In the present case, weight of the left lung was more than that of the right lung. In case of aspiration, the gastric contents normally should have entered more in the right lung because of the anatomical design of right bronchus, being more in line with the trachea. But this is possible only in the standing posture. With sudden entrance of a foreign material into the respiratory tract, the posture assumed cannot be defined and so in case of fall in the position in which she was found, most of the material might have entered the left side rather than right side thus increasing its weight. Grossly both the lungs were taut. Histopathology report had a significant positive finding of presence of vegetable matter in the terminal bronchioles and alveoli, in nearly all sections of both lungs. These foci were surrounded with minimal inflammatory cells. The poor inflammatory response, in an antemortem aspiration, can be explained by occurrence of sudden death from choking leaving no time for inflammation to develop. The alveoli were found expanded along with broken septa. This is possible because of forced expiratory efforts and coughing as a result of obstruction in the respiratory passages.

With conflicting literature available, there was a dilemma regarding the importance to be given to gastric contents found in the respiratory tract at postmortem examination in the present case. According to Saukko and Knight, there is no reliable method of distinguishing agonal or even early postmortem over-spill from true vital aspiration unless clinical or other witnessed evidence is available. [2]

On the other hand, according to Modi, vomited matter may regurgitate into the larynx and by inspiratory efforts may be aspirated into the smaller bronchioles so as to result in suffocation. If there is postmortem spill, these contents cannot reach the smaller bronchi and bronchioles. [5]

Several cases have been reported by Polson et al, wherein witnessed cases of sudden death showed a quantity of vegetable material, part of the lunch, obstructing the air passages downwards from the larynx to the intrapulmonary bronchi of both the lungs at postmortem examination. In all such cases, true signs of asphyxia were absent and death had been attributed to vagal inhibition. [4]

There was no history of her suffering from any disease in the immediate past except for the ga-

stritis and episodes of burning pain in chest after meals suggestive of gastric regurgitation. Hence the only manner in which she could have died is accidental.

She might have vomited and subsequently aspirated the vomit. The exact triggering factor for gastric regurgitation and subsequent aspiration could not be ascertained and can only be hypothesized.

In the present case, there was no eyewitness to the terminal event. The deceased had gone to take bath within a couple of hours of her lunch. The incident occurred while she was about to take bath as she had taken her clothes off. Before taking her bath, she had washed all her clothes. This is done in squatting posture with buckets of clothes in front. This results in pressure over the abdomen while leaning forward to take clothes from the bucket. The deceased, while washing her clothes, probably from application of pressure onto her epigastric region, regurgitated and subsequently aspirated the stomach contents into her respiratory tract. With the sudden gush, she must have fallen forwards, resulting into a prone posture [in which she was discovered]. The sudden entry of foreign material could have resulted into neurogenic cardiac arrest leading to her death. [2] The vegetable matter being present in the terminal bronchioles and alveoli along with the minimal inflammatory reaction surrounding it substantiated the aspiration to be antemortem and recent and the only evidence of the cause of death in the present case.

It is not customary to opine about the manner of death in India and such opinion hence was not given in this case. However, the death could not be attributed to suicide because of the circumstances in which the body was found [the lady being naked and any prospective female suicide victim would never want herself to be discovered without her clothes after her death]; [5] similarly it could not be labeled as homicide as the bathroom was closed from inside. Moreover, there was nothing suggestive at autopsy to suspect these manners of death. Whether such autopsy can be labeled as negative autopsy or a questionable cause of death can be given is a matter of discussion.

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Original research paper

Significance of Weight and Maximum Length as an Objective for Sexing of Unknown Femora A Research Study in Punjab

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Abstract

Identification of sex from the skeleton is an important demographic assessment in medico legal investigations. Length and weight of femur are the two reliable skeletal elements for sex determination. Large number of reports does exist about the sex determination from long bones such as femur anthropological and forensic contexts. It is a very well known factor that skeletal dimensions and standards of skeletal identification do vary with different populations. The present study aims at obtaining results from two femoral dimensions in Punjab cadavers to develop standards in determination of sex. In case of femur maximum length and weight are one of the parameters significantly important in sex dimorphism. The matter being of medico legal importance, an attempt was made by forensic experts and anatomists of SGRDIMSAR, Sri Amritsar to carry out various measurements to differentiate the sex of the femora. This was done in femora of either known sex. The diseased femora were rejected. The aim of this study is to prove that the weight and the Maximum length of femur will significantly differentiate the sex of the femora and this fact will help to arrive at an objective process for the sexing of femora of unknown sex.

Key Words: Forensic Anthropology, Physical Anthropology, Femur, Sex Determination, Human Identification

Introduction:

The correct determination of sex is a key aspect in the analysis of a skeleton from forensic and archaeological contexts. For this purpose, the skull and the pelvis are two highly reliable skeletal elements which can predict the sex accurately. [1]

It has long been customary among anatomists, anthropologists and forensic experts to judge the sex of the skeletal material by non-metric observations. Lately, sexual divergence has been based upon actual measurements in different bones. [2]

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Among the long bones, the femur received a special attention by the researchers for the usage of femur in sex determination. Fragments of skeletal remains of femur were used to determine the sex. [3]

It is a known fact that standards of skeletal identification vary among different population and the same cannot be used for another population. Male femora can be sexed with high degree of accuracy while there is ambiguity in sexing the female femora. The studies on sexual dimorphism are based on the simple principle that axial skeleton weight of male is relatively and absolutely heavier than that of females. [4]

The other factor which makes the weight an indentation on the femur is the modification of the female pelvis with respect to its specialized function of reproduction. It is also a known factor that, stress and strain experienced by the femur is different in male and female.

The present investigation aims at obtaining results from two femoral dimensions in SGRDIMSAR, Amritsar medical college to develop standards in determination of sex.

Material and Methods:

Data for this study includes 40 adult dry femora of known sex, in which 28 belonged to male skeleton and 12 were from female skeleton. Among the male femora, 14 were right and 14 were left. In females 6 were right and 6 were left. The femora are

The following parameters were studied in the 40 femora.

1. Maximum length: Greatest distance between lower end of medial condyle and upper end of head of femur using osteometric board.
2. Weight of the femur.

Mean and standard deviation of the measurements for the above parameters are calculated to nearest mm and their statistical analysis was done. T-test was used as statistical application with p value < 0.0001.

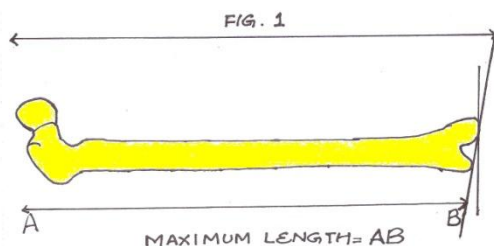


Figure 1:

- **Maximum Length of Femur 'AB'**
- **Distance from the most superior point on the head of the femur to the most inferior point on the distal condyle**
- **Osteometric board is the instrument used**

Result:

The mean and standard deviation of the above parameters in males and females and the right and left sides are presented in **Table II**. No significant differences were observed on right and left sides in both sexes, however significant difference was observed between males and females in both parameters. Maximum length of femur in males was 43.75 ± 0.16 and in females 39.81 ± 1.40 . Weight in males was 449.06 ± 9.05 and in females 349.41 ± 11.82 .

Table III shows the consolidated mean and standard deviation of the above parameters in males and females showing the significance for Maximum length $p = <0.0001$ and weight $p = <0.0001$ respectively.

Discussion:

It has been reported by Kate that the **maximum femoral length** is 2cm longer than its trochanteric length. [5] It has widely been recognized that skeletal characteristics vary among populations, and due to this regional variability that each population should have specific standards to optimize the accuracy of identification. Several studies using a variety of measurements and characteristics of the femur have therefore been conducted from all over the world, with varying degrees of accuracy. [6] [4]

Studies on various osteometric data from femur of central India were reported. [7] Long bones are particularly suitable for metric analysis because they have no easily recognizable morphologic indicators of sex. In this regard, the femur has been studied most extensively. These studies have been conducted on the femoral dimensions and sexual dimorphism in different ethnic groups. These studies point out the need to recognize that there are significant size differences between the populations. Such studies were also conducted on populations such as South African whites and blacks. [3]

Of interest is the research by Albanese, [8] who studied samples from both the Terry and a Portuguese collection, using both the hipbone and the femur, attempted to create standards which could be used across populations. A research was also done in German population [9], South African Whites [1], in Spanish [10], in Chinese [11], [12], in Scottish [13] and in Nigerians [3]. The discriminant function analysis of sexual dimorphism in the Thai femur and the data was then compared with data similarly derived from North American, African, and East Asian samples and then tested using functions derived from them to determine if population specific sexing formulas were necessary. [14]

It has also been observed that female femur is shorter than the male; and in the male the left longer than the right and vice-versa in the female (Singh & Singh, 1971). [15] Maximum length was observed to be one of the important traits that could be used for sex determination. Large number of reports in different populations has been reported.

In South African white population [3], maximum length was determined as 469.68 ± 27.97 . The total length of the male femur was longer than the female and in the male the left femur longer than the right. So in this study length was found to be the best in sex determination of femora. In India, studies were done in Central India and North India. [15]. Few regions of South India were included in wide collection study on femurs in 1970's [5].

In the present study, it was observed that mean maximum length was higher 43.75 ± 0.16 in males was higher in females 39.81 ± 1.40 .

In the present study, it was observed that mean weight in males was higher 449.06 ± 9.05 than females 349.41 ± 11.82 .

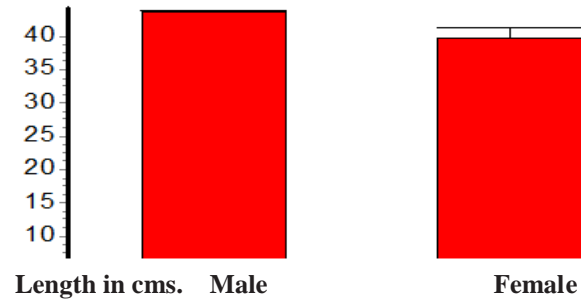
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HISTOGRAMS

Mean and Standard Deviation



Mean and Standard Deviation

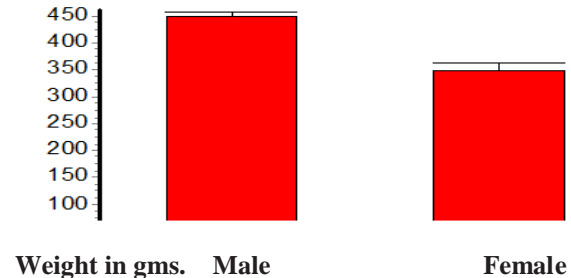


Table I

Sr. No.	LENGTH				WEIGHT			
	MALE		FEMALE		MALE		FEMALE	
	Right	Left	Right	Left	Right	Left	Right	Left
1	43.77	43.74	40.27	40.27	453.51	453.48	363.65	360.65
2	43.70	43.68	39.33	39.44	454.67	455.60	345.54	346.45
3	43.72	43.69	38.90	38.89	449.00	448.90	366.44	367.33
4	43.90	43.85	37.66	37.59	438.80	436.88	345.61	346.23
5	43.88	43.90	41.42	41.39	455.85	455.68	336.45	336.81
6	43.64	43.62	41.37	41.23	455.62	450.2	338.70	339.07
7	44.04	43.90			455.65	455.48		
8	43.62	43.60			436.77	436.67		
9	43.83	43.80			458.88	458.66		
10	44.00	43.90			438.67	439.00		
11	43.60	43.54			439.90	439.89		
12	43.61	43.55			460.63	461.00		
13	43.53	43.48			456.75	456.55		
14	44.10	43.83			435.68	435.44		

Table II:

Mean and SD of two parameters on right and left sides in males and females

PARAMETER	MALE		FEMALE	
	Right	Left	Right	Left
Maximum length	43.78 ± 0.18	43.72 ± 0.14	39.82 ± 1.47	39.80 ± 1.45
Weight	449.31 ± 9.19	448.81 ± 9.24	349.39 ± 12.68	349.42 ± 12.10

Table III:

Mean, SD, t-value and p-values in male and female femur of both the parameters.

Sr. No.	Parameter	Male Mean ± SD	Female Mean ± SD	t-value	p-value
1.	Maximum.Length	43.75 ± 0.16	39.81 ± 1.40	14.90	<0.0001*
2.	Weight	449.06 ± 9.05	349.41 ± 11.82	21.07	<0.0001*

1. The two-tailed 'P' value is < 0.0001, considered extremely significant, t = 14.902 with 38 degrees of freedom.
2. The two-tailed 'P' value is < 0.0001, considered extremely significant, t = 29.076 with 38 degrees of freedom.

Original Research Paper

Age Estimation from Medial End of Clavicle by X- Ray Examination

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Abstract

Fixing up of the individuality of a person, no matter if it is new born baby in the hospital or in criminal cases and in civil cases like marriage, inheritance of property, passport, insurance claims, disputed sex and missing persons etc. has got its own importance. In the present study 100 individuals are studied between the age group of 16 to 25 years in male and female (separately), whose X- ray examination is done at Rajindra Hospital ; Patiala, Punjab. Male and female individuals were studied with age interval of two years and ten cases from each age interval were taken. The study is undertaken to know the fusion of medial end of clavicle to know the fusion of epiphysis. In this study, every individual's X-ray chest AP view is taken to know fusion of epiphysis at medial end of clavicle.

Key words: Epiphyseal Fusion, X-ray, Criminal, Civil, Insurance, Passport

Introduction:

If proper age is not given it is injustice to the patient and the profession. There are many agencies for fixing the identity of a person from village panchayat to police and usually it is the police which help the most in this job. But when all other agencies fail then the medical jurist comes into picture and he is able to do this job by virtue of his knowledge and experience. So he is able to supply to the police certain facts about an individual, dead body or fragmentary remains which will enable them to complete the identification. [1, 4, 6, 9] To narrow the wide age range union of epiphysis of bones in present study is done with the help of fusion of epiphysis in medial end of clavicle.

Age of each individual studied was confirmed from birth certificate, service record, driving license, passport, ration card or voter's card etc.

Material and Methods:

In present study, 100 cases were studied including Male and female differently. The cases studied were between age group of 16-25 years that were exposed to x-ray at Rajindra Hospital Patiala.

Male and Female individuals were studied with age interval of two years and ten cases from each age interval were taken. The cases were studied with the help of X-ray Chest- antero-posterior view for medial end of clavicle.

Status of epiphyseal union was divided into following four stages:

Stage	Appearance and fusion	Grade
I	Centre not appeared	A
II	Centre appeared but no union	+
III	Union started but incomplete	++
IV	Complete union	+++

Method for X- Ray examination: Study has been carried out by Roentgenographic technique.

The technique included standardization of -

1. Time of exposure
2. Positioning of the part
3. Distance of film from X- Ray tube and
4. Processing and time of developing the films.

Positioning of the Epiphysis during X- Ray:

Clark's radiographic technique has been followed in this investigation.

AP View for clavicle: Positioning of Patient and film: The patient was lying supine on the X-Ray table with the centre of the clavicle being examined over the midline of the table. A small sand-bag is placed under the opposite shoulder to rotate the patient slightly towards the affected side to make sure that the medial end of the clavicle is not superimposed on the vertebral column. The arm of the side being examined is in a relaxed position by the side of the trunk. The film is placed transversely in the Bucky tray centred to the clavicle and should be large enough to include the whole of the clavicle and its medial and lateral articulations.

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Direction and Centring of the X- ray Beam: The vertical central ray is directed to the middle of the clavicle. Exposure taken on arrested respiration.

Observations:

Table No. 1 shows in eight cases (80%) centre not appeared & in two cases (20%) centre appeared but no union occurred in age group 16-17 years.

In age group 18-19 years, in eight cases (80%) centre not appeared & in two cases (20%) centre appeared but no union occurred.

In age group 20-21 years, in two cases (20%) centre not appeared, in three cases (20%) centre appeared but no union occurred, in three cases (30%) union started but incomplete & in two cases (20%) complete union occurred.

In age group 22-23 years, in one case (10%) centre not appeared, in one cases (10%) centre appeared but no union occurred, in two cases (20%) union started but incomplete & in six cases (60%) complete union occurred.

In age group 24-25 years, in two cases (20%) union started but incomplete and in eight cases (80%) complete union occurred.

Table no. 2 shows in age group 16-17 years, in one case (10%) centre not appeared, in four cases (40%) centre appeared but no union occurred and in five cases (50%) union started but incomplete.

In age group 18-19 years, in six cases (60%) centre appeared but no union, in three cases (30%) union started but incomplete & in one case (10%) complete union occurred.

In age group 20-21 years, in three cases (30%) centre appeared but no union, in five cases (50%) union started but incomplete & in two cases (20%) complete union occurred.

In age group 22-23 years, in four cases (40%) union started but incomplete & in six cases (60%) complete union occurred. In age group 24-25 years, in ten cases (100%) complete union occurred.

Discussion:

In present study males shows epiphyseal union at 22-23 years age group and earliest union occurred at 20 years. Female shows epiphyseal union at 22-23 years age group and earliest union occurred at 20 years and one month. The present study findings are close to Stevenson, Galstaun, B.D. Chaurassia, Parikh and Krishan Vij. [1, 4, 9, 16]

Table No. 4 shows for males in 20-21 years age group two cases (20%) show complete union, in 22-23 years age group six cases (60%) show complete union and in 24-25 years age group eight cases (80%) show complete union.

For females in 20-21 years age group 2 cases (20%) show complete union, in 22-23 six cases

(60%) show complete union and in 24-25 years age group ten cases (100%) show complete union.

Conclusions:

According to Stevenson (1924) in both male and female earliest union occurred at 18 years but in present study for males, earliest union occurred at 20 years and for females it is 20 years & one month. Present study and Stevenson show different results because they are performed in different races.

In present study, majority of cases show complete union at 22-23 years for male and female both. These findings are in tandem with study carried out by Parikh because both studies are done in India.

From the present study it can be **concluded:** Epiphysis of medial end of clavicle fused in most of the cases at 22-23 years for male and female both. Earliest union occurs at 20 years in males and 20 years and one month in females.

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Table No. 1
Incidence and extent of fusion of the medial end of clavicle in different age groups for Males

Extent of fusion	Age Group 16-17 years	Age Group 18-19 years	Age Group 20-21 years	Age Group 22-23 years	Age Group 24-25 years
	Cases (%)	Cases (%)	Cases (%)	Cases (%)	Cases (%)
Centre not appeared	8 (80)	8 (80)	2 (20)	1 (10)	0 (0)
Centre appeared but no union	2 (20)	2(20)	3 (30)	1 (10)	0(0)
Union started but incomplete	0 (0)	0(0)	3 (30)	2 (20)	2(20)
Complete union	0 (0)	0(0)	2 (20)	6 (60)	8(80)

Table No. 2
Incidence and extent of fusion of the medial end of clavicle in different age groups for Males

Extent of fusion	Age Group 16-17 years	Age Group 18-19 years	Age Group 20-21 years	Age Group 22-23 years	Age Group 24-25 years
	Cases (%)	Cases (%)	Cases (%)	Cases (%)	Cases (%)
Centre not appeared	1(10)	0 (0)	0 (0)	0(0)	0(0)
Centre appeared but no union	4(49)	6(60)	3(30)	0(0)	0(0)
Union started but incomplete	5(50)	3(30)	5(50)	4(40)	0(0)
Complete union	0 (0)	1 (10)	2 (20)	6 (60)	10 (100)

Table No. 3
Comparison of time of fusion (in years)

Author	Year	Race	Sex			Earliest Union (years)
			Male	Female	Mixed	Male/Female
Stevenson's	1924	White & Negroes	22-24	22-25	-	18
Davies & Parsons	1927	English	-	-	25	-
Flecker	1932	Australians	21	21	-	-
Galstaun	1937	Bengalis (Indians)	22	20	-	-
Krogman	1962	U.S.A.	-	-	25-28	-
Stewart	1973	U.S.A.	26 or more	-	-	-
Chaurassia	1980	Indian	-	-	21-22	-
Parikh	1990	Indian	-	-	22	-
Inderbir	1993	Indian	-	-	25	-
Krishan Vij	2001	Indian	-	-	20-22	-
Present Study	2001	Punjab (Indian)	22-23	22-23	-	M = 20 F = 20 years & one month

Table No. 4
Age of incidence of complete union

Age Group (Years)	No. of cases examined	For Males	For Females
		No. of cases with complete union (%)	No. of cases with complete union (%)
16-17	20	0 (0)	0 (0)
18-19	20	0(0)	0(0)
20-21	20	2 (20)	2(20)
22-23	20	6(60)	6(60)
24-25	20	8 (80)	10(100)

Original research paper

Burns during Pregnancy: A Socio-Cultural Disease

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Abstract

Burns during pregnancy poses a serious threat to the life of baby, as well as to the mother. More severely it is associated with various social and economical problems, as well as associated with illiteracy and poverty which many cases complicate its prevention. Burns during pregnancy influence maternal as well as foetal outcome. Keeping this in view a comprehensive task was undertaken to assess the maternal and foetal outcome in relation to burn extent and gestational age of foetus.

A total of thirty two cases of burn females with pregnancy were analyzed. There were 23 maternal and 26 foetal deaths. Percentage of abortion during the third trimester was highest. Rate of maternal mortality increased with percentage of Total Body Surface Area (TBSA) burnt. Maximum incidence of maternal mortality rate was with cases of burns involving more than 50% TBSA.

Key Words: Pregnant Females, TBSA, Maternal Mortality, Life of Foetus, Gestational Age, Burn, Socio-economic Disease, Thermal Injury, Rule of Nine, Dying Declaration

Introduction:

Burns during pregnancy creates a severe threat to baby, as well as to the mother. More severely it is associated with social problems, economical problems, illiteracy and poverty which many times complicate its prevention. [1] In developing country like India, burns in women of reproductive age occur more frequently than they do among similarly aged women residing in more developed countries. Thermal injury sustained during pregnancy presents special problem for the gravid woman and her foetus. [2] This study was carried out with an aim to determine the maternal and foetal outcome in relation to burn extent and gestational age of foetus and the dynamics surrounding burns during pregnancy.

Material and methods:

This prospective study was carried out in the Deptt. of Forensic Medicine in collaboration with Deptt. of Plastic Surgery, JNMC, Hospital, AMU, Aligarh, during the period from 1st July 2005 to 31st July 2007.

A total of thirty two pregnant burn women in the age group 17-39 years admitted to the Burn Unit were analyzed.

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The data was collected on the basis of age, percentage of burn over the body surface, gestational age, maternal and foetal outcome.

The percentage of body surface area burn (TBSA) was estimated by the method of Rule of Nine.

Dying declaration of the victim being recorded by the Magistrate and data collected was entered into a standard proforma prepared for this study and were analyzed. On the basis of analysis and observation, results were drawn and discussed with other relevant literatures.

Results:

In this study 32 cases of pregnant burn victims in the age group 17 to 39 years were assessed. Gestation age varied from eight weeks to 34 weeks with 16 cases in the first trimester, nine cases in the second trimester, and seven cases in the third trimester. Burn up to 25% total body surface area (TBSA) did not produce any effect on pregnancy in first trimester. One of the two cases aborted in the second trimester, while one case went into premature labour in third trimester. Burn of 26%-50% TBSA range led to abortion of two cases in first trimester. In the second trimester single case aborted and the foetus was nonviable. In the third trimester single case went into premature labour and was still born.

Burn of 51%-75% TBSA range led to abortion of all cases in the first and second trimester. In the third trimester three cases went into premature labour and were still born. Burn of 76%-100% TBSA range led to abortion of all cases in first and second trimester and in third trimester all cases went into premature labour and were still birth. The percentage of abortion in first trimester was 68.7%, in second

trimester 88.9%, and in third trimester 100% (Table No.1, 2, 3).

Maternal and foetal outcome in relation to TBSA are shown in Table-4. 23 maternal death and 26 foetal death cases occurred in total of 32 cases. In burns up to 25% TBSA no maternal death occurred but 2 foetal death occurred, in 26%-50% TBSA range three maternal and two foetal death occurred, in 51%-75% TBSA range 12 maternal 12 foetal death occurred, and in 76%-100% TBSA range eight maternal and eight foetal death occurred.

Table No.1: Distribution of burn extent in first trimester

Burn	No. of cases	No. of cases who aborted	No. of maternal deaths
Upto 25%	3	0(0%)	0(0%)
26%-50%	4	2(50%)	1(25%)
51%-75%	7	7(100%)	7(100%)
76%-100%	2	2(100%)	2(100%)
Total	16	11(68.7%)	10

Table No. 2: Distribution of burn extent in second trimester

Burn	No. of cases	No. of cases who aborted	No. of maternal deaths
Upto 25%	2	1(50%)	0(0%)
26%-50%	1	1(100%)	1(100%)
51%-75%	2	2(100%)	2(100%)
76%-100%	4	4(100%)	4(100%)
Total	9	8(88.9%)	7

Table No. 3: Distribution of burn extent in third trimester

Burn	No. of cases	No. of cases who aborted	No. of maternal deaths
Upto 25%	1	1(100%)	0(0%)
26%-50%	1	1(100%)	1(100%)
51%-75%	3	3(100%)	3(100%)
76%-100%	2	2(100%)	2(100%)
Total	7	7(100%)	6

Table No. 4: Distribution of burn extent in relation to maternal and foetal outcome

Burn	No. of maternal death	No. of foetal death
Upto 25%	0	2
26%-50%	3	4
51%-75%	12	12
76%-100%	8	8
Total	23	26

Discussion:

Burn injury during pregnancy appears to be a major problem in developing countries. This high prevalence is peculiar in our community probably because of illiteracy, unsafe cooking habits, and our social custom of dowry. [1] In this study 14.9% of all women of reproductive age with burns were pregnant. This is similar to the findings of Prasanna M [3] (Karnataka) reported 15%, but different from Taylor et al. [4], reported 7%, and Mathew RN[5] reported

5-7% of burns in pregnant women of reproductive age group.

Abortion during the first trimester was 68.7%, in second trimester was 88.9%, and in third trimester 100%. This is in accordance with the finding of V. Mago et al. [6] The study highlights that as far as pregnancy is concerned burns precipitate abortions and premature labour on a very significant scale. Effects on the foetus are deleterious and proceed to abortion.

Yingbei Z et al. [7] in their study reported that all abortion, dead foetus and still births occurred within the first post burn week. McCauley et al. [8] reported that a second and third trimester burns may be lethal to the foetus with maternal burns more than 50% total body surface area.

Our study showed that maternal mortality increased with burns >25% of Total Body Surface Area and was maximum with burns more than 50%. This is in accordance with the study of Rayburn et al. [9] and Cheah SH. [10] The overall maternal mortality was 71.8% and foetal mortality was 81.2% which is similar to the study of Akhtar MA. [11] Thus a positive relationship was found between the percentage of maternal body burn and risk of maternal and foetal death.

In this study most of the burns occurred in 17-39 years age group. This is probably because of increasing familial stress due to day to day problems like, cooking with an open unguarded fire, rearing of smaller children, overburdened household activities etc, and living through in an overcrowded space with minimal amenities inviting frequent accidents.

Moreover in the developing country like India, females are married earlier than the males in the family and are more exposed to social and family stress much earlier than males resulting in this devilish like human behavior. [12]

Conclusion:

Although the relevant literature is limited, the incidence of burns in pregnancy does not appear to be low, especially in developing countries such as India where burns constitute a social disease. In every case of burn whatever explanation be given by the relative/victim; a thorough investigation must be conducted by Investigating officer (I.O) or magistrate, providing proper history to the Medicolegal Expert, allowing him to pick up slightest clue available & decide whether the case is accidental/suicidal/homicidal. A societal awareness, strict legislation, honest and speedy delivery of justice by the Courts is all that is required in addition to a change in the attitude of the community.

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Quality of Medical Education is directly related to **Quality of Health Care Services** in any Country, which in fact directly related to **Quality of Health/Life** of its **Citizen**. Healthy mind can only reside in healthy body. By improving the Quality of Medical Education one can thus, serve **humanity**.

This is a group of like minded persons who wishes to participate in improving quality of medical education in India in democratic manner. Mainly **Medical Doctors, Medical Teachers, Lawyers, Social Activists, Journalists, etc.** can become member of this group. Information pertaining to improving the quality of medical education may be shared on this platform.

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- If you can spare at least two hours a week
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Q. Is there any fee for becoming member of this group?

- No, you need not to pay any fees to become member of this group

Q. Can a non-medical person become member of this group?

- Yes, a non-medical person can also become its member. In a democratic setup opinion of even a single person kept meaning, particularly when it is related to one of the most important **Fundamental Human Right** i.e. **Right to Quality of Health Care** part of **Right to Life** protected by the **Indian Constitution** under **Article 21**.

Q. To whom I can contact in case of any difficulty?

- You can contact on following address:
- Prof (Dr.)Muksh Yadav
- Email: drmukesh65@yahoo.co.in
- Group email address: Quality_of_Medical_Education@yahoogroups.com
Group home page location: http://groups.yahoo.com/group/Quality_of_Medical_Education
Play your much awaited role in improving the **Quality of Life** of your fellow colleague and future generation and serve the humanity. Help in Improving the Indicators of **Human Development Index of India** (Life Expectancy, Maternal Mortality, Infant Mortality, etc.) and help **Mother Land India**, to become a **Developed Nation** and **Global Leader** in **Health and Medical Education Industry**.

Mukesh Yadav

Original research paper

Penetrating Chest Injuries: A Medicolegal Analysis

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Abstract:

Penetrating injuries are one of the commonest methods of committing murder, of which penetrating injuries of the chest/heart are very serious and prove fatal in most of the cases (1). In a post mortem study of penetrating chest injuries at Lucknow, majority of the victims were adult male between 20-50 years of age.

In majority of the cases injuries were caused by firearms usually a shot gun. Injuries by knives and daggers were also seen in few cases. Injuries were seen on the front of chest, predominantly on the left side, in majority of the cases. Lungs were damaged in all the cases. Heart; aorta & other thoracic organs were also injured in substantial number of cases. In the cases where heart was found damaged, the right ventricle was injured in majority of the cases. Two-third of the victims died within three hours after getting injuries, either on the spot or in the way to the hospital. All the cases of penetrating chest injuries were homicidal & personal rivalry was the single most common reason behind these deaths.

Key words: Firearms, Stab Wound, Lungs, Haemorrhage, Personal Rivalry

Introduction:

Penetrating chest injuries are a great challenge for medical professionals because of high mortality rate. Here external injuries look smaller but majority of them proves fatal due to damage of vital organs and major blood vessels. Survival of victim depends upon the extent of damage and promptness of medical services.

Here in this study the epidemiological, medicolegal and clinico-pathological aspects of penetrating chest injuries are studied in the cases brought to the mortuary of K G Medical University Lucknow for Post Mortem examination. All the data thus collected, are compiled and presented in this paper.

Materials & methods:

The materials for the present study were the fatal cases of penetrating chest injuries brought to the mortuary of KGMU, Lucknow for post mortem examination in 2005-06.

The cases where few superficial injuries were on the chest but the cause of death was in the abdomen or in other parts of body were not included in the study.

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Badly decomposed or skeletonised bodies, where significant penetrating injuries were not visible, also not included in the study.

All the information related to epidemiological & medicolegal aspects of the cases were collected from the interrogation of relatives, friends and police officer accompanying the dead body and also from the inquest report. Attempt was also made to collect this information from the victim when he was alive, conscious and admitted in the hospital.

Data related to injuries, damage to internal organs and cause of death were collected during the post mortem. All the data are thus collected, compiled and presented in the table.

Observations and results:

Here 60 cases of penetrating chest injuries are studied and it was found that the majority of the victims are young adult male. Age-wise the maximum number i.e., 26 (43.33%) of the victims is from 21-30 years of age, then from 31-40 and 41-50 years of age group i.e., 28.33% & 15% cases respectively (table 1). None of the case is found below 13 and above 67 years of age. Sex-wise most of the victims are male i.e., 54 (90%), 9 times greater than of female (6- 10%) cases.

Three-fourth (45-75%) of the penetrating chest injuries are caused by firearms, of which 1/3 by rifled firearms and 2/3 by shotguns (table 2). Injuries by sharp pointed weapons, knives and daggers, are found only in 12 (20%) of the cases.

In majority of the cases number of blows were few (table 3), either one (46.67%) or two (28.33%). More than three blows were seen only in 7 (11.67%) of the penetrating chest victims.

Exteriorly in majority of the cases (46-76.67%) injuries were present on the front of chest more on the left side i.e., in 24 (40%) followed by right side of chest in 16(26.67%), both right and left side of chest in 5 (8.33%) cases. Injuries were present on the back in 10 (16.66%) and on both sides front and back of the chest only in 4 (6.66%) cases (Table 4).

Internally lungs were found injured in all the 60 cases. Heart was found injured in 15 (25%) and it is also associated with injury to oesophagus in 6 (10%) and ascending aorta & right pulmonary artery each in 3 (5%) cases (table 5).

In the cases where heart was involved, the right ventricle alone was found injured in majority (60%) of the cases (table 6). Left ventricle was found injured in 3 (20%) and the whole heart was lacerated in 3 (20%) cases also.

Half (30) of the victims died on the spot, just after getting the injury. Another 13 (21.67%) were died within 3 hours (table 7) and haemorrhage and shock was the cause of death in almost all the cases. Only 6 (10%) of the victims survived more than 48 hrs. and died due to infection &/or complications of haemorrhage.

All the cases of penetrating chest injuries are homicidal in nature and personal rivalry (66.66%) is the most common motive behind the murder (table 8). Other reasons of deaths are police encounter (10%), dacoity (5%) etc.

Discussion:

Penetrating chest injuries are known from ancient time. These are mainly caused by sharp pointed objects such as knife, dagger, nails, spear, arrow, screwdriver etc. Besides these swords, scissors, chisels, razors etc. are also used as stabbing weapons. Now arrows and spears are replaced by firearms. In a notable case, Julius Caesar (44 B.C.) was stabbed 23 times, but only one wound was fatal that was on the chest between first and second rib. [2]

In another historic case Mrs Indira Gandhi was fired 26 rounds by her security men injuring all the vital organs but the bullet which perforated the aorta was primarily responsible for fast death.

In this study majority of the victims are young adult males, deaths are homicidal and personal rivalry is the motive behind the murder in most of the cases. This is similar to the observations made other Forensic experts. [3, 4].

Although knife is the most common weapon used in penetrating chest injuries [5], three-fourth of the cases in this study, are due to firearm injuries. This is probably due to high mortality in firearm injuries.

Penetrating injuries are mostly inflicted on the front of chest (76.67%) and on the left side

(40%). The result is exactly matching as mentioned in Vij's Textbook of Forensic Medicine & Toxicology [6] but is against the observation mentioned in Polson's Forensic Medicine where homicidal penetrating injuries are most frequently present on the back. [7]

Internally lungs were involved in all the cases followed by heart, ascending aorta and pulmonary vessels.

Conclusion:

- Penetrating chest injuries were seen in the cases of injuries caused by firearms or sharp pointed weapons.
- Majority of victims were young adult males between 21-40 years of age.
- These penetrating injuries were mostly present on the front of chest and caused by one or two blows.
- Lungs were involved in all the cases, but heart, right pulmonary artery, ascending aorta and esophagus was also involved in substantial number of cases.
- In the cases where heart injured, right ventricle was most commonly involved.
- Most of the victims died either on spot or within 3 hrs. when the patient was in the way to hospital or in emergency before proper surgical treatment given.
- The most common cause of death was shock & hemorrhage, especially when the person dies within few hours.
- All the cases of penetrating chest injuries were homicidal in nature & the personal rivalry was the main motive behind such deaths.

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Table No.1 Age and sex of the victims

Age Groups (in Yrs)	Male Nos. (%)	Female Nos. (%)	Total Nos. (%)
0 – 10	0 (0)	0(0)	0(0)
11 – 20	3(5)	0(0)	3(5)
21 – 30	22(36.6)	4(6.67)	26(43.33)
31 – 40	15(25)	2(3.33)	17(28.33)
41 – 50	9(15)	0(0)	9(15)
51 – 60	3(5)	0(0)	3(5)
61 – 70	2(3.33)	0(0)	2(3.33)
Above-71	0(0)	0(0)	0(0)
Total	54(90)	6(10)	60(100)

Table – 2 Weapon Used

Weapons Used	No. of cases	%
Firearms alone	45	75
A. Rifled firearm	15	25
B. Shotgun firearm	30	50
Sharp cutting/ pointed weapons alone	12	20
A. Knife	9	15
B. Dagger	3	5
Firearms & sharp cutting both	3	5
Total	60	100

Table – 3 Number of blows

Number of blows	No. of cases	%
One blow	28	46.66
Two Blows	17	28.33
Three Blows	8	13.33
More than three Blows	7	11.66
Total	60	100

Table -4 External Injuries: area Involved

Area of chest involved	No. of cases	%
Front of chest	46	76.67
Right side chest	16	26.67
Left side chest	24	40
Mid line in front	1	1.66
Both side chest	5	8.33
Back	10	16.66
Front & Back of the chest	4	6.66
Total	60	100

Table - 5 Internal organs damaged

Internal organs injured	No.	%
Lungs	60	100.00
Right lung alone	18	30
Left lung alone	13	21.67
Left. Lung + Heart	6	10
Left. Lung + Heart + Ascending Aorta + Rt. Pulmonary Artery	3	5
Both lungs alone	14	23.33
Both Lungs + Heart + Oesophagus	6	10
Heart alone	0	0
Total	60	100

Table – 6 Injuries to heart

Parts of Heart	Firearms	Sharp cutting penetrating weapons	Total
	No. (%)	No. (%)	No. (%)
Right atrium	0(0)	0(0)	0(0)
Right ventricle	6(40)	3	9(6)
Left ventricle	0(0)	3	3(20)
Whole heart	3(20)	0	3(20)
Total	9(60)	6	15(100)

Table - 7 Period of Survival

Period of survival (in hrs)	Firearms	Sharp weapons	Total
	No. (%)	No. (%)	No. (%)
Immediate death /died on spot	28 (46.66)	2 (3.33)	30 (50)
½ hr – 1 hr	5 (8.33)	3 (5)	8 (13.33)
1 hr – 3 hrs	0 (0)	5 (8.33)	5 (8.33)
3 hrs– 12 hrs	5 (8.33)	0	5 (8.33)
12 hr–48 hrs	6 (10)	0	6 (10)
>48 hrs	3 (5)	3 (5)	6 (10)
Total	47 (18.33)	13 (21.66)	60 (100)

Table - 8 Motives behind Homicide

Motives	No. of cases	%
Personal Rivalry	40	66.66
Police Encounter	6	10
Rash or Sudden Provocation	5	8.33
Dacoity	3	5
Accidental	3	5
Infidelity	1	1.67
Sexual Assault	1	1.67
Unknown	2	3.33
Total	60	100

Original research paper

Time since death from degenerative changes in the Kidney

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Abstract

Time since death is made out from gross postmortem changes like cooling of the body, postmortem staining, rigor mortis, decomposition etc. In the present study Histological changes in the Kidney tissue were studied at various postmortem intervals in the human body died due to road traffic accidents.

This study is conducted in the Department of Forensic Medicine in collaboration with Department of Pathology, G.S.V.M. Medical College, Kanpur, U.P. A total of 45 cases are taken belonging to both sexes i.e. 36 males and 9 females were studied. These are of different age groups.

All road traffic accidents are taken into account. In this study control can not be taken because the histological changes of tissue after death is influenced a great deal by atmospheric temperature and humidity besides other external and internal factors. Therefore these must be taken into account in all studies of postmortem interval whether histological, biochemical or physical.

Key Words: Kidney, Cloudy Swelling, Proximal Convoluted Tubules, Distal Convoluted Tubules

Introduction:

Estimation of time since death is one of the most important object of postmortem examination. Time passed since death continues to be a major problem for the forensic pathologist and its determination plays an important and vital issue in medico-legal cases because of the fact that forensic experts are very often required to answer questions relating to time of death in the courts of law.

The traditional methods of ascertaining the time since death based on naked eye observations of the gross changes in a dead body occurring after death to provide a rough approximation of post mortem interval, at best only and would appear to be still the closest approximation of the time passed since death in a given case.

These various gross changes in the body after death are loss of corneal reflex and changes in eye, cooling of the body, post mortem hypostasis, rigor mortis, decomposition and other putrefactive changes.

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Some clue of time of death is also gathered from the condition of food in stomach, intestine and urine in bladder. [1, 2, 3, 4]

Attempts have also been made to determine time passed since death by studying biochemical changes in blood, CSF and intraocular fluids. [5, 6, 7] The biochemical methods have been found to be of not much use once the decomposition changes start.

The problem worsens when body is mutilated skeletonised or invaded by animals. Time bound histological and histochemical study of degenerative changes in various organs and tissues may be a good solution. [8, 9, 10, 11]

Forensic pathologist throughout the world are trying to establish time passed since death by studying degenerative changes in organs and tissues at different intervals but definitive conclusion is still awaiting. [12, 13, 14]

The histological studies on various tissues after death have been mostly confined to single organ or tissue by individual workers at different atmospheric conditions. Moreover very few workers works based on histological studies of post mortem tissue changes appears to have been undertaken by Indian and more so in Uttar Pradesh. Since only a single organ was studied by most workers, any comparative evaluation of the varying rate of decomposition of the different organs and tissues can not be made out. [15, 16]

Material and Method:

Material for the present study is Kidney taken directly from the dead bodies during postmortem examination. Only the cases where the time of death is known and verified either by the doctors or by relatives & friends present at the time of death and also

supported by postmortem changes, have been taken for the study.

Thus, bodies found unnoticed will not be studied, precautions will also be taken to exclude the cases having pathology affecting the cellular architecture or biochemical constituent of the material. Such tissues thus collected, sliced and fixed in 10% formalin for histological study.

Total 45 cases, in which 36 male and 9 female were studied. These are of different age and sex. All road traffic accidents are taken into account.

Collection of Organs:

These organs were then kept in 10% formalin for 24-48 hrs for fixation. Small pieces or blocks of tissues each 1-2 mm thick were taken for histological examination and were processed by the routine methods of processing for histological studies by fixation, dehydration followed by embedding in paraffin wax. [17, 18]

The paraffin sections of tissues were labeled during the process of block making in the following manners form case: 1st case to 45th Kidney from the blocks of tissues, sections were cut at 4-5 μ thickness with a rotating microtome. The sections were then placed in warm water at 50 °C in a tissue floatation bath for spreading out and were then mounted on glass slide smeared with albumin glycerin solutions. The slides were stained by reactive haematoxylin and eosin stain.

The stained slides were examined under light microscope for studying the various histological changes that take place in Kidney tissue at different time intervals after death.

Plan of study:

In this study total 45 cases of road traffic accident are taken. These cases are of different age and sex. The cases in which time passed is known has taken. The environmental temperature and humidity is recorded from newspaper from which average temperature is drawn.

The average temperature ranges between 20°C to 35°C, humidity between 45% to 92% and duration range was 7-34 hrs.

Now this temperature range is divided in 4 groups as shown in Table No. 1

Table -1

Group	Temperature	No. of Cases
I	20 °C	9
II	21-25 °C	6
III	26-30 °C	11
IV	31-35 °C	19
Total		45

Duration is also divided into five groups as shown in Table No. 2

Table -2

Group	Duration	No. of Cases
I	Up to 12 hrs	5
II	13 – 18 hrs	13
III	19 – 24 hrs	14
IV	25 – 30 hrs	9
V	31 – 34 hrs	4
	Total	45

Now these 45 cases are studied with the effect of temperature and duration. First gross changes in liver studied. Then they were preserved in 10% formalin for microscopic study.

As described earlier, these changes are graded from 0-4, these are as follows:

- **G-0:** No Change
- **G-1:** Mild (Architecture maintained, mild cloudy swelling and disruption of tubular epithelium)
- **G-2:** Moderate (Architecture maintained, more cloudy swelling and disruption of epithelium, glomeruli swollen)
- **G-3:** Severe (Architecture disturbed, cloudy swelling and disruption of epithelium is prominent. Collapse of glomeruli)
- **G-4:** Very severe (Complete collapse of glomeruli, marked disruption of epithelium Nuclei are fragmented)

Observations:

All cases are divided in groups according to temperature and duration which is discussed earlier.

Degenerative changes in Kidney:

As in this study, all Road Traffic Accident are taken. So in case of trauma to kidney we will also find the changes which are related with trauma.

We will find ischemic Acute Tubular necrosis (ATN) or shock kidney, occurs due to hypoperfusion of the kidney resulting in focal damage to the tubules.

Ischemia may result from:

- i. Shock (Post traumatic, Burns etc.)
- ii. Crush injuries
- iii. Non traumatic rhabdomyolysis (Alcohol, Coma, muscular exertion)

Gross: Kidneys are enlarged and swollen.

Cut Section: Cortex often widened and pale, while medulla is dark.

Histological:

- Predominant changes are seen in the tubules, while glomeruli are normal
- Interstitium shows edema and mild chronic inflammatory cell infiltrate
- Tubular Changes as follows:
 - i. Dilatation of Proximal convoluted tubules and Distal Convoluted tubules.
 - ii. Focal tubular necrosis at different points along the nephron.
 - iii. Flattened epithelium lining the tubules suggesting epithelial regeneration.

- iv. Eosinophilic hyaline casts.
- v. Disruption of tubular basement membrane adjacent to cast

Points which are taken:

- **Tubules:** PCT & DCT (Hydropic Changes disruption of epithelium)
- **Glomeruli-Swelling**Collapse
- **Nueleli** - Pyknosis, degeneration

Discussion:

In the present study 45 cases of different age and sex are taken in which 36 male and 9 female. Average environmental temperature ranges b/w 20 – 35 °C, humidity b/w 45-92% and duration range was 7-34 hrs.

On histological study kidney revealed the various changes which are follows:

- In first 12 hrs, temp. 26-30⁰c all 5 cases show mild (G-1) degenerative changes.
- In 13-18 hrs, with increasing temperature of up to 31-35⁰c, moderate & severe changes are seen. Only 2 out of 13 cases show severe changes (G-3).
- In 19-24 hrs, with increasing temperature of up to 31-35⁰c, severity increases (G-3). 8 out of 14 cases show G-3 changes.
- In 31-34 hrs with further increase in temperature of 31-35⁰c, only mild & moderate changes are seen.

(1) In a study done by Dr. Rakesh Tandon (1985): At 30⁰c Cloudy swelling of PCT & DCT was seen by 12 hours after death.

- By 24 hrs there was diffuse cloudy swelling of the cells of renal tubules and this also involved the blood vessels and glomeruli.
- After 30 hrs these changes became diffuse and more intense and there was severe autolysis in 48 hrs.
- At 20⁰c mild and focal autolytic changes could be seen 24 hrs after death.
- Between 36&48 hrs these changes were marked and diffuse throughout the kidney substance, while after 72 hrs post mortem severe autolytic changes could be seen.
- At 40⁰c, the changes became diffuse by 24 hrs and observations made after 36 hrs revealed advanced autolytic changes so that only vague outlines of tubules, glomeruli and blood vessels could be made out.
- At 30⁰c bacterial infiltration and liquefaction of kidney after 72 hrs.

(2) Choudhuri et al. (1981) studied kidney of goats in:

- (a) Open air at temp... range of 18 - 31⁰c.
- (b) Pond water at 22⁰c.
- (c) Refrigerator at 4⁰c and observed cloudy swelling of tubular cells followed by cells of glomeruli and blood vessels in a sequence

b/w 4-24 hrs PM in both open air and pond water.

- Complete disintegration of kidney was seen at 48 hrs in open air and on the 5th day in pond water.
- In refrigerator at 4⁰c the glomeruli remnants could still be identified after 5 days.

Summary and Conclusion:

In this study it is observed that the rate of microscopic changes increases as the temperature and duration increases up to 24 hrs & 31 - 35 °C. But with further increase of temperature and duration mild to moderate changes are observed.

Further studies using large number of cases & environmental conditions such as age, sex, humidity, body built, clothings & surrounding of the body etc. in different seasons should be done. Findings derived from such studies are likely to go a long way to promote the course of scientific crime investigation and fair administration of criminal justice, by way of furnishing more accurate answers, to the age old questions of the time passed since death in a given case of unnatural death under investigation.

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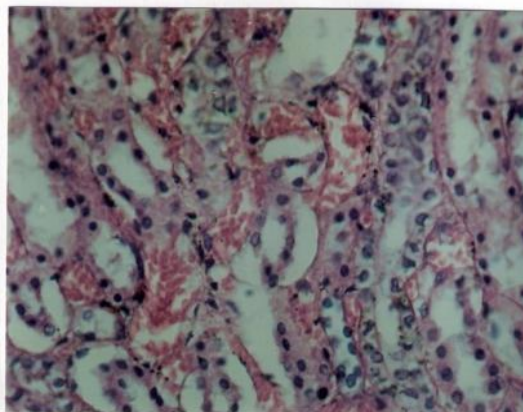


Figure - 1

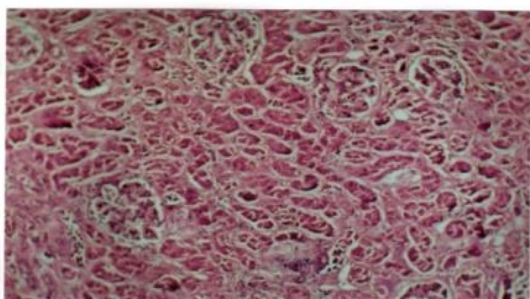


Figure - 3

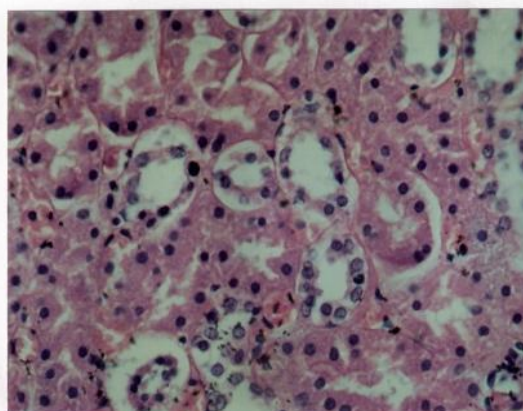


Figure - 2

Figure 1 & 2 -At temp. 20 °c, duration 21 hrs shows cloudy swelling in tubules (H&EXHP).

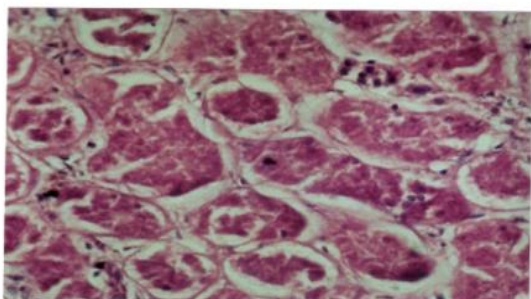


Figure - 4

Figure 3 & 4 - At temp 34 °c, duration 24 hrs show complete collapse of glomeruli and disruption of epithelium (H&ExLP&HP).

Table No. III
Degenerative Changes (Microscopic Changes - According to duration) in Kidney

Duration	G-0		G-1		G-2		G-3		G-4	
	No	%	No.	%	No.	%	No.	%	No.	%
Up to 12 hrs (5 Cases)	-	-	5	100	-	-	-	-	-	-
13-18 hrs (13 cases)	-	-	1	7.69	10	76.92	2	15.38	-	-
19-24 hrs (14 cases)	-	-	4	28.57	2	14.29	8	57.14	-	-
25-30 hrs (9 cases)	-	-	3	33.33	6	66.67	-	-	-	-
31-34 hrs (4 cases)	-	-	2	50	2	50	-	-	-	-

(-) No Case Available

Table No. IV**Degenerative Changes (Microscopic Changes - According to temperature) in Kidney**

Temperature	G-0		G-1		G-2		G-3		G-4	
	No.	%	No.	%	No.	%	No.	%	No.	%
20 ⁰ c (9 cases)	-	-	3	33.33	6	66.67	-	-	-	-
21-25 ⁰ c (6 cases)	-	-	5	83.33	1	16.67	-	-	-	-
26-30 ⁰ c (11 cases)	-	-	5	45.45	2	18.18	4	36.36	-	-
31-35 ⁰ c (19 cases)	-	-	2	10.53	11	57.89	6	31.58	-	-

(-) No Case Available

Table No. V**Kidney (Relation between Temperature and Duration)**

	12 hrs (5 cases)	13-18 hrs (13 cases)	19-24 hrs (14 cases)	25-30 hrs (9 cases)	31-34 hrs (4 cases)
20 ⁰ c (9 cases)	-	2	2	2	3
21-25 ⁰ c (6 cases)	-	-	3	3	-
26-30 ⁰ c (11 cases)	5	3	3	-	-
31-35 ⁰ c (19 cases)	-	8	6	4	1

Table No. VI

	12 hrs (5 cases)		13-18 hrs (13 cases)		19-24 hrs (14 cases)		25-30 hrs (9 cases)		31-34 hrs (4 cases)	
	Grade	%	Grade	%	Grade	%	Grade	%	Grade	%
20 ⁰ c (9 cases)	-	-	G-2	100	G-1 G-2	50 50	G-2	100	G-1 G-2	75 25
21-25 ⁰ c (6 cases)	-	-	-	-	G-1	100	G-1 G-2	66.67 33.33	-	-
26-30 ⁰ c (11 cases)	G-1	100	G-2 G-3	75 25	G-3	100	-	-	-	-
31-35 ⁰ c (19 cases)	-	-	G-1 G-2 G-3	12.5 75 12.5	G-2 G-3	16.67 83.33	G-1 G-2	25 75	G-2	100

(-) No Case Available

Original research paper

Age Determination in Girls of Jodhpur Region by Epiphyseal Union of Bones at Ankle Joint

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Abstract

There is no statistical data to establish variation in epiphyseal fusion in Western Rajasthan populations. This significant oversight can lead to exclusion of persons of interest in a forensic investigation. Epiphyseal fusion of the distal tibia and fibula in sixty females was analyzed on radiological basis to assess the range of variation of epiphyseal fusion at each age. In the study the X ray films of the subjects were divided into three groups on the basis of degree of fusion. Firstly, those which were showing No Epiphyseal Fusion (N), secondly those showing Partial Union (P), and thirdly those showing Complete Fusion (C). Observations made were compared with the previous studies. Results indicate that complete fusion in females occurs as early as 14 years in the distal tibia and fibula. All females demonstrated complete fusion by 19 years with no significant differences between ancestral groups.

Key Words: Epiphyseal Union, Ankle Joint, Distal End of Tibia, Distal End of Fibula

Introduction:

Determination of the age of an individual on the basis of the appearance and the fusion of the ossification centres of limb bones is a well accepted fact in the field of medical and legal professions. The principal means employed by a medical man to have a fairly accurate estimate of age of a person can be utilized are shown in Table I. According to Aggarwal MI & Pathak IC (1957), [1] epiphyses of bones unite during age periods which are remarkably constant for a particular epiphysis.

This is possible due to complex but dependable system by which the osseous framework of the body develops, grows and matures. Epiphysis of the bones unites at a particular age and this is helpful in age determination. Determination of age is helpful in both civil and criminal cases.

In the living age determination is the most important issue to the court and to the common citizens as well. It is essential to establish the identity of a person at the time of admission to schools, colleges, institutes, or while competing in sports tournaments at regional, state or national levels. It is also important while taking consent or in cases relating to juvenile offenders, rape, kidnapping, employment in Govt. establishments, competency as a witness, attainment of majority, marriage, fixation of criminal responsibility, etc.

Extensive work on the determination of age of epiphyseal union has been carried out in different states of India as well as abroad, and from the findings of various workers, it is evident that there is not only difference in the age of epiphyseal union in India and abroad, but also in the different states of India. These differences may be on account of varying genetic and epigenetic factors like climatic, economic and dietetic conditions. [2]

The feature commonly used for assessment of age is the timing of the union of epiphyses with the diaphysis. Until the teenage years, the diaphyses of the long bones are separated from their epiphyses on both the ends by a radiolucent interval, the epiphyseal line. [3] The present study is focused on radiological examinations of ankle joint of girl subjects of known age between 14 to 20 years of Western Rajasthan population.

Aims and Objectives:

- 1) To procure radiology films of ankle joint of both sides of girls aged between 14 to 20

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years of female subjects of Western Rajasthan.

- 2) To examine the status of epiphyseal lines of bones.
- 3) To assess whether the data correlate or contradict the findings of different authors in other parts of India and data of other countries.

Material and Methods:

The present study was carried out in Department of Radiodiagnosis, Dr. Sampurnanand Medical College and Associated group of Hospitals, Jodhpur. A total of seventy girls participated in this study. The subjects included girl students of schools, Medical college and degree colleges of Jodhpur. The subjects were from 13-20 years of age. An informed consent was taken from all subjects prior to each investigation.

The subjects chosen for the study were evaluated and confirmed for the following criteria:

- 1) They are born to parents living in Western Rajasthan and have lived in Western Rajasthan since birth.
- 2) The subjects do not have any disease/deformity pertaining to bones or chronic disease affecting the general health.

The X ray films were taken and films were developed with the help of experienced technicians. The part X rayed was ankle for distal end of tibia and fibula.

For the study the X ray films were divided into three groups for each epiphysis -

1. Those showing No epiphyseal union (N)
2. Those showing partial union (P)
3. Those showing complete union (C)

Observations:

The observations thus made are shown in Table II. None of the cases was showing non union.

Distal end of Tibia: Distal epiphyseal line of Tibia was fused in all cases by 14 years.

Distal end of Fibula: Distal epiphyseal line of Fibula was fused in all cases by 19 years.

Discussion:

The data evaluated from the present study was compared with the data of previously published

studies from different parts of country and world.^{4,5,6,7,8,9,10} These findings are depicted in Table III and IV.

Despite an apparent wealth of knowledge, it is extremely difficult to find consensus on ages of epiphyseal union at the ankle for females. [11]

Conclusion:

Currently there is no authentic data for assessment of time of fusion of epiphyseal lines for bones of ankle joint for Jodhpur (Western Rajasthan) population. The current study is first to present data for same. The presence of one more stage i.e. "partial fusion" between incomplete and complete stages of fusion provides furthermore defined age range estimations for the process of epiphyseal fusion at ankle. Definitely this is going to help Forensic experts for more efficient estimation of age in Western Rajasthan population for medico legal purpose.

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Table I
Various methods by which assessment of age can be done

Age Group	Method	Range of application
Below 25 years	1. Dental Eruption 2. Bone size and maturity 3. Ossification center 4. Epiphyseal union	Birth to 20 years Fetal age-18 years Fetal age-20 years 12-25 years
Over 25 year	1. Tooth microscopy 2. Microscopic bone age 3. Pubic symphysis	Over 20 years Birth to 95 years 18-50 years
Birth to old age	1. Cortical Resorption 2. Skull sutures 3. Ribs Ends 4. Sternum 5. Cancellous Regression 6. Joint margins	Birth to 90 years 25-80 years 18 years-old age Over 20 years 18 years-old age 18 years-old age

Table II
Showing observations for degree of fusions for distal ends of Tibia and Fibula

Sr. No.	Age group (yrs)	No. of cases	Degree of fusion Distal end of Tibia				Degree of fusion Distal end of Fibula			
			Partial complete	%	Complete	%	Partial complete	%	Complete	%
1.	13-14	10	6	60	4	40	5	50	5	50
2.	14-15	10	-	-	10	100	-	-	10	100
3.	15-16	10	-	-	10	100	-	-	10	100
4.	16-17	10	-	-	10	100	-	-	10	100
5.	17-18	10	-	-	10	100	-	-	10	100
6.	18-19	10	-	-	10	100	1	10	9	90
7.	19-20	10	-	-	10	100	-	-	10	100

Table III
Comparison of age of Distal Epiphyseal Union of Tibia in various Regions and Races with present study

Sr. No.	Researcher	Race/ Region	Age of observations (Years)
1.	Davies and Parson (1927)	England	18
2.	Hepworth (1929)	Punjabi	17-18
3.	Flecker (1932)	Australians	14
4.	Pillai (1936)	Madrasis	14-17
5.	Galstaun (1937)	Bengalis	13-15
6.	Basu and Basu (1938)	Hindu	15
7.	Agarwal and Pathak (1957)	Punjab	15-16
8.	Narain and Bajaj (1957)	Uttar Pradesh	17-19
9.	Present Study	Western Rajasthan	14-15

Table IV
Comparison of age of Distal Epiphyseal Union of Fibula in various Regions and Races with present study

Sr. No.	Researcher	Race / Region	Age of Observations (Years)
1.	Davies and Parson (1927)	England	18
2.	Hepworth (1929)	Punjabi	17-18
3.	Flecker (1932)	Australians	14
4.	Pillai (1936)	Madrasis	14-17
5.	Galstaun (1937)	Bengalis	13-15
6.	Basu and Basu (1938)	Hindu	15
7.	Agarwal and Pathak (1957)	Punjab	15-16
8.	Narain and Bajaj (1957)	Uttar Pradesh	17-19
9.	Present Study	Western Rajasthan	14-15

Original research paper

Suicide in Youth: Shifting Paradigm

*Rastogi Pooja, M.D. **Kochar SR, M.D.

Abstract

In today's scenario high occupational mobility, high ambition and desire for high standard of living is leading to high incidence of suicidal deaths. Nowadays suicidal gesture, attempted suicide & well successful suicide cases are seen in the society often on. A prospective cum retrospective study is carried out in the Department of Forensic Medicine and Toxicology, Mahatma Gandhi Medical College & Hospital, Jaipur w.e.f. 2004- 2008. In this period out of total 627 autopsies performed, 223 were found as suicidal deaths. In these 223 cases, 88 cases ended their life by poisoning, rest of them in the decreasing order are as follows – Train Run-over (55), Hanging (43), Drowning (20), Alcohol (9), Burn (4), Celphos Poisoning (3), Insecticides Poisoning (1).

This clearly indicates that availability of highly lethal suicidal method and rate of suicide are interrelated. During the study we have found three new innovative methods of committing suicide. All three victims were pursuing their professional qualification and will be discussed in this study.

Key Words: Suicide, Poisoning, Burn, Hanging, Intentional Self-Harm

Introduction:

Suicide is not new in human history rather it is as old as humanity itself and its sources reaches far back into the beginning of the culture. It is a specifically human problem. Any animal can die by disease and can be destroyed intentionally or accidentally by an outside agency but as far as we know only man can will his death and kill himself. At some stage of evolution man must have discover that he can kill himself. It is the most personal action, which an individual can take. The study on suicide illustrates that human action, however personal is also interaction with other people and that the individual can not understood in isolation from his social matrix.

Suicide is widely prevalent and no nation and culture has escaped from it, though the toll varies from place to place. The prevalence of suicide in today's world is quite alarming. In year 2000 about 800000 suicide deaths occurred worldwide.

The World Health Organization estimates that more people die each year from suicide than in all the world's arm conflicts.

The word suicide was first used by Sir Thomas Browne in his "Religio Medici" in 1642 and subsequently by Walter Charleton in 1651. Prior to the introduction of word "Suicide" self destruction, self killing and self murder were in practice.

Suicide has been defined by Beck et al as, "a willful self inflicted life threatening act which results in death."

Schneidman (1976) defined it as, "the human act of self inflicted, self intentional cessation of life". It is an act committed out of constricted thinking, tunneled logic and acute anguish. [1]

The world health organization defines suicidal act "as the injury with varying degrees of lethal intent and suicide may be defined as a suicidal act with fatal outcome."

Durkheim (1858-1917) defined suicide as "death resulting directly or indirectly from a positive or negative act of the victim himself, which he knows will produce this result." This excludes those who survive the attempt. [2]

Suicide may be defined as, "an intentional act causing harm to a person amounting to death and committed by person himself in the absence of contribution from any external agency particularly in the commencement of act." Recently the term suicide has been replaced by "Intentional Self-Harm"(ISH) in the scientific literature due to derogatory nature of the word "Suicide".

Nowadays suicidal gesture, attempted suicide, well successful suicide cases are every now and then we seen or hear in the society. Increasing numbers of deaths from suicide is a measure public health problem in India today.

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Aims and Objectives:

1. To find out the pattern of suicide
2. To find out the stressful life event
3. To study the Psycho social cultural and precipitating factors for suicide in relation to age and gender with a view to formulate some preventive strategies

Material and Method:

The study is confined to the undoubtful cases of suicide. In the study various epidemiological characteristics of cases and medico legal aspects were collected from the perusals of police papers, postmortem reports and thorough questioning of the parents, relatives, friends, neighbours and police officers. The nature of death was first evaluated by exclusion method then the dead body was examined externally and internally on autopsy table in different natures of death. Finally data pertaining to external and internal findings were collected, compiled and discussed.

Observations:

In the study Suicidal cases from 2004-2008 were examined retrospectively and was carried out in the Department of Forensic Medicine and Toxicology, Mahatma Gandhi Medical College and Hospital, Sitapura, Jaipur.

Since year January 2004 to December 2008 total 627 medico legal autopsies were conducted, out of them 223 cases were found to be of Intentional Self Harm (ISH).(Table-1)

Among them the most vulnerable age group was 21-30 years (Graph 1). Male outnumbers the females (male 79, female 14- Graph 2).

Suicidal deaths are more prominent in married persons (Table 2)

Poisoning was the most common method used for ending the life irrespective of the education level, socio-economic status and rural-urban life etc.(Table 3)

Jumping against the moving train was the second most common method used for ISH (55), Hanging remain the third manner of choice for ISH (43) followed by Burn (4) being the least preferred method.(Table 3).

The study also reveal that Domestic unhappiness and shattered Family relation is the most common precipitating factor for committing suicide (23.77%), followed by Unhappy Love affairs (18.83%). However despair over torture is the lease common precipitating factor (1.35%) (Table 4) In our study out of these 223 cases, we have found three new innovative method , especially used by educated professionals, that are as follows

Case 1:

A young Doctor of 32 years, married anesthetic by profession has applied his professional knowledge to put an end on the frustration and fear aroused due to marital disharmony and fear of pro-

ceeding of 498 A. He ends his life by self cannulation , a cocktail of Ketamine (3 vial) and Vecuronium(2 vial), on assessable left wrist.

**Case 2:**

A young unmarried 22 years old, Second year Engineering Student designed a scene on the basis of his technical skills to end his life due to unhappy love affair. He has sealed the ventilators and windows of his rented room after putting a live coal Angeethi and bolted the door from inside. The dead body on postmortem examination depicted the typical features of CO poisoning.

**Case 3:**

A young male patient of 19 year, student of engineering college, brought to the hospital with the history of diffuse swelling around the dorsum of left hand with pain. After taking the patient in confi-

dence, he revealed highly significant history indicating his suicidal intention by injecting snake venom on assessable left dorsum of hand that he bought through a local snake charmer.

Discussion:

The causes and circumstances for suicide are numerous and do not admit an easy classification and categorization. The common means adopted for suicide in India are poisoning, hanging, drowning, jumping from height, jumping against moving train, fire arm and fire etc.

The incidence and rate of suicidal deaths is lowest in Bihar (1.10/lakh) while maximum cases are found in Sikkim(48.20/Lakh), However in Union Territories of India Pondicherry reported maximum number (46.90/Lakh)-(Source- National Crime Record Bureau).

In our study the young age group (21-20 Yrs) is the most common victim of ISH and consistent with P. Midha et al (2001). [3]

The motives behind suicide in our study are marital disharmony and shattered family relations, Unhappy Love affairs and depression. This is in agreement with Kuo W H, Gallo J J and Eaton W.W. et al (2004), [4] where they have mentioned depression as the motive for committing suicide. Our findings are also in agreement with Gupta S.C. & Singh H. (1981). [5] who has found marital or relationship dispute as one of the motives for suicide. Marital disharmony is the most common precipitating factor both in India and abroad (P. Midha et al -2001, Phillips M. R. et al. 2002, [6] Vijay Kumar L. et al -2003. [7]

The WHO has also reported the poverty as a major factor for suicide followed by stress, mental illness, unemployment and substance abuse. (Jan-cloes M.1998, [8])

Among the methods of suicides that are commonly encounter in the routine medico-legal practice could be categorize into physical and chemical methods.

The methods of suicide employed generally reflect the different avenue available in the community. Knowing the pattern of suicide in an area not only help in early management of such cases but also suggests taking earlier preventive measures. It is necessary for the death investigators to be aware of the common scenario, risk factors, methods and the victims as well as pitfalls that may be encountered. In our study most common method is unknown poisoning (39%), jumping against moving train (25%), hanging (19%), Drowning (9%), Alcohol (4%), Burn (1.8%).Higher numbers of death due to jumping against a running train are due to the highly busy rail track connecting Jaipur, to West and South part of the India. At the time of peak impulse the availability of passing by train is almost always there.

In our case study three different type of the case reports are identified and highlighted, that gives a warning alarm that youth are misusing their knowledge.

It is pertinent to mention here that cases of suicidal death due to firearm, sharp edged weapons are not found in our study.

Jumping from height and use of motor vehicles has not been found in our study and these two types of cases if not impossible but difficult to prove to be suicidal in nature.

Conclusion:

The methods of suicide employed generally reflect the different avenue available in the community. In this study most commonly used methods are:

- Unknown poisoning (39%)
- Jumping against moving train (25%)
- Hanging (19%)
- Drowning (9%)
- Alcohol (4%)
- Burn (1.8%)

Higher numbers of death due to jumping against a running train are due to the highly busy rail track connecting Jaipur to West and South part of the nation. At the time of peak impulse the availability of passing by train is almost always there. In our case study three different type of the case reports are identified and highlighted, that gives a warning alarm that youth are misusing their knowledge.

The above-stated facts indicate that the unnatural death is an alarming indicator for the democratic ruling government morally. Therefore the government with its full resources in the association with the Non Government organization must develop a continuous intervention services for suicide attempts and population at risk in order to prevent further risk of suicide and safeguard valuable lives at risk without loosing any time.

Recommendations:

Responsibility for prevention of violence in our society does not rest only on the law enforcing personnel but also public health and other human service agencies should assist in preventing primary violence to reduce other major causes of morbidity and mortality

It is necessary for the death investigators to be aware of the common scenario, risk factors, methods and the victims as well as pitfalls that may be encountered

Therefore, the government with its full resources in the association with the Non Government organization must develop a continuous intervention services for suicide attempts and population at risk in order to prevent further risk of suicide and safeguard valuable lives at risk without loosing any time.

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Table A**Incidence and rate of suicidal deaths in India (2004-2008))**

S.No.	Year	Total No. of Suicides	Estimated Mid-Year Population (Lakhs)	Suicide Rate (per 100,000)
1	2004	113,697.00	10,856.00	10.5
2	2005	113,914.00	11,028.00	10.3
3	2006	118,112.00	11,197.75	10.5
4	2007	122,637.00	11,365.50	10.8
5	2008	125,017.00	11,531.30	10.8

social psychiatry & psychiatric epidemiology 2004; 39(6):497-501.

Table 1**Cases of intentional self harm (ISH)**

Year	Total Postmortem	Total Suicidal Deaths	Percentage
2004	117	32	27.35
2005	88	31	35.23
2006	121	44	36.36
2007	145	55	37.93
2008	156	61	39.10
Total	627	223	

Table 2**Distribution of marital status of people committing intentional self harm (ISH)**

Marital Status	Male	Female	Total
Married	105	22	127
Unmarried	46	9	55
Unknown	38	3	41
Total	189	34	223

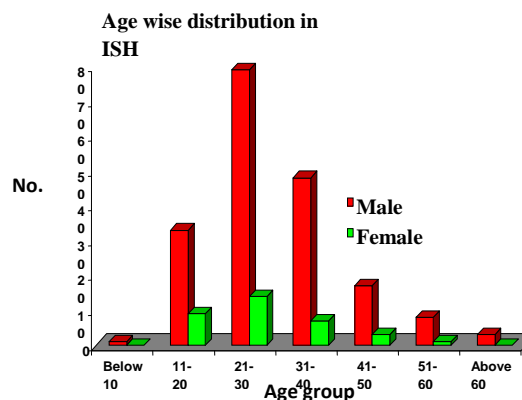
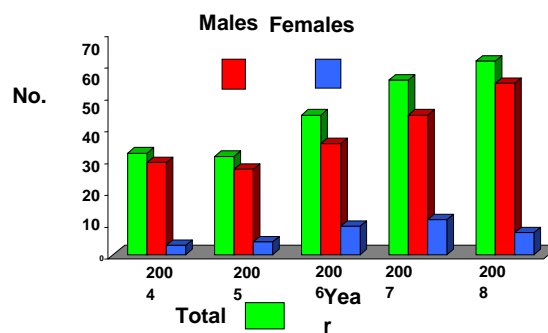
Table 4**Precipitating factors for ISH**

Precipitating Factors	Numbers	Percentage
Domestic Unhappiness and shattered family relations	53	23.77
Unhappy Love affairs	42	18.83
Dowry related	26	11.66
Monetary Loss in Lottery/Shares	21	9.42
Failure in examination	19	8.52
Poverty and unemployment	18	8.07
Insanity	16	7.17
Unknown/undetermined	13	5.83
Dispute over properties	6	2.69
Multiple attempts	6	2.69
Despair over torture	3	1.35

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Table 3

Choice of method of ISH		
Method	Cases	Percentage
Unknown Poisoning	88	39.46
Jumping against running train	55	24.66
Hanging	43	19.28
Drowning	20	8.97
Alcohol poisoning	9	4.04
Burn	4	1.79
Celphos Poisoning	3	1.35
Insecticide Poisoning	1	0.45
Total	223	

Graph 1**Graph 2****Gender wise distribution in ISH**

Original research paper

Age of Menarche in Girls of Uttarakhand

*Dr. Chandra Prakash, **Dr Bhavana Srivastava, ***Dr Sanjay Gaur, ****Dr Renu Bala, *****Dr Abhishek Rai, *****Dr Roham

Abstract

Menarche is a physiological and developmental phenomenon significant in the life of a female. It occurs between the ages of 10 to 16 years. Study suggests that menarche tends to appear earlier in life as the social, nutritional and economic condition of society improves. There is paucity of information about menarchial age in hilly regions of Uttarakhand. Therefore, this research was undertaken to determine age of menarche and its variation with geographical, seasonal and nutritional status. This study was carried out through a questionnaire in 450 girl students between age 17-26 years at Uttarakhand Forest Hospital Trust, Medical College, Haldwani, India.

The mean age of onset of menarche was $13.6 (\pm 1.1)$ years. The monthly occurrence of menarche had peaks in May-June. The mean menarchial age of girls belonging to plain area was 13.18 ± 1.31 years, which showed significantly earlier onset as compared to girls from hilly area (14.21 ± 1.46 years). In hilly areas girls having vegetarian diet had significantly higher age of menarche (14.60 ± 1.33 years), compared to girls having non-vegetarian diet (14.09 ± 1.56 years). Therefore altitude, season and nutritional status have bearing on the mean menarchial age in girls of Uttarakhand.

Key Words: Age at menarche, altitude, nutrition, Uttarakhand

Introduction:

Menarche is the onset of menstruation and it is one of the most significant mile stone in a woman's life. Unlike other pubertal changes that are gradual and continuous, menarche is a distinct event with a sudden onset. It is highly correlated with after pubertal characteristic and is, therefore preferred as a benchmark for sexual maturation. For most females it occurs between his age of 10 to 16 years, however, it shows a remarkable range of variation. [1]

These variations are often the cause of anxiety for female adolescents and their families at large. These variations are known to be sensitive indicator of various characteristic of population including nutritional status, geographical location, environmental condition and magnitude of socio economic inequalities in a society. [2]

Studies have suggested that menarche tends to appear earlier in life as the social, nutritional and economic condition of the Society improves. [3]

Early onset of menarche has been the risk factor for breast cancer, ovarian cancer and other diseases. [4] It has been noted that the average age of menarche is gradually going down. [5] In Sweden during the past 50 years, the average rate of decline was 10 days per annum, in Japan it was one year in a period of eight years [6], in India a decrease of 5-7 days per annum was observed in Bengali Hindu girls. [7] In Northern and Eastern Europe the downward trend in menarche age has stopped. The menarchial age has fallen steeply but is stable around 13 years and may be rising again. There is variability for age at menarche between women across different countries or across different ethnic group. [8]

During the past century there has been a secular (time related) trends towards an earlier onset of menarche in developed countries, with a decline of 2-3 months per decade in Europe and United States. [9] General improvement in nutrition and health has been suggested to explain the downward trend. The earlier onset of menarche has also been seen in developing countries like Bangladesh. [10]

In the population under study life style has changed over the years with higher literacy and better nutritional states, women have become more conscious about the health aspect of their families. More and more women are taking employment to supplement the family income. But still there is paucity of information on the menarchial age in hilly regions of Uttarakhand and its relation with social, nutritional states and geographical region. This research was undertaken to determine the age of menarche and its

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variation with respect to geographical and nutritional status.

Material and Method:

Study Area:

The study was carried out in the Uttarakhand Forest Hospital Trust Medical College, Haldwani, Nainital, where students from all parts of the state of Uttarakhand India study.

Subjects:

This included 450 girl students between 17 yrs. and 26 yrs. studying in medical and paramedical courses.

Method of Data Collection:

Using the retrospective method, 450 questionnaires were distributed to girl students, of these 20 were not properly answered. The questionnaire included socio- demographic information about the responded age, educational status of self and family income and residence. The question related to menstruation comprised menarchial age, month of onset and dietary habits. The questionnaire were verbally interpreted in simple language and properly explained to avoid any form of misunderstanding and to facilitate accurate response by the subject. The questionnaires were collected immediately after completion to minimize interpersonal communication amongst the subjects and to prevent the influence of friends on individual response.

Informed consent of the girls was obtained.

Statistical Analysis:

Mean, standard deviations were determined. Z score was used to test for significance since the sample size was large. In all cases a 5% level of error was assured 95% level of confidence accommodated with a critical value of 1.96 on a two tailed distribution or a critical value of 1.64 on a one- tailed distribution.

Result:

The girls were in the age group of 17 to 26 years. The mean (SD) ages of the girls included in the study were 19.1 (± 1.8) years. All had menstruated at the time of interview.

The mean age of onset of menarche was 13.6 (± 1.1) years. The monthly occurrence of menarche was not uniformly distributed throughout the year but had peaks in May-June, two third had menarche during the summer months. **Table No.1** and **Fig. No. 1**

The estimated mean menarchial age of girls belonging to plain area was 13.18 \pm 1.31 years as compared to girls from hilly area having 14.21 \pm 1.46 years. This result showed significantly earlier onset of age of menarche in girls belonging to plain areas of the state (Z score = 10.21). **Table No. 2** and **Fig No. 2**

In hilly areas girls having vegetarian diet had significantly higher age of menarche 14.60 \pm

1.33, compared to girls having non-vegetarian diet 14.09 \pm 1.56. However there was insignificant difference in menarchial age of girls belonging to plain areas having vegetarian 13.09 \pm 1.26 or non vegetarian diet 12.97 \pm 1.39. (**Table No. 3, Fig No. 3**)

Discussion:

Data from the present study shows a statistically significant lower mean menarchial age of girls from plain area (13.18 \pm 1.31) as compared to those from hilly region (14.21 \pm 1.46). A number of factors may have contributed to this difference. Studies have reported that elevation above sea level influences menarchial age at the rate of approximately three months delay for each 100 meters ascent of altitude. The authors also pointed out that economic and nutritional condition at high altitude are poorer and the calorie requirement for existence may be greater. [11] The summer peaks in menarche in our study contrast with those studies in rural Bangladesh were half of the adolescent attained menarche in winter months. [12] This may be due to increased temperature and stress during summer months.

In this study there was insignificant difference in the mean menarchial age of plain area girls having non-vegetarian or vegetarian diet. While in hilly area girls there was significantly higher mean age of menarche for girls on vegetarian diet as compared to girls on non-vegetarian diet. This was probably due to diet rich in protein. In the study done on Slovenian girls the researcher observed that for those whose diet were rich in protein particular the meat the mean age at menarche was 12.65 (\pm 0.13 SE) years whereas for girls whose diet was largely carbohydrate, it was 14.1 (\pm 0.11 SE). [13] In the study on Maharashtrian girls the researcher found that girls having non-vegetarian diet would menstruate about six months earlier than a vegetarian. [14] Another study on Maharashtrian girls also showed early menarche as the food habits changed from vegetarian to eggetarian to non-vegetarian diet. [15] The present study also showed a positive correlation of age at menarche and non vegetarian diet.

Whatever the explanation, the accelerating influence of good nutrition on menarche has also been reported from Denmark, China Japan, Mexico Israel and many parts of the world.

Conclusion:

The mean menarchial age of girls in the study was 13.6 (\pm 1.1) years. Girls belonging to plain area had significantly lower mean age of menarche than girls from hilly area signifying the influence of altitude on the menarchial age. The summer peaks in menarche May- June, contrast with those studies where half of the adolescents attained menarche in winter months probably due to increased stress and temperature during summer months. The girls having non vegetarian diet had significantly earlier onset of

menarche especially those from hilly areas. Hence the present study showed a positive correlation of age of menarche and non vegetarian diet.

Therefore, it is proven beyond doubt that altitude, temperature and nutritional status have bearing on the mean menarchial age in girls of Uttarakhand.

Table No.1: Monthly distribution of age of menarche

Month	Number of girls
Jan - Feb	49
Mar- Apr	89
May-June	107
Jul-Aug	90
Sept-Oct	54
Nov-Dec	41

Table No. 2: Mean menarchial age in girls belonging to Plain and hill areas

	Plain area girls	Hilly area gils	Z Score
Menarchial age (years)	13.18 ± 1.31 (n= 254)	14.21 ± 1.46 (n= 176)	10.21 *

Values are Mean ± SD

* Statistically significant

Table No.3: Relationship between menarchial age (years) and vegetarian and non-vegetarian diet in girls from plain & hilly regions

Areas	Vegetarian diet	Non-vegetarian diet	Z Score
Plain	13.09 ± 1.26 (n= 142)	12.97 ± 1.39 (n=112)	- 1.12 Ns
Hilly	14.60 ± 1.33 (n= 105)	14.09 ± 1.56 (n=71)	9.74 *

Value are mean ± SD

* Statistically Significant

NS- Not significant

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Fig No.1: Monthly distribution of the age of menarche

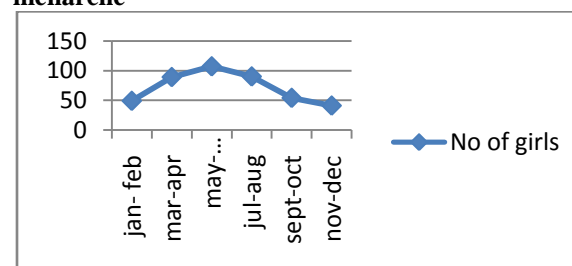


Fig No. 2: Mean menarchial age in girls belonging to Plain and hill areas

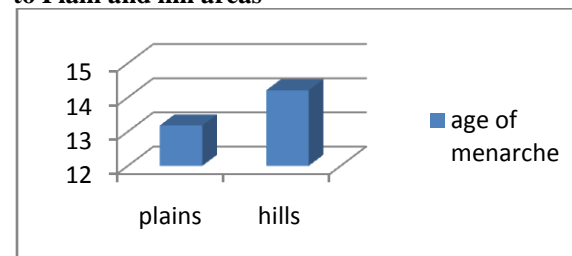
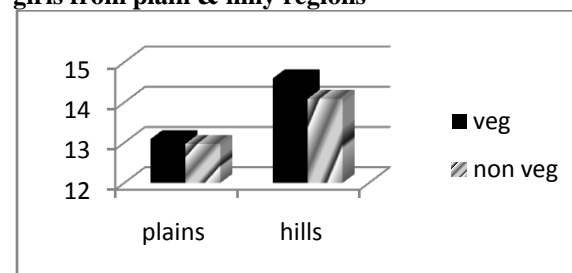


Fig No. 3: Relationship between menarchial age (years) and vegetarian and non-vegetarian diet in girls from plain & hilly regions



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Original Research Paper

Five Year Survey of Toxicological Testing of Clinical Body Fluid Samples at the Poison Control Centre in the Indian State of Kerala

*Pillay VV, Arathy SL, Vijesh KP, Vipin KG

Abstract

The Poison Control Centre (PCC) at Amrita Institute of Medical Sciences, Kerala, was established in June 2003, but became fully operational from January 2005. There are only four PCCs in India recognized by the World Health Organization, of which this is one.

A five-year (2005 to 2009) review of biological samples analyzed for chemicals, drugs and toxins by the analytical laboratory attached to the PCC is presented to give an indication of the commonest types of poisoning encountered in this region of India, aside from venomous bites and stings. Such data are not adequately available so far, which is also true for other parts of the country.

Results of the survey show that there has been a steady rise in the receipt of samples over the entire period from 432 in 2005 to 601 in 2009.

Among the samples analyzed, the commonest toxicants are pesticides, pharmaceuticals, heavy metals and alcohols. Of the pesticides, organophosphates accounted for the maximum number, while most of the remaining comprised zinc phosphide, carbamates, pyrethroids, paraquat, phosphorus, and bromadiolone. Aluminium phosphide, which is a common pesticide in some other regions, was virtually non-existent, while zinc phosphide, a rodenticide, is the second highest in incidence. Of the pharmaceuticals, the largest number comprised sedative-hypnotics, while antipyretic drugs, especially paracetamol, accounted for a most of the remaining. Of the metals, the commonest was lead, followed by arsenic, mercury, iron, etc. Requests for copper testing were common, but mostly pertained to Wilson's disease, and not toxicity. Among the alcohols, ethanol was the commonest.

Even though Kerala is rich in flora, plant toxins were low in incidence, because of the difficulty in testing for such toxins, as compared to chemicals. Bites and stings were not included in this study. Therapeutic monitoring of drugs, which accounts for a large number of samples received by the laboratory was also not part of the survey.

Key Words: Poison Control Centre, Analytical Toxicology, Pesticides, Pharmaceuticals, Heavy Metals, Alcohols

Introduction:

The incidence of poisoning in India is among the highest in the world, and it is estimated that more than 50,000 people die every year from toxic exposure. [1] The causes of poisoning are many - civilian and industrial, accidental and deliberate.

The commonest agents in India appear to be pesticides (organophosphates, carbamates, chlorinated hydrocarbons, and pyrethroids), sedative drugs, chemicals (corrosive acids and copper sulfate), alcohols, plant toxins (datura, oleander, strychnos, and gastro-intestinal irritants such as castor, croton, calotropis, etc.), and household poisons (mostly cleaning agents). [2-5]

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Aluminium phosphide is commonly involved in suicidal and accidental poisoning in some northern Indian states. [6, 7] One recent study pertaining to poisoning statistics demonstrated more of such differences between northern and southern Indian states. [8] Among children the common culprits include kerosene, household chemicals, drugs, pesticides, and garden plants. [9, 10]

The Evolution of Poison Control Centres:

Arising out of a growing concern over the burgeoning incidence of poisoning worldwide, coupled with a lack of public awareness about its seriousness, Poisons Information Services made their first appearance in the West in the early 1950s. Since then, all around the world similar Centres have sprung up, performing the invaluable functions of generating public awareness on poisoning, and imparting much needed toxicological diagnostic and therapeutic assistance to doctors. Today there are more than 75 such certified Centres in the USA alone, providing almost any information within a

matter of seconds through the use of intricate, computerized information resource systems. [11] India made a belated foray with the establishment of the National Poisons Information Centre at the All India Institute of Medical Sciences, New Delhi in December, 1994. The World Health Organization released its computer software on poisons (INTOX) for use by the Centre. A second Centre was subsequently opened at the National Institute of Occupational Health, Ahmedabad (Gujarat). Some more Regional Centres have come up in cities such as Chennai (Tamil Nadu) and Cochin (Kerala) with poison information and analytical services.

The Cochin PCC was established in 2003, and became fully operational from January 2005. It has an Analytical Laboratory attached to the Centre that tests for common poisons or drugs in body fluids, as well as in water and medicinal preparations, and other commercial products.

This paper presents the results of toxicological analyses on body fluid samples of poisoned vic-

tims carried out by this Centre for a 5-year period from 01 January 2005 up to 31 December 2009. The samples (gastric aspirate/lavage, blood, and urine) were received from all over Kerala state.

Discussion:

A total of 432 cases (comprising gastric aspirate/lavage, blood, and urine samples in each case) were analyzed in 2005, of which 220 tested positive for various poisons. The figures were 451 and 266 for 2006, 481 and 254 for 2007, 580 and 307 for 2008, and 601 and 370 in 2009. The break up is listed in **Table No. 1**. It is important to note that all three samples (gastric aspirate/ lavage, blood, urine) were not necessarily received in every case; the positive result indicates merely that one of the three at least revealed the presence of the particular toxicant.

Table No. 1
Body Fluid Samples Analyzed at Poison Control Centre, Cochin: 2005-2009

Year	Poison Detected						Sub-totals
	Pesticides	Pharmaceuticals	Heavy Metals	Alcohols	Plant Tox-ins	Miscellaneous	
2005	67	43	36	20	3	51	220
2006	53	55	69	26	9	54	266
2007	89	60	24	20	6	55	254
2008	100	53	43	48	10	53	307
2009	87	70	66	66	11	70	370
Sub-totals	396	281	238	180	39	283	Grand Total 1417

In the same period, the number of samples analyzed (mostly serum, and a few urine samples) for therapeutic monitoring was 43, 425, 446, 534 and 716 for the years 2005, 2006, 2007, 2008, and 2009 respectively. The number is small for the year 2005, because the concept took about a year to really catch on among physicians. The drugs tested for therapeutic monitoring included mainly digoxin, lithium, phenytoin, valproic acid, phenobarbitone, carbamazepine, etc. These data are not included in this study since they do not represent poisoning cases.

Not surprisingly, for the overall 5-year period, pesticides ranked number one among all the

toxicants that were detected in the samples (396 out of a total of 1417 positive samples). This is reflected in earlier studies from various regions of India. [1-5, 7, 8] In the UK, pesticides are responsible for only about 1% of deaths from poisoning while various studies in India indicate that the figures range from 20% to a staggering 70%! [12] Again not surprisingly, organophosphorus pesticides accounted for the maximum number among the various pesticides (47%), followed by zinc phosphide (20%), carbamates (16%), pyrethroids (6%), paraquat (5%), bromadiolone (4%), and phosphorus (2%), (**Table No. 2**).

Table No. 2
Body Fluid Samples Tested Positive for Pesticides (2005-2009)

Pesticide Detected (in percentage of the total)						
*Organophosphates	Zinc phosphide	Carbamates	Pyrethroids	Paraquat	Bromadiolone	Phosphorus
47	20	16	6	5	4	2

*Organophosphates: chlorpyrifos, monocrotophos, malathion, quinalphos; Carbamates: carbofuran, propoxur; Pyrethroids: prallethrin, cypermethrin, fenvalerate

Among the organophosphorus pesticides, chlorpyrifos accounted for 30% of the positive

samples. As far as carbamates were concerned, most of the samples tested positive for carbofuran (95%),

while propoxur figured in 5% of the cases. Plasma cholinesterase level which was done in 78% of the organophosphate cases and 85% of the carbamate cases showed significant suppression (less than 50% of the lower limit of the normal) in 65% of the former and 51% of the latter.

Of the pyrethroids, prallethrin accounted for 50% of the positive samples. The remaining was accounted for by cypermethrin (28%) and fenvalerate (22%). Aluminium phosphide which ranks number one among pesticide poisoning cases in some northern and western regions of the country [13] accounted for only a single case, and has been included in the list of miscellaneous toxicants.

Pharmaceutical drug overdose came only second to pesticide poisoning, which is an indication of increasing preference of the former over the latter in recent times by those wishing to commit suicide.[14] A few of the cases reported here were accidental overdoses, especially in children (7%). Of the

pharmaceutical drugs that tested positive over the entire 5-year period, the following were most commonly implicated: sedative-hypnotics (barbiturates, benzodiazepines, opiates) (53%) and non-steroidal anti-inflammatory drugs (especially paracetamol) (15%). The rest comprised antipsychotics, antidepressants, anticonvulsants, etc (**Table No. 3**). Samples received for routine therapeutic drug monitoring numbered hundreds every year (except the first year), and were not included in the survey.

Of the heavy metals that tested positive (mostly in urine and/or blood), the following were common: lead, arsenic, and mercury (**Table No. 4**). This is in agreement with most studies done in India and abroad, the three metals being the commonest culprits among all the metallic poisons. [15] Lead was significantly more common than the others, probably because it is the commonest metallic ingredient in Ayurvedic medicines, which are very popular in Kerala. [16]

Table No. 3
Body Fluid Samples Tested Positive for Pharmaceutical Drugs
(2005-2009)

Drug Detected (in percentage of the total)								
Sedative-hypnotics	NSAID	Anti-psychotics	Anti-depressants	Anti-convulsants	Anti-histamines	Anti-diabetics	Steroids	Miscellaneous
53	15	8	4	3	2	2	1	12

Sedative-hypnotics: barbiturates, benzodiazepines, opiates; **NSAID:** salicylates, paracetamol, ibuprofen, piroxicam, diclofenac; **Antipsychotics:** lithium, monoamine oxidase inhibitors, selective serotonin reuptake inhibitors, carbamazepine; **Antidepressants:** tricyclics; **Anticonvulsants:** phenytoin, valproic acid; **Antihistamines:** chlorpheniramine maleate; **Antidiabetics:** glibenclamide, glyburide; **Steroids:** prednisolone; **Miscellaneous:** antihypertensives, anti-infectives, anticholinergics.

Table No. 4
Body Fluid Samples Tested Positive for Heavy Metals

Year	Metal Detected (year-wise)				Total
	Lead	Arsenic	Mercury	Miscellaneous	
2005	19	11	1	5	36
2006	51	7	2	9	69
2007	17	1	1	5	24
2008	32	0	6	5	43
2009	39	10	11	6	66

The metals grouped under “miscellaneous” column in the table comprised cadmium, antimony, chromium, manganese, and bismuth. Copper was not taken into account in the study, since most cases were suspected patients of Wilson’s disease, and not copper poisoning. Copper screening was done in 90, 91, 118, 130 and 115 samples in 2005, 2006, 2007, 2008, and 2009 respectively, and the number of positive results (above toxic range based on sex and age) were as follows: 22, 37, 41, 44, and 36. It is unfortunately not clear as to how many of these represent true copper poisoning, and how many are cases of Wilson’s disease, since the information was not forthcoming from the attending physician in most of these cases.

Urine screening for heavy metals (lead, arsenic, mercury, bismuth and antimony) by simple biochemical testing (dithizone method) was done in

some cases, but has not been included in the survey, because the exact metal cannot be pinpointed. The number of metal screens were as follows from 2005 to 2009: 36, 15, 52, 41 and 18.

The next major group of toxicants comprised the alcohols, of which ethanol was present in all the samples (180), and methanol was detected in addition to ethanol, in 11 cases (3 in 2005, nil in 2006, 3 in 2007, 1 in 2008, and 4 in 2009). The fact that alcohols, especially ethanol should figure prominently in a Kerala study should come as no surprise, since this small Indian state accounts for the highest per capita consumption of liquor in the country (8.3 litres)! [17] The other alcohols such as isopropanol, ethylene glycol, etc., did not figure in any of the samples though such requests were received in a few of the alcohol cases.

Of the requests for detection of plant toxins, there were a total of 95 cases over the 5-year period, but positive result could be obtained only for 39 (less than 50%), which was mainly because of the difficulties generally associated with plant toxin detection in samples. Of the toxins that turned up positive, the main toxins encountered were related to *Cerbera odallum* (one of the commonest plant products used for committing suicide in Kerala [18], strychnos, yellow oleander, and abrus (in decreasing order of

incidence). Less common toxins included alkaloids of datura and white or pink oleander. This is a little different from most other regions of the country, where *Cerbera odallum* is quite rare, while plants such as datura are quite frequently encountered in poisoning cases. [1, 3, 7]

The miscellaneous group of toxicants actually comprised a substantial number of the total (283/1417), but because of the diversity, individual representatives were too few to be included in distinct categories. Of the numerous toxicants that have been included in this category, the following are some of the more important ones: copper sulfate, petroleum based compounds (especially kerosene), corrosives (hydrochloric acid, carbolic acid, formic acid), paraphenylene diamine (a popular ingredient of hair dye), oxalates, borax, iodine, etc. Even esoteric toxicants were detected in some samples, for e.g., pigments such as malachite green and auramine (increasingly being used in the manufacture of "synthetic cow dung powder" which is used for various purposes, especially by Tamilian people of low socio-economic strata [19]), and bis-acrylamide, a potent neurotoxin that has applications in several fields, especially biotechnology.

Conclusion:

A five-year (01 January 2005 to 31 December 2009) review of biological samples analyzed for chemicals, drugs and toxins by the analytical toxicology laboratory attached to the Poison Control Centre, Amrita Institute of Medical Sciences, Cochin, Kerala reveals that the commonest toxicants appear to be pesticides, pharmaceuticals, heavy metals, and alcohols. Of the pesticides, organophosphorus compounds accounted for the maximum number, while most of the remaining comprised zinc phosphide, carbamates, pyrethroids, paraquat, phosphorus, and bromadiolone. Of the pharmaceuticals, the commonest were sedative-hypnotics, while antipyretic drugs, especially paracetamol accounted for a significant part of the remaining. Of the heavy metals, the commonest appeared to be lead, followed by others such as arsenic, mercury, iron, etc. Among the alcohols, ethanol was the commonest. Plant toxins were quite low in incidence, which is because of the difficulty in testing for such toxins in the laboratory, as compared to chemicals. Toxic principles of *Cerbera odallum* were most commonly encountered.

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Original research paper

Correlation of Odontometric Measures in Sex Determination

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Abstract

Mandibular canines exhibit the greatest sexual dimorphism amongst all teeth. The present study was performed on 400 healthy volunteers (200 males, 200 females) of 17 - 21 years with the aim to investigate whether any correlation existed between odontometric measures including mandibular canine index, and sex determination. Mean value of intercanine distance was higher in males than females and the difference was statistically highly significant (p value <0.01). Comparison of mean values of left and right mandibular canine widths exhibited lesser values in females. The variation in right and left mandibular canine width between males and females was highly significant (p value <0.01). The right and left mandibular canine index (MCI) among genders showed no significant difference. A mesio-distal canine width greater than 7.3 mm was suggestive of male sex. Our study conclusively establishes the existence of a definite statistically significant sexual dimorphism in mandibular canines and that MCI is of limited value.

Key Words: Sexual Dimorphism, Intercanine Distance, Mandibular Canine Width, Mandibular Canine Index

Introduction:

Identification of sex in damaged dead bodies (non-living population) is an essential step for medico-legal purposes. Teeth are an excellent material in living and non-living population for anthropological, genetic, odontological and forensic investigations. Their extreme durability in the face of fire and bacterial decomposition makes them invaluable for identification. Being the hardest and chemically the most stable tissues in the body, they are selectively preserved.

Teeth may be used for sex determination with the aid of odontometric analysis. Mandibular canines are found to exhibit the greatest sexual dimorphism amongst all teeth. [1, 2] "Sexual dimorphism" refers to those differences in size, stature and appearance between male and female that can be applied to dental identification because no two mouths are alike.

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 diseases, are exposed to less plaque, calculus, abrasion from brushing, and are the last teeth to be extracted with respect to age. [3]

Canine teeth have also been reported to survive in air, train and hurricane disasters. [4] These findings indicate that mandibular canines can be considered as the 'key teeth' for personal identification. [1] Besides, the dentition in males is larger than in females. Males possess larger tooth crowns than that in females in contemporary human populations.

Studies performed on the mandibular canines by various authors [5-8] using the ratio between the maximum crown width and inter-canine width, i.e. mandibular canine index (MCI), may determine sex with an accuracy of 84.3% in males and 87.5% in females, 83.3% in males and 81% in females, 78% in males and 66% in females, and 68.34% in males and 81.67% females respectively by comparing the observed MCI with a standard value. MCI was employed in numerous studies on large population as it is simple, reliable, inexpensive and easy to perform for determining sex. Further, Kaushal *et al* [1] and Rai *et al* [9] observed that whenever, mesio-distal canine width was greater than 7.0 mm or 7.2 mm respectively, the probability of being a male subject was more.

The aims of the present study was firstly to investigate whether there exist any correlation between odontometric measures and sex determination and secondly, the accuracy with which these measures including mandibular canine index could be employed for the determination of sex in healthy population.

Material and Methods:

This cross sectional prospective study included 400 healthy volunteer students of various affiliated institutions of Rohilkhand Educational Charitable Trust, Bareilly, Uttar Pradesh. The males and

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females were equally distributed and their age group ranged 17-21 years.

The inclusion criteria were as follows:

- (i) Healthy state of gingival and periodontium, (ii) Caries free teeth, (iii) Normal overjet and overbite, (iv) Absence of spacing in the anterior teeth, and (v) Normal molar and canine relationship.

The significant exclusion criteria employed for selection of the study sample were malalignment, malrotation, malocclusion, spacing, missing incisor, dental restoration, dental wiring and prosthetics, and attrition. Persons suffering from chronic systemic diseases were also excluded.

A total of 418 student volunteers were enrolled of which 18 subjects following oral cavity examination were excluded for the purpose of the study based on exclusion criteria. Thus, the present study comprised of 400 subjects (200 males and 200 females).

The following intraoral measurements were taken by using a Vernier Caliper with resolution of 0.02 mm after getting consent of the subjects.

1. **The mandibular canine width:** was taken as the greatest mesio-distal width between the contact points of the teeth on either side of the lower jaw.
2. **The inter-canine distance:** was measured as the linear distance between the tips of right and left mandibular canine in the lower jaw.

Each parameter was measured two times separately by two investigators and the average value was calculated.

Sexual Dimorphism in right and left mandibular canines was calculated using formula given by Garn & Lewis [10] as follows:

Sexual Dimorphism = $(X_m / X_f - 1) \times 100$
(X_m = mean value of male canine width; X_f = mean value of female canine width).

The mandibular canine indices were calculated based on the formula used by Rao *et al* [5].

Observed mandibular canine index (MCIo) was calculated using the formula:

Mesio-distal crown width of mandibular canine (MCIo)
$= \frac{\text{Mesio-distal crown width of mandibular canine (MCIo)}}{\text{Mandibular canine arch width or inter - canine distance}}$

Standard Mandibular canine index (MCIs) value was obtained from the measurements taken from the samples by applying following formula:

Standard MCI (MCIs) = $[(\text{Mean male MCI} - \text{SD}) + (\text{Mean female MCI} + \text{SD})] / 2$

MCIs value is used as a cut-off point to differentiate males from females.

Statistical Analysis:

All readings obtained were subjected to statistical analysis and Z-test was applied to derive conclusions and sexual dimorphism in right and left mandibular canines. Appropriate statistical analysis was also done for statistical significance of different parameters.

Results:

Table 1 depicts sex related differences amongst various parameters. When the mean value of intercanine distance of the 400 subjects (200 males and 200 females) were compared, males showed higher value than the females and the difference was statistically highly significant (p value < 0.01). However, the variance value for the females was more than the males.

The width of the mandibular canine was almost bilaterally symmetrical both for males and females. When the mean values for left and right mandibular canine widths were compared between males and females, the females showed lesser value. Furthermore, variation in width of the right and left mandibular canine was more in the males than in females. The observed difference in the variation of the right and left canine width between males and females was statistically highly significant (p value < 0.01).

The right and left mandibular canine index were almost bilaterally symmetrical in both the males and females with more variation in females as compared to males. However, there was no statistical significance of these observed differences between the genders for right and left mandibular canine indices (p value > 0.1).

Table 2 shows percentage of sex correctly predicted using right and left side MCIs. It was observed that out of 200 males, sex was correctly predicted only in 100 males and out of 200 females only 104 females were correctly predicted by using right side MCIs (0.256). Thus overall correct sex prediction was noted in 204 individuals i.e. 51%. Similarly, correct sex prediction was noted in 198 individuals (96 males and 102 females) with overall 49.5% accuracy by using MCIs left side (0.257).

Table 3 shows overall predictive value in respect to sex determination with standard MCI. The calculated standard MCI for both males and females was found to be 0.257. We could predict sex correctly with accuracy of 48% and 51% for males and females respectively and overall predictability with 49.5% accuracy.

Table 4 depicts standard MCI of other workers. An interpolation was made with values of observed MCI (MCIo) of our study with those of standard MCI (MCIs) of other workers and predictive value in respect to sex determination was charted out. We observed an accuracy of 49.5% by applying MCIs (0.257) with MCIo by using our data. However,

er, when MCIs of others workers in the field namely Rao *et al* [5] (0.274), Muller *et al* [11] (0.269), Kaushal *et al* [8] (0.274) and Reddy *et al* [7] (0.256) was used for predictive value by using our data (MCIO), we observed an accuracy of 47.5%, 45.5%, 47.5% and 50% respectively.

It has been observed that the right mandibular canine exhibited greater sexual dimorphism (2.804%) as compared to left canine (2.326%). It has been further observed that whenever mesio-distal canine width was greater than 7.3 mm, the probability of sex being male was 100%.

Discussion:

Gender determination in damaged / mutilated dead bodies or from skeletal remains constitutes the foremost step for identification in medico-legal examination. Although DNA profile gives accurate results yet measurement of linear dimensions, such as inter-canine distance and mesio-distal width of canine teeth can be used for determination of sex in large population because it is simple, reliable, inexpensive and easy to perform. Moreover, mandibular canines exhibit the greatest sexual dimorphism amongst all teeth and differ from other teeth with respect to high level of survival in dentition. [1, 2]

Considering the fact that there are differences in odontometric features in specific populations, even within the same population in the historical and evolutionary context, it is necessary to determine specific population values in order to make identification possible on the basis of dental measurements. [12] It has already been opined that in the present day humans, sexual dimorphism in mandibular canines is not merely a coincidence but can be expected to be based on functional activity.

Our study included 400 healthy volunteers (200 males and 200 females) students of age ranging 17 - 21 years since attrition is minimal in this age group. Moreover, subjects of this age group are selected because eruption of canines and growth in width of both the jaws including the width of dental arches are completed before the adolescent growth changes. The intercanine distance does not increase after 12 years of age.

In the present study the intercanine distance both in males and females is found highly significant (p value <0.01). Our findings are well corroborated by a number of workers in the field [1, 7-9, 13-16]. It is further observed that mean intercanine distance in males is 25.7 ± 1.50 mm and the value in females is 25.28 ± 1.60 mm, thus values in males being higher than those of females. Similar observations in males and females has been observed by Kaushal *et al* [1] (male: 25.873 ± 1.253 , female: 25.070 ± 1.197), Reddy *et al* [7] (male: 26.860 ± 1.48 , female: 26.287 ± 1.45), Kaushal *et al* [8] (male: 25.87 ± 1.25 , female: 25.07 ± 1.19), Abdullah [13] (male: 26.9552 ± 2.3129 ,

female: 26.4575 ± 2.7790), and Al-Rifaiy *et al* [14] (males: 27.0171 ± 2.3168 and females: 26.4615 ± 2.7761 mm). However, Al-Rifaiy *et al* [14] reported a higher mean values amongst males and females in their study on the school students comprising 251 males and 252 females with age ranging from 15 – 18 years from Riyadh, Saudi Arabia.

In the present study there exists a statistically significant sexual dimorphism in the morphometry of the mandibular canines as far as mandibular canine widths are concerned. We have noted the mean value of right canine width in males and females to be 6.60 ± 0.51 mm and 6.42 ± 0.46 mm respectively and that of left canine width in males and females 6.60 ± 0.52 mm and 6.45 ± 0.50 mm respectively. These values are found to be highly significant (p <0.01). It is also observed that mean values of canine widths to be higher in males compared to females.

Our findings in males and females are supported by Kaushal *et al* [1] who have reported mean right canine width in males 7.229 ± 0.280 mm and in females 6.690 ± 0.256 mm, and left canine width in males 7.299 ± 0.292 mm and in females 6.693 ± 0.323 mm in their study on 60 subjects (males: 30 and females: 30) of 17 – 21 years age group. Similar observations are also being noted by a number of research workers [7-9, 13, 14]. Boaz and Gupta [17] by evaluating dental cast of 100 South Indian patients (50 males and 50 females) in the age group of 14 – 20 years have observed mean right canine width in males 6.9880 ± 0.56773 mm and in females 7.0520 ± 0.53117 mm; and left canine width in males 6.9880 ± 0.56230 mm and in females 7.0080 ± 0.55138 mm. Their observations too are in conformity with our findings as far as sexual dimorphism is concerned. But in contrast to our observations the mean values of mesio-distal widths of right and left canine are greater in females than in males. However, in their study they have noted no statistical significance to the observed difference between males and females for mesio-distal measurements of each of the mandibular canines.

In the present study comparison of right canine width with left canine width in males have showed no difference and a similar observation is noted in females when right canine width is compared with left canine width. Thus, it can be clearly stated that the canine width of either side both in males and females depicts no significant differences. Our findings are well supported by other workers [1, 7-9, 13, 14, 17] who have also observed no significant difference in canine width of either right or left side. Such observations of the present study has medico-legal repercussions in that if only right or left side of mandible is available, we can construct the other half because canine width remains almost the same.

The present study establishes the existence of a definite statistically significant sexual dimorphism in

mandibular canines. It is the Y chromosome which intervenes most in the size of teeth by controlling the thickness of dentine, whereas the X chromosome, for a long time considered to be the chromosome responsible, only comes into play concerning the thickness of enamel. [2, 18] The notable difference between canines in determining sex has been due to the influence of the Y chromosome which is not uniform in all teeth. On the other hand the X-linked genetic influence on tooth width is rather uniform for all teeth. [7]

Of late, MCI has been implicated as a tool for sexual dimorphism. In the present study, right and left MCI value in males and females does not exhibit any significant sexual dimorphism (Table 1). Interestingly, a number of authors [1, 7, 8] in contrast to our observation, have reported that there existed a statistically significant sexual dimorphism by observing MCI. In variance, Acharya and Mainali [15] have utilized MCI in determining sex and compared its accuracy with absolute canine measurements. Measurements are taken from 117 dental stone casts (63 males, 54 females) in 19–28 years. Independent sample t-test has revealed no significant sexual dimorphism in MCI. These findings are in conformity with those of ours. In addition, discriminant analysis of MCI reflects poor ability to differentiate the sexes. The poor ability of MCI in sex assessment is attributed to it being a relative value - it is obtained as a ratio of two absolute measurements (mesio-distal dimensions of canines and intercanine distance) and does not reflect sex differences that exist in the absolute measurements per se. [15]

Kaushal *et al* [8] in their study on 30 males and 30 females of the North Indian population in the age group of 17 - 21 years on right and left mandibular canine have observed that the probability of sex determination using right MCI for males and females is 70% and 80% respectively and that with left MCI for males and females has been 66.67% and 83.33% respectively. This is in contrast to our findings wherein we have noted still lower values for sex prediction i.e. 50% in males and 52% in females using MCI of right side and 48% males and 51% females using MCI of left side. Further, the probability of correct prediction of sex using MCI is higher for females. We have noted an overall higher percentage of accuracy for sex prediction from right side MCI as compared to left side MCI.

Sex dimorphism in tooth size and the accuracy of odontometric sex prediction is found to vary in different regions and researchers have advocated the need for population specific data. [19] It has been observed that the overall predictive value in respect to sex determination with standard MCI is less than 50% (49.5%). The accuracy of predicting sex is more in cases of females though the difference of prediction among males and females is not very significant.

Our observations are highly contradictory to the observations of the other workers in the field who have observed an accuracy of 85.9%, 82.15%, 75% and 72% respectively. [5, 6, 8, 7]

A comparison of observed MCI with standard MCI has also been utilized for predicting sex of an individual. According to Rao *et al* [5], if the calculated Mandibular Canine Index (observed MCI) for the individual is higher than the Standard Mandibular Canine Index (MCIs) the individual is considered to be male if it is less than the standard MCI, the subject is a female. Reddy *et al* [7] by using MCIs observed by Rao *et al* [5] and Muller *et al* [11] on their sample have reported the overall accuracy of predictive value to be 35% and 55% respectively. They have reported a higher percentage of accuracy in males (37% & 62%) as compared to females (33% & 48%) which is in contrast to our observation.

Similarly, we have utilized the standard MCI of other authors [5,8,11] in our sample in an attempt to find out the accuracy in predicting sex and it overall ranged from 45.5% - 50%. Interestingly, the percentage of accuracy is found to be 72%-80% in females compared to males who have shown lesser values ranging 15%-22%. However, when MCIs of Reddy *et al* [7] has been utilized, we have observed equal values in males and females i.e. 50% in each gender.

The percentage sexual dimorphisms can also be calculated by using Garn and Lewis formula [10] and according to the present study the right mandibular canine exhibited greater dimorphism (2.804%) as compared to left (2.326%). Our findings are contradictory to those of other workers who have reported the left mandibular canine to exhibit greater percentage of dimorphism with still higher value of 7.954%, 9.058%, and 8.891% respectively [1,7,8]. This observation is of definite significance and the discrepancy can be well explained as tooth morphology is known to be influenced by cultural, environmental and racial factors.

In the present study it is observed that whenever mesio-distal canine width is greater than 7.3 mm, the probability of sex being male is 100%. This is in contrast to Kaushal *et al* [1] and Rai *et al* [9] who have reported corresponding values as 7.0 mm and 7.2 mm respectively. This finding could be of immense medico-legal importance in identification of North Indian subjects as the determination of sex makes identification easier.

Conclusions:

Our study conclusively establishes the existence of a definite statistically significant sexual dimorphism in mandibular canines and that MCI is of limited value and can only be used as an adjunct with other parameters for the determination of sex in cases of highly mutilated and damaged bodies where jaws are at hand. It is concluded that a mesio-distal canine

width greater than 7.3 mm is 100% suggestive of males.

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Table -1
Sex related differences amongst various parameters

Parameters	Sex	Mean \pm S.D. (mm)	Coefficient of Variation	Z-test	p-value	Significance
Inter-canine distance	Male	25.76 \pm 1.50	5.82	3.10	P<0.01	Highly significant
	Female	25.28 \pm 1.60	6.33			
Right canine width	Male	6.60 \pm 0.51	7.73	3.71	P<0.01	Highly significant
	Female	6.42 \pm 0.46	7.17			
Left Canine width	Male	6.60 \pm 0.52	7.88	2.94	P<0.01	Highly significant
	Female	6.45 \pm 0.50	7.75			
Right MCI*	Male	0.256 \pm 0.019	7.42	0.50	p>0.1	Not significant
	Female	0.255 \pm 0.021	8.24			
Left MCI*	Male	0.257 \pm 0.019	7.39	0.49	p>0.1	Not significant
	Female	0.256 \pm 0.022	8.59			

MCI* = Mandibular canine index

Table 2

Percentage of sex correctly predicted using MCI
MCIs (Right) = 0.256 and MCIs (Left) = 0.257

Sex	No.	%
Male	96	48
Female	102	51
Total	198	49.5

Table 3

Overall predictive value in respect to sex determination with standard MCI (0.257)

Sex	MCI Right side		MCI left side	
	No.	%	No.	%
Male	100	50	96	48
Female	104	52	102	51
Total	204	51	198	49.5

Table 4

Predictive value by using standard MCI by other
Authors on present sample

S. No.	Study	MCIs	Sex	%
1.	Rao et al [8]	0.274	Male	15
			Female	80
			Overall	47.7
2.	Muller et al [14]	0.269	Male	22
			Female	72
			Overall	45.5
3.	Kaushal et al [11]	0.274	Male	15
			Female	80
			Overall	47.5
4.	Reddy et al [10]	0.256	Male	50
			Female	50
			Overall	50

OBITUARY

***“He who is successful is not ideal.
 Only he is ideal and revered,
 Who, irrespective of success or failure,
 Gain or loss, victory or defeat,
 Remains steadfast in the pursuit of his mission”***



Dr.B.B.L. Agarwal

(July 30, 1939- Feb. 5, 2010)

An eminent teacher, mentor and guide Dr.B.B.L. Agarwal was a true Karmyogi and fatherly figure for all Forensic fraternity.

His ideals and vision will continue to inspire and serve as a beacon of light for us at all times.

As a teacher and good human being he remains in our hearts and mind always and forever.

Original research paper

Estimation of stature by anthropometric examination of forearm and hand

*Kumar Sushil, **Srivastava, A.K., ***Sahai, M.K.B.

Abstract

As the incidences of crime are going on increasing, the matter of identification of an individual is becoming prime importance now days.

Estimation of stature forms important criteria for establishing individuality of the person and require special attention in cases when bodies are found in mutilated state and only fragment are discovered. The mutilation of dead body is done intentionally by criminals who wants to destroy all traces of identity and thus facilitates the disposal of the dead. In a country like India, animals and vultures may attack a dead body and mutilate in a very short time when exposed in open field.

200 young and healthy male medical students aged between 18 to 25 years having no disease or deformity were examined anthropometrically in respect to their height and length of right forearm and hand.

The stature varied from 149.13 cm to 177.33 cm with mean value 164.97 cm and the standard deviation 5.52 cm. On the other hand mean length of the forearm and hand was found to be 45.47 cm and the multiplication factor is calculated as 3.899 cm.

Key Words: Stature, Anthropometric, Forearm, Hand, Multiplication Factor

Introduction:

Estimation of stature forms important-criteria for establishing individuality of a person and require special attention. In cases, where bodies are found in mutilated state and only fragments are recovered.

Dimensional relationships between the body segments and the whole body have been of interest to artists, scientists, anatomists, anthropologists and medicolegists for long time.

Artists use dimensional relationships in depicting the ideals of beauty, and this has resulted in creation of the rules of body proportions. The earliest evidence of the use of such rules comes from the ancient Egyptians. (Richer and Hale, 1971)

Studies on the estimation of stature from skeletal remains or mutilated limbs, mostly of long bones have been reported as indicated by the published work of the Pearson (1899), Trotter and Glesser (1952). [11, 14]

The Indian perspective of the problem of stature estimation has been studied by Athwale et al (1963), Patel et al (1964), Joshi et al (1964,65), Lal and Lala (1972), Kalte and Bansal (1974), Thakur and Rai (1987), Saxena (1984), Bhatnagar et al (1984), Jasuja (1987) and Jasuja et al (1991, 1993, 1997). [1-10, 12-14]

The significant body segments for estimation of stature are length of foot, hand, hand with forearm, arm, upper extremity, length of head, height of head, distance between sterna noth and pubic symphysis, etc Crown to rump and rump to heel ratio is also a significant dimensional relationship. In the present study length of forearm and hand of various subjects is measured anthropometrically for estimation of stature and the existing literature reveals that it is 5/19 of the stature.

Material and Methods:

The study was conducted at Ganesh Shankar Vidyarthi Memorial Medical College, Kanpur (Uttar Pradesh) under department of Forensic Medicine on 200 healthy male medical students of the age group ranging between 18-25 years irrespective of caste, religion, dietary habits and socioeconomic stature etc. The subjects having any disease or deformity were not included in the study. The left handed subjects were also excluded.

The subjects were examined anthropometrically in respect to their height and the length of forearm with hand. The height was measured between vertex and heel on floor using stadiometer in standing

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posture of the subjects with barefoot with head oriented in eye-ear-eye (Frank fort) plane. The length of Forearm and hand was measured between tip of olecranon process of ulna and the tip of middle finger of Left hand of the subjects using sliding caliper as well as standard measuring tape. The measurements were taken where the pronated and forearm were placed on flat, hard and horizontal surface with extended and abducted fingers but without any abduction adduction, flexion or extension of wrist-joint so that the forearm was directly in longitudinal axis with the middle finger.

All the measurements were taken between 11.00 am to 02.00 pm by the same observer i.e. author number one.

Observations:

The stature varied from 149.13cm to 177.33cm with mean value 164.97cm and the standard deviation 5.52 cm. On the other hand length of the forearm and hand varied from 38.25cm to 45.48cm with the mean value 45.47cm.

The observations in respect to the caste, religion, dietary habits, socio-economic strata, height and length of forearm and hand vise distribution are as stated below vide Table No. 1 to Table No. 7

Discussion:

Estimation of stature is an important parameter in medicolegal examinations and anthropological studies. Morphology of forearm and hand helps in estimation of stature therefore the study was carried out to investigate the relationship between the stature and length of forearm and hand. Effect of hand dominance on hand measurement has been suggested therefore uniformly left extremity was selected. Diurnal variation also plays a significant role in the anthropometric measurement hence at the result of measurement were taken at a fixed time.

The multiplication factor was calculated and the accuracy of the estimated height was checked by comparison with the actual stature. Similarity of the results indicates that the length of forearm and hand provides an accurate and reliable means for estimation of stature of mutilated body of an unknown individual.

Conclusion:

200 young and healthy male medical students aged 18 to 25 years having no disease of deformity were examined anthropometrically in respect to their stature and length of forearm and hand irrespective of their caste, religion, dietary habits and socio-economic strata.

The height was measured by stadiometer in standing posture of the subject with barefoot, whereas the length of forearm and hand was measured as a distance between the tip of olecranon process and the tip of middle finger using sliding caliper and standard measuring tape. The dimensions were taken by the same person at fixed time.

The stature varied from 149.13cm. to 177.33 cm. with mean value 164.97cm. and the standard deviation 5.52 cm. on the other hand length of forearm and hand was found to be 45.47 cm. and multiplication factor is calculated as 3.859. Therefore, the stature can be calculated using following formula: $\text{Stature} = \text{Length of forearm and hand} \times 03.859 \pm 2.5 \text{ cm.}$

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Table No. 1
Age wise distribution of the cases

Age Group	Subjects	
	No.	%
18-19	20	10
19-20	24	12
20-21	34	17
21-22	36	18
22-23	32	16
23-24	28	14
24-25	26	13
Total	200	100%

Table No.6
Age group-wise height of the cases

Age group	No. of cases	Average height
18-19	20	150.17
19-20	24	164.437
20-21	34	164.647
21-22	36	163.0833
22-23	32	165.8531
23-24	28	165.875
24-25	26	166.530

Table No.4
Distribution of cases in respect to the dietary habits

Age group	Vegetarian	Non-vegetarian	Average	Total
18-19	08	04	08	20
19-20	06	07	11	24
20-21	09	04	21	34
21-22	07	05	24	36
22-23	09	11	12	32
23-24	11	03	14	28
24-25	03	09	14	26
Total	53	43	104	200

Table No. 7
Age group wise length of forearm and hand

Age grouping	Subjects	
	No.	%
18-19	20	10%
19-20	24	12%
20-21	34	17%
21-22	36	18%
22-23	32	16%
23-24	28	14%
24-25	26	13%

Table No. 2
Caste wise distribution of the cases

Age group	Brahmin	Kshatriya	Vaishya	Kayastha	Other	Total
18-19	02	01	03	01	13	20
19-20	03	02	01	02	16	24
20-21	05	03	07	05	14	34
21-22	01	02	03	04	26	36
22-23	03	05	04	01	19	32
23-24	02	02	02	03	19	28
24-25	04	03	03	05	11	26
Total	20	18	23	21	118	200

Table No. 3
Religion wise distribution of the cases

Age group	Hindu	Muslim	Sikh	Bodh	Jain	Christian	Total
18-19	16	1	1	-	2	-	20
19-20	19	2	-	-	3	-	24
20-21	33	-	-	-	1	-	34
21-22	27	3	2	1	2	1	36
22-23	28	1	-	-	3	-	32
23-24	20	-	1	-	7	-	28
24-25	19	-	1	1	5	-	26
Total	162	7	5	2	23	1	200

Table No.5
Distribution of cases in respect to the socio-economic strata

Age group	Socio economic strata										Total	
	I		II		III		IV		V			%
18-19	02	01	10	05	08	04	-	-	-	-	20	10
19-20	03	1.5	11	5.5	10	05	-	-	-	-	24	12
20-21	04	02	14	07	16	08	-	-	-	-	34	17
21-22	05	2.5	15	7.5	16	08	-	-	-	-	36	18
22-23	04	02	16	08	12	06	-	-	-	-	32	16
23-24	07	3.5	09	4.5	12	06	-	-	-	-	28	14
24-25	05	2.5	08	04	13	6.5	-	-	-	-	26	13
Total	30	15	83	41.5	87	43.5	-	-	-	-	200	100

Original research paper

Fatal Burn Injuries in Accidental Vehicular Crush A Medicolegal Study

*Dr. Putul Mahanta

Abstract

Vehicle explosions result deadly fires which causes loss of many lives. This study explores the way of identification of sixteen fatal burnt bodies following a vehicular crush where identification was so difficult because of incineration of few cases. The victims were mainly of lower socio-economic, under graduate, bachelor group and businessmen by profession. The common age group was 21-30 years with a male and female ratio 9:1. Urban was the place of incidents and that too at 10 pm at night in the month of December with heavy truck as offending vehicle was the classical features of this study. From the observations and analysis of the incident with due consideration of environmental factors, vehicular conditions like operation of old ill maintained vehicles in high speed in a restricted area, in coordinated functioning of various traffic control agencies at night etc, certain aetiologies are elicited and their preventive measures are suggested.

Key Words: Burn Injury, Vehicular Crush, Identification, Contributory Factor

Introduction:

Thousands of people suffer severe burn injuries each year and hundreds more lose their lives. Burn injuries occur on the job, at home, and on the roads as a result of faulty equipment, negligence, and uncontrollable circumstances. Burn injuries are costly, result in permanent scars as well as lifelong damages and death as usual.

Vehicle explosions cause serious, deadly, fires. Vehicle explosions are commonly caused by faulty equipment, leaks, electrical malfunctions, and other defective automotive equipment. Explosions fueled by flammable liquid leaks (gasoline leaks, etc.) are additionally dangerous. Vehicle explosions result in the deaths of hundreds of people each year and injure thousands more.

The pathologist is frequently asked to perform an autopsy to aid in the investigation. The majority of deaths from burns are results of accidents.

These accidents involve all ages, but more commonly the aged and children. Multiple fatalities from burns may also result from plane crashes or automobile accident. [1]

Worldwide there are approximately 5.2 million deaths from injuries every year and non-fatal injuries account for about one-tenth of the global burden of disease. Injuries may be divided into two categories: unintentional injuries, including road traffic injuries, drowning, burns, poisoning and falls; and intentional injuries, which result from deliberate acts of violence against oneself or others. [2]

Incident History:

An old ill-maintained cruiser (car) containing 16 passengers, driven by a old driver with a speed of 90 mph. The driver attempting to slow his car down after encountering the smoke and fog swerved suddenly to miss a vehicle parked on the undivided highway near the city of Guwahati, Assam, India in the month of december striking head on a heavy truck at about 10 PM. In this collision, the car was pushed under the heavy truck, where the car then burst into flames. The drivers of the truck got out and raced over to the car and pulled its driver out of the burning car, likely saving that driver's life. All the 16 persons lost their live. All the death cases were sent to the Department of Forensic Medicine, Gauhati Medical College by the police for autopsy.

Aims of Investigation:

The medicolegal investigation of these cases of burns in vehicular crushing was aimed at answering the following questions as stated by Abdullah Fatteh. [1]

Was the person alive before the fire started? Did the burns cause death? If death was from causes other than burns, did the burns contribute to death? Were there any natural diseases or injuries that could have caused death or contributed to it? Were the burns sustained accidentally or did the person commit

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suicide? Was death a result of crime? Was there any attempt to conceal crime? What was the cause of the onset of fire? What was the source of fire? What evidence was found to identify the decedent?

Material and Methods:

Personal belongings of all the 16 victims present as per informants as well as informations collected from scene visit were documented and compared in a specially designed proforma.

- Basic informations from relatives / police about their belongings, physique, relative position inside the vehicle etc.
- A meticulous external and internal examination.
- Routine photographs.[X-ray was advised].
- Biological method for identification (e.g. DNA analysis).
- Blood/visceras for alcohol and CO etc.
- Histopathological examination (HPE) of available skin/tissues.

Observation and Result:

1. **Age:** The most common age group involved was 21-30 years for 28% followed by the age group of 31-40 years (20%).
2. **Sex:** In this present study male outnumbered (90%) the female (10%).
3. **Occupation:** It was observed that most of the victims (30%) were the businessmen followed by the student group of 29%.
4. **Educational background:** A total of 30% cases were belonging to under graduate group followed by graduate for 25%, illiterate for 20% and other 25%.
5. **Marital status:** A higher incidence for 52% of death was observed in bachelor group followed by marital group for 48%.
6. **Socio-economic condition:** A 64% cases were observed amongst lower socio-economic group followed by middle class for 30% and other for 6%.
7. **Time and place of incident with offending vehicle:** It happened on undivided highway near the city of Guwahati, in the month of December striking head on a heavy truck at about 10 PM.
8. **Injuries:** All the cases were burnt to various degrees and 10 were incinerated with missing of body parts at places [Figure 1, 2, 3]. A cherry-red coloration of mucous membranes and blood and internal organs. Soot particles were present over tracheo-bronchial tree. Some of the viscera were burnt and missing, others partially roasted. No visible injuries including fractures found apart from burn injuries.
9. **Survival period:** The present study describes death of 90% on spot, and 10% on way to hospital.
10. **Laboratory investigation:** Laboratory investigation for CO and for alcohol etc found negative. Tissues preserved for DNA analysis were sent to

Forensic science laboratory. The **Histopathological examination [HPE]** of available skin tissues shows findings of vital reaction like necrotic tissues, capillary dilation, cellular infiltration, gas inside the vessels, hemorrhages etc [Figure 4, 5].

11. **Causes of death:** 90% of the cases died following neurogenic shock followed by hypovolemic shock for remaining 10% cases that died on way to hospital or in hospital.



Fig. 1

Partly incinerated body in pugilistic attitude with missing parts of it



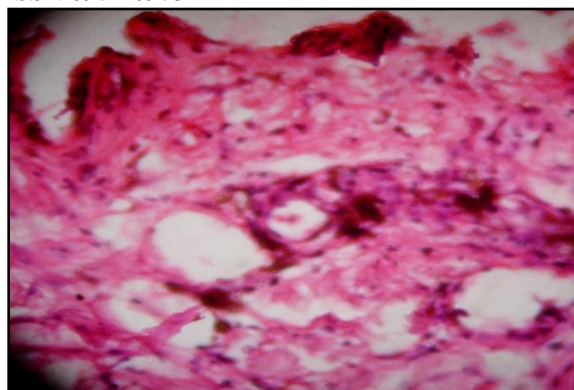
Fig. 2

Incinerated body with missing parts of it

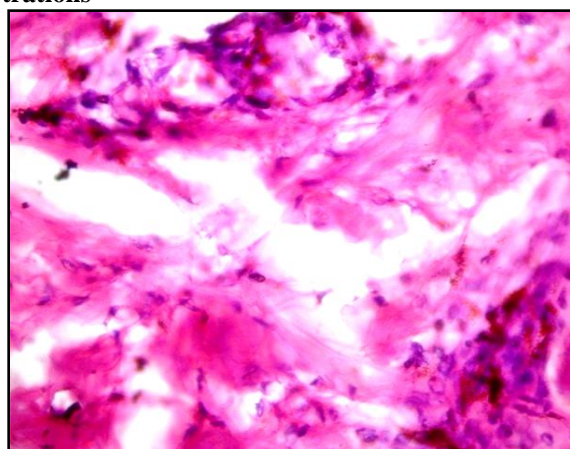


Fig. 3

Partly incinerated body in pugilistic attitude with missing parts of it

**Fig. 4**

Microscopic slide of available skin/tissue with dilated capillaries, tissue necrosis and cellular infiltrations

**Fig. 5**

Microscopic slide of available skin/tissue showing tissue necrosis, cellular infiltration with dilated capillaries

Discussion:

Burn injuries have been a major cause of concern since prehistoric days to the present era of modern medicine. Road traffic fatalities as a result of burn following vehicular crush is not very uncommon and was an agreement with a similar type of incident that has reported in *Pierce County*. [3] Scene visit also revealed informations regarding the cause of fire and the site of origin of the fire. The overall study of the circumstances of death at the scene has given informations concerning the manner of death.

Correlating informations furnished by informants with autopsy findings, including dental and available medical records, routine photographs etc has helped in identification of all the incinerated victims and were found accurate, economic and rapid methods of identifying badly burned victims in this bus accident and is of agreement of Martin-de-Ias-Heras et al. [1, 4]

The general belief that burns usually occur at the two extremes of age, indicating the accidental nature of infliction does not hold true in the present investigation where the majority of cases belongs to second or

third decade of life and the same findings were reported by Martin A. Crore et al [5] and L.P.H. Leenan et al [6] and they described involvement of mean age of 30 and 28 years respectively.

The male dominance over female in this presentation was also reported by Martin A. Crore et al [5], L.P.H. and Leenan et al. [6]

The majority of the victims were belongs to lower socio-economic group which tallied with the findings of Jhanjee Akash. [7] Their inability to have satisfactory transportation as well as treatment may also play a role besides exposing them self to the risky environment in search of job etc.

The present study also describes the location of urban area which is an agreement of Norman L.G.[8] in United States, Nedd Willard [9] and Environment Deptt [10].

Furthermore Smith B.H.et al [11] also reported that the most common time of vehicular accident is in between 9pm to 12 am. The reason for this includes insufficient light, disobeying traffic rules and less number of on duty traffic police during the night time.

Being the cold, foggy December month and that to near to the great river Brahmaputra the vehicle was driven at about 90 mph. The road has a posted speed limit of 55 mph. In the evening of the incident the temperature was 12°C and conditions were foggy with no wind. White smoke emitting from a nearby industries had migrated to a low lying area on the highway, mixing with fog, and creating near zero visibility conditions. This incident is in agreement with NIOSH. [12] J. Chandra et al [13] and R. Chandulal [14] also reported that heavy truck to be the common offending vehicle in road traffic accident which is well tallied with this incident of vehicular crushing. Furthermore a total of 90% cases died on spot in this present study. Majority of the cases died following neurogenic shock followed by hypovolemic shock for remaining 10% cases that died on way to hospital or in hospital. This emphasized the fact that these victims need emergency medical care on the spot and rapid transportation to trauma centre. This tallied well with the findings of "The Lancet" [15] and Paul Almasy. [16] The study conducted by S. Sevvit [17] has also reported that majority of accident victim died at the scene of accident. K. E. Daly et al [18] reported that majority of deaths due to multiple injuries occurred before arrival at hospital. This accidental burn is in agreement with Sharma BR et al. [19]

In this present study following factors played a **contributory role** which is an agreement of NIOSH [12] investigators in an investigation of *similar type of motor Vehicle Crash*: (a) Inability to establish traffic control on both sides of an undivided highway, (b) Ineffective coordination among the multiple agency response, (c) Migration of fog and smoke mixture onto the highway and (d) Operator of the car not ad-

justing manner of vehicle operation during poor visibility.

Pre-incident planning that includes agreements formed by a coalition of all involved parties such as mutual aid fire departments, emergency Medical Services (EMS) companies, police, and highway departments may save valuable time, present a coordinated response, and provide a safer emergency work zone. [20]

Conclusion:

To prevent such fatalities of burn in vehicular accident there should have a combined co-ordinated effort from all concerned. Following steps *may be of help* in its prevention:

- Allow well maintained, good conditioned vehicle to operate.
- Strict legislation to ban on drugs (including alcohol) on driving.
- Issuing driving licenses strictly to those medically fit persons.
- Increase awareness about safety traffic measures including speed limit.
- Increase vehicular engineering to prevent crashes i.e. mandatory provision of Fire Extinguisher with each and every vehicle.
- Multidisciplinary approaches for accurate and quick management and rehabilitation.

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Case Report

Floating Thromboembolism: A Case Report

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Abstract

Medico legal autopsies are conducted in cases of sudden unexpected deaths, primarily to establish the cause of death. In cases where deaths have occurred in apparently healthy individuals, deaths under suspicious circumstances or who have sustained injuries, pulmonary embolism forms the principal cause of sudden unexpected death. Pulmonary thromboembolism (PTE) is caused when thrombi are detached from the deep vein of the lower leg. The most important causes for incorrect diagnosis are failure to suspect Pulmonary Embolism, and the protean nature of the disease. Presentation is often "atypical". Signs and symptoms are frequently vague and nonspecific and rarely "classic". In more than 95% of cases, venous emboli originate from deep leg vein thrombi above the level of the knee. Most pulmonary emboli (60 to 80%) are clinically silent because they are small. Remarkable differences actually exist concerning the point of origin and the final localization, as well as the size and age of thromboemboli, the presence or absence of pulmonary infarction, and the underlying pathology. This paper highlights a rare case of a young individual with minor injuries who succumbed to pulmonary thromboembolism.

Key Words: Pulmonary Thromboembolism, Autopsy, Road Traffic Accident

Introduction:

Sudden deaths are mostly natural deaths, which occur immediately or within 24hrs of the onset of terminal symptoms which may be totally different from the symptoms he was suffering. Pulmonary embolism is the most under diagnosed cause of death where no autopsy is performed. Incidence is 20-30 per 100,000 hospital admissions and fatality is 2% to 6%. In United States, patients with deep venous thrombosis, only 70% suffered from symptoms and 30% were asymptomatic.

Pulmonary embolism accounts to 50,000 deaths/year in United States alone and is one of the most common preventable hospital deaths. Death is often linked with missed /delayed diagnosis which points to the importance of clinical suspicion for successful management.

Deep venous thrombosis first became associated with long periods of sitting during World War II, where accelerated rates of fatal embolisms were suffered by Londoners sitting in deck chairs in air raid shelters.

Pulmonary thromboembolism has also developed after 3 to 4 days of prayer in the same position as part of excessive religious activities. [1]

Recently pulmonary thromboembolism has developed after long haul of air travel (economy class), and other mechanisms associated with travel, occupation, hobbies and other life styles, such as thrombosis, [2] seat immobility thrombosis etc.

Right sided heart thrombi may develop within the right heart chamber or the peripheral venous clots that accidentally lodge in right heart structures on their way to lungs.

Type B thrombi attach to atrial or ventricular wall indicating that they are probably of local origin, whereas type A thrombi with worm like shape are extremely mobile and are from peripheral venous system, and may cause cardiovascular collapse when entrapment occurs. [3]

The association of disease with trauma may have criminal aspect or involve compensation benefits for relatives; this is quite often encountered in circumstances, where there has been possible correlation of emotions or excitement with sudden death.

At times it will be difficult for forensic expert to opine when the trauma per se is not fatal or when the lesion found at autopsy is compatible with life and also when death occurs after few days of the event in an ambulatory young individual as in this case.

In the present case we have come across a relatively rare floating atrial thrombus from peripheral vein, seen only in 4-18 % of patients presenting with acute pulmonary embolism.

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Case History:

On 27/11/08, the deceased, a pillion rider said to have sustained injuries when the motor cycle collided with an auto rickshaw. He was treated at a nursing home as out patient. On 1/12/08 around 2 AM in the night the deceased is said to have complained of breathlessness and burning sensation in epigastria with profuse sweating. Patient was treated at local nursing home and was referred to M S RA-MAIAH HOSPITAL, Bangalore. Past and drug history were not contributory.

Course in Hospital:

Patient presented with the above mentioned symptoms at 11am on 1-12-08 and shifted to CCU. Investigations were done; ECG showed Q S in lead II, T wave inversion in lead III, Chest leads V 4-5. Screening ECHO was done at bed side and revealed dilated Right Atria and Right Ventricle, severe Right Ventricular dysfunction, a big clot in Right Atria proposing into Right Ventricle with fair LV function. D-dimer tested positive.

Patient was treated with anti platelets and LMW heparin. Plan for surgery i.e. embolectomy was thought. At 2.45 PM patient developed severe hypotension and bradycardia, later he was put on ventilator, at 3.55 PM patient was declared dead despite all resuscitative measures.

Autopsy Findings:**External Findings:**

Dead body of an adult male aged about 34 years, measuring 5 feet and 10 inches in length, well built and moderately nourished; dark brown in complexion. Eyes closed, pupils dilated and fixed post mortem staining present over the back, rigor mortis well appreciated all over the body.

External Injuries:

1. Abrasion, 20x5 cm present over outer aspect of right forearm covered with black scab.
2. Abrasions, 8x3 cm and 2x1 cm present over front of left thigh and left knee respectively covered with black scab.
3. Grazed abrasion, 8x4cms over left knee covered with black scab.
4. Surgically sutured wound 6cms in length present, 2cms below left knee, on dissection wound was muscle deep with extravasation around.

Internal Injuries:

- Lungs-Both lungs edematous, cut section-right lung shows small thrombi adherent to the pulmonary arterial branches
- Heart-weighs 600gms, left ventricle wall-thickness-1.5 cm. Right ventricle wall 0.5cm.
- On dissection a worm like thrombus in right atria propping into right ventricle through tricuspid valve was seen.

- Coronaries-patent
- Aorta-intact
- Stomach- contains 50 ml of dark colored fluid, no unusual smell, mucosa normal.
- Other organs were intact and congested.

Histo-pathological Report:**Gross Examination:**

- Lungs - Right lungs 600gms, external surface shows grey with white areas (infarction). Cut section shows blood vessels filled with clots.
- Left lungs-500gms, Cut section shows blood vessels filled with clots.
- Heart- Left ventricle hypertrophy, right ventricle, coronary vessels, aorta- unremarkable.

Microscopy of Lungs shows pulmonary edema and foci of infarction. Some of the smaller pulmonary arterial branches show recent thrombi. Blood vessels in hilar regions show postmortem clots.

Cause of Death:

“Death is due to respiratory failure as a result of thromboembolism consequent upon injuries sustained.”

Discussion:

An embolus is a detached intravascular solid, liquid, or gaseous mass that is carried by the blood to a site distant from its point of origin. Almost all emboli represent some part of a dislodged thrombus, and hence the commonly used term for this condition is thromboembolism. The age and sex, incidence rate for persons 15 years or older is 149 per 10,000. The overall age incidence rate is higher for men than for women, and PTE accounts for an increasing proportion of VTE for both genders as age increase. The VTE incidence in hospital patients is over 100times greater than that among people not in the hospital

Thrombosis is the process of solid mass in the constituent of flowing blood, the mass itself is called thrombus. Virchow's triad- endothelial injury, alteration in flow of blood, hypercoagulability of blood plays important role in the formation of thrombus. [4]

The most common sites of thrombosis are in deep femoral, popliteal and posterior tibial veins; other veins such as the venous sinuses of dura mater or sub-clavian or axillary veins, external and internal iliac veins, prostates plexus, uterine and ovarian veins.

Risk Factors [5]

Venous stasis	Endothelial injury	Hypercoagulability	
Prolonged L.L. immobility	Previous D.V.T.	Primary	Secondary
Bed rest	Femoral IV Catheter	Factor V leiden mutation Hyper-homo-cysteinemia	Anti phospho-lipids antibody
Surgery	Hip surgery	Prothrombin G-A20210 gene variant	Malignancies
Pregnancy	Strenuous muscle activity	Protein C & S deficiencies.	Heparin induced thrombocytopenia (H.I.T)
CHF, Trauma to bones/soft tissues		Anti thrombin III deficiency.	Rarely Long haul air travel Ethrombosis

Injury to the tissues, especially the legs and pelvic region may cause local venous thrombosis in the contused muscles or around fractured bones causing detachment of embolus to the distant organs. Tissue trauma increases the coagulability of the blood for several weeks, the peak being between one and two weeks.

The injury may confine the victim to bed, either because of general shock and debility or because of the trauma. Trauma itself necessitates recumbency as in head injuries, trauma or injury affecting the legs. In either case recumbency leads to pressure on calves and immobility causes reduced venous return and stasis because of lessened muscular massage of leg veins. The common result is thrombosis of deep veins of legs, which can extend proximally into popliteal and femoral vessels, forming a dangerous source of venous thromboemboli.

A large embolus in the pulmonary trunk often produces a noticeable fullness before the vessel is opened. The embolus which blocks the pulmonary trunk causes death in few minutes due to vagal inhibition, acute asphyxia or right heart failure. Infarction of lung is seen when the broncho pulmonary segment or vessel is blocked. [4]

Among patients with acute pulmonary embolism, the right heart thrombi is usually found in those who are hemodynamically compromised, it is also a marker of worse prognosis in apparently stable patients. Patients with type A thrombi have a very poor prognosis with high mortality of 44% with severe and fatal pulmonary embolism. The common result is thrombosis of the deep veins of the legs, which can extend proximally into the popliteal and femoral vessels forming a dangerous source of venous thrombi. Small emboli may break off and im-

pact in more peripheral branches of pulmonary arteries. [3]

Ethrombosis is a newly recognized variant of DVT, caused by sitting at computer for long periods of time. The first case of ethrombosis, which occurred in New Zealand man who developed DVT sitting at a computer for 18 hrs a day. [2]

Some studies have shown that there is little evidence that pulmonary embolism originates from DVT of peripheral veins. This lack of association between PE and DVT has four possible explanations (a) diagnosis tools for DVT are insufficiently sensitive to detect (b) Many clots originate in the upper limbs and upper clots are missed as we focus on lower limbs (c) Clots formed in lower limb veins do not break off rather dislodge completely and embolise to the pulmonary circulation without leaving residual clot in periphery (d) clots in the pulmonary circulation appear de novo and are unassociated with peripheral DVT. [6]

In this case the victim had soft tissue trauma to leg in the form of laceration and contusion of musculature leading to local venous thrombosis and later on detachment as emboli to lungs.

Complications of Embolism:

- 1) Sudden death
- 2) If delayed mimics M I
- 3) If numerous causes acute cor-pulmonale/ acute RHF
- 4) Pulmonary infarction
- 5) Pulmonary hemorrhage
- 6) Resolution

Medicolegal Aspects of Pulmonary Embolism: [7]

Pulmonary embolism is the most under diagnosed condition, several investigations into the medico legal aspects have been made and the peak occurrence is at about two weeks after trauma.

Knight's survey shows more than ¾ of the victims had predisposing factors such as injury, surgical operation or immobility in bed. But the remaining ¼ were ambulatory and apparently healthy. This has important medico legal implications because if fatal pulmonary embolism can strike an appreciable proportion of the population who have not suffered one of the recognized predisposing factors then the cause-effect relationship after trauma is weakened.

If the standard of proof in criminal trial must be proved beyond reasonable doubt, then the fact that up to 20% of pulmonary embolism deaths have not followed trauma/ immobility, must surely remove the cause-effect relationship from near certainty to mere probability, which is not sufficient for criminal conviction and hence the decisions vary from case to case. In our case the victim had history of trauma i.e. laceration of.

After lung dissection, the source of embolus must be sought, usually it is seen in femoral vessels,

and then leg dissection for thrombosed vein should be sought, to look into the residual thrombus because the large part of thrombus from the source might have been detached, alternatively transverse/ longitudinal incisions can be made into the calf to examine the deep veins.

Dating of pulmonary embolism and deep vein thrombosis Dating has a considerable medico legal importance as to know whether a pulmonary embolus arose prior/subsequent/after traumatic event. Major difficulty is that the embolus may be of most recent addition to an extending venous thrombosis that is considerably older. Thrombo-endothelial junction, residual thrombus in leg vein, segment of thrombosed vein with adjacent muscle gives information regarding age of thromboembolism.

Histological dating:

- A. Platelet and RBC appearance gives no useful information
- B. Phosphotungstic acid- haematoxylin staining shows
 - i. Fibrin as purplish strands on 1st day.
 - ii. Meshwork of strands and sheets by 4th day.
 - iii. Deep purplish fibrin by 2 weeks
 - iv. By 25th day begins to absorb.
- C. Martius scarlet blue stain show the early pink fibrin-fringed by scarlet in about a week
- D. Endothelial proliferation useful in 1st week
- E. Fibroblasts begins to appear by 2nd day & is maximum by 2nd to 3rd week, elastic fibers appear not before 28 days, but maximum density in about 2 months
- F. Haemosiderin, blue granules demonstrated by Pearl reaction may be seen by the end of 1st week and reach maximum by 3 weeks
- G. Capillaries appear on 2nd day as buds and in next three months substantial canalization occur, full lumen restoration occurs by 6-12 months
- H. Leucocytes are inconsistent markers, polymorphs starts appearing by 1st day followed by mono nuclear cells.
- I. Covering of thrombus surface by endothelium is rapid and may begin on 1st day and is completed within few days. Various authors have given 24-72 hrs as the time required, usually the size of thrombus surface matters.

Conclusion:

Pulmonary thromboembolism remain a potentially deadly and common event, which may present in various ways and is one of the most under diagnosed and missed cause of death, which is usually detected at autopsy. Early detection and clinical

suspicion can prevent death from pulmonary embolism.

In cases of pulmonary thromboembolism following some time after injury or period of immobilization, the condition can occur spontaneously and therefore the injury may not cause death,⁹ but literature and our study has shown that minimal injury with mobility can also lead to thrombosis and detach as emboli. Hence the emboli should be traced to its source and dating of emboli should be sought to determine whether pulmonary embolus arose prior to or subsequent to traumatic event.

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Fig No. 1
Abrasion right forearm



Fig No. 2

Surgically sutured wound and abrasions on left lower limb



Fig No. 3

Emboli at Tricuspid valve

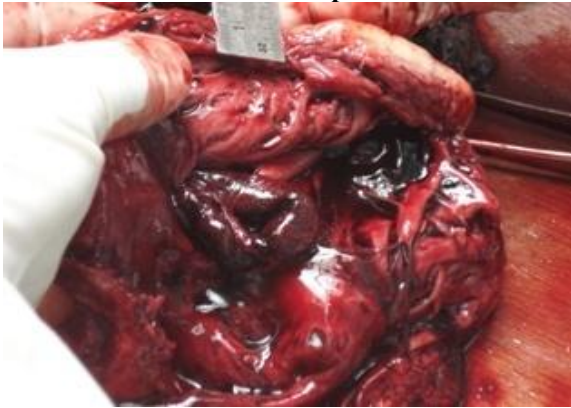


Fig No. 4

C/S of lung showing pulmonary arterial branches with small thrombi



Fig No. 5

Slide showing areas of pulmonary infarction

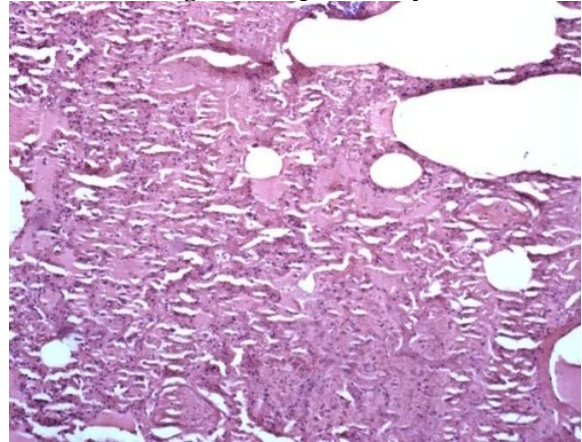
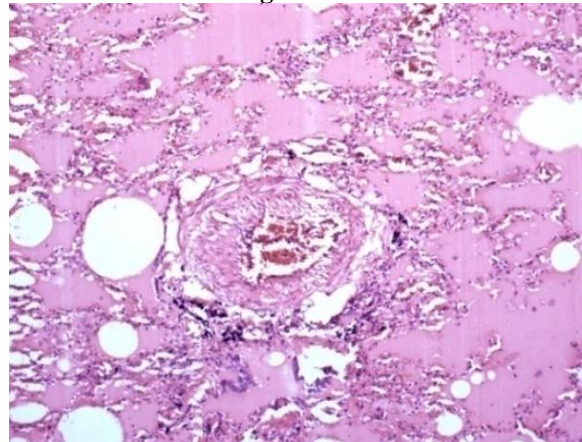


Fig No. 6

Slide showing recent thrombus



Case report

Heat Induced Morphological Changes in the Brain

*Dr. Mukesh K Goyal, **Dr Shiv R Kochar, ***Dr Shrikant S Asawa

Abstract

In severe conflagration the terminal state of the body often does not reflect the condition at the time of death. Some-times death might have occurred before any heat reaches the body and the death might have been caused by inhalation of smoke. It is difficult or rather impossible for the forensic expert to determine the extent of ante-mortem damage caused by flames. The classical distinction of “red flare or vital reaction” are usually absent in such cases.

Destruction of the victim by fire is one of the oldest methods used by murderers to conceal their crime, and hence every death by burning require the most meticulous medico-legal scrutiny. Here we report an unusual cases of heat induced morphological changes in brain in a 60 years male, who was addicted to alcohol and smoking and found burnt on his bed in a locked room from inside. Typical vital reaction was not appreciable anywhere on the body so as to frame the opinion in favour in ante-mortem burns but on of dissection of skull certain unusual gross pathological finding was observed which helped in framing the opinion in favour of “Death due to accidental ante-mortem flame burns”.

Key Words: Heat haematoma, Carbon Mono-oxide poisoning, Postmortem Artefact

Introduction:

When a head has been exposed to severe external heat sufficient to burn the scalp and perhaps the skull, blood may be extruded from the diploe and venous sinuses into the extradural space to produce a ‘heat haematoma’. The mechanism is obscure, but may be the result of blood being boiled from diploe layer of bone through emissary veins, or shrinkage of the brain may aspirate blood from the skull. The false haematoma is brown and friable, and the adjacent brain shows hardening and discoloration from the heat.

The importance of artifact is that may be mistaken for a true epidural bleed from a head injury, and may mislead the forensic pathologist and investigator into thinking that the fire was started criminally to cover up a fatal assault.

As most instances are seen in conflagration in building, there is often a significant level of carboxyhaemoglobin in the body if the death occurred when the fire was in progress. This should be of the same concentration in the heat haematoma as in the peripheral blood; if the victim suffered a head injury before fire started, then there should be little or no carboxyhaemoglobin in the haematoma.

Case Profile:

A burnt body of a male was referred to the department of Forensic Medicine for expert post mortem opinion. Police inquest revealed that the burnt body was of an identified male aged about 60 years; He was addicted to alcohol and smoking. The body was found in lying position on a burnt bed with the door of the room bolted inside.

Autopsy Findings:

An autopsy was performed on the same day. The whole body displayed as pugilistic attitude, blackened, at places charred with loss of skeletal structure leading to absent feet, hand and lower 1/3 part of lower limb, the back was severely burned to the III or IV degree (Figure-1). Severe artifactual lacerations were seen in the skin of the chest, abdomen of various dimensions without any sign of vital reactions.

The scalp was almost burned away and was not accomplished by any sign of intury; The charred skull was opened by traditional chisel and hammer method. The left part of the head was burned more severely than the right part, although skull fracture due to a mechanical force was not found. Interestingly a mass of size 9.5 cm X 6.0 cm yellowish-white in color, which was obviously different from the brain

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matter and heat haematoma was also seen on the dura mater of the parieto-occipital region. A horizontal section of the brain showed herniation of the cerebral tissue through a slit in the dura mater into the epidural space.

Internally:

The color of tissues and the blood in the deeply located internal blood vessels were suggestive of carbon monoxide poisoning due to its appearance of cherry red color. This was confirmed by a quick test by adding 10% Sodium hydroxide solution to the blood in a tube and matching against a white background, its color remained pink in contrast to the normal blood, which immediately becomes brownish green.

All the viscera were found healthy and congested except few change attributed to intense heat. Soot particle were found in the oral cavity adherent to the teeth tongue and pharynx, they were traceable up to the IInd order bronchial tree divisions (Figure-2). They were also found embedded in the mucosa of the stomach.

Histologically, H&E stain showed that the thermo-coagulated mass was cerebral tissue. The nerve cells and glial cells were also thermo-coagulated, and the pericellular and perivascular spaces were conspicuously expanded. Neuropathological changes such as intracerebral hemorrhage, cerebral contusion and so on were not found.

In view of history of the case viscera were preserved for chemical analysis to exclude any associated poisoning and for determination of alcohol contents. The chemical analysis revealed the visceral alcohol content was 290 mg %.

Discussion:

Fire is commonly used to conceal homicide therefore while framing an expert opinion in such type of cases one must be very careful. In this case there were multiple lacerations of variable size and shape on chest and abdomen. This may lead inexperienced observer (such as police) to suspect that antemortem wound have been inflicted, and the fire being used to cover up a criminal offence. Which were due to heat, skin contracts markedly and splits often appears. Factually the heat skin contract and splits markedly leading to artifactual appearance similar to lacerated wound but classically these heat split are limited to skin and subcutaneous fat. Where as true lacerated wound usually involves deep seated muscles. [1] Presence of haematoma in the skull strongly indicates its origin due to application of mechanical force, but heat haematoma in the extradural space is another false lesion in severely burnt bodies. This haematoma was found (Figure-3) in this case was "Heat haematoma" and suggested mechanism for the development of heat haematoma is escape of boiled blood from the venous sinuses into the dura

which become spongy from gas bubbles and is tawny or chocolate brown color.

The exterior of the skull overlying the haematoma is charred, burnt away and are commonly found in frontal region. [2] The presence of a mass of size 9.5 cm X 6.0 cm yellowish-white in color (Figure-4), which was obviously different from the brain matter and heat haematoma was also seen on the dura mater of the parieto-occipital region invites attention and it was possibly developed due to effect of intense heat which might have split the tense dura and allowed the brain tissue to ooze out into the large space into cranium and it has formed a mass of yellowish white paste. This finding is also consistent with findings reported by T Kondo. [3]

Therefore the possibility of trauma is also excluded [4]. The presence of sooty particle upto the IInd order bronchioles and in the stomach coupled with a positive chemical spot test for carbomonooxide, strongly indicate that victim was alive before the fire begun. [1, 4]

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Figure-1

The whole body blackened, at places charred with loss of skeletal structure, burnt to the third or fourth degree



Figure-2

Carbon soot particle adherent in tracheal mucosa



Figure-3

Heat hematoma in the extradural space



Figure-4

**Presence of a mass of yellowish-white in colour
(cooked up brain tissue)**



Case Report

Death due to Airgun Injury: A Case Report

*Dr.Y. Udayashankar, **Dr .M.P. Kumar

Abstract

In medicolegal practice, the examination of injuries is very important to solve the medicolegal problems like weapon identification, age of the injury, fatality, ante mortem or postmortem etc. Commonly the firearms are classified like rifled guns and smooth bored guns. Usually cases encountered are from these weapons. In these weapons gun powder is used to propel the projectile. The preliminary knowledge of these weapons is important to identify the weapon. In case of airgun, compressed air is used to propel the projectile.

An airgun is a rifle, pistol or shotgun which fires projectiles by means of compressed air or gas in contrast to a firearm which burns a propellant. Most airguns use metallic projectiles called as pellets. The death due airgun is rare. The death that happened in this case is discussed in detail due to rarity of its kind.

During the injury examination, the analysis of the injury is important. Its size, shape, nature of margins, abrasions collar, grease collar, tattooing, soot, and burns are all to be noted in firearm injuries to decide the weapon, entry or exit wound etc.

Key Words: Airgun, Firearm, Children, Death

Introduction:

In these air guns, compressed air is used to fire lead shots. They are commonly used for killing birds or in sports like bursting balloons in a fair. These lead shots have limited range. But if fired at a human body from a close range, they can penetrate and if they enter into vital organs like heart, death can occur. It may damage the eyes. [1]

Because of their extremely light weight, loose velocity rapidly, becoming harmless in less than 100 yards. These are used for target shooting, sport activities; firearm training .However a modern air rifle can fire a pellet with accuracy up to ranges of at least 50 yards. Here the mass of the pellet/projectiles and velocity is low. [2] They are usually regarded as safe weapons. [3]

Case History:

During September 2009, a dead body of a boy aged 6 years was brought for post mortem examination with history of firearm injury.

The police papers narrated that the boy had died in the JSS hospital Mysore, during treatment.

The victim and assailant both are of younger age group-6 and 14 years respectively. (Both being kids).The victim belongs to scheduled caste community and assailant to Muslim community.

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Here the mass of the pellet and velocity is low and usually minor injuries are expected...And these Airguns are considered as toys in our society. Its use does not require any license .But serious injuries can be caused at short range.

Researchers at the university of Washington and Cincinnati schools of Medicine recently reviewed records of children admitted to three medical centers because of Airgun injuries from 1988 through 1996.The results of the study were published in an article entitled "Serious and Fatal Airgun Injuries: More than meets the EYE" in the journal PEDIATRICS(1997:100-609-612). [4]

Of the 101 children studied 71% of the injuries were UN intentional, 5% were assaults and 1% was suicides.

15% of the children required intensive care treatment. Over half required one or more surgical procedure. 38 had eye injuries (66% permanent vision impairment), 14% injuries to neck, 15% to chest including 3 to the heart and 19 had injuries to belly.

Authors conclude that Airguns pose a significant risk of severe injury, permanent disability and even death.

The editors of Medicinenet would add --- what is the real purpose of these supposed toys we give to our children? Whose interests we really satisfying? Are we acting as responsible parents? [4]

Conclusion:

Death is possible with Airgun if the victim is of younger age group and at short range and if the pellet hits the vital areas like neck, chest, head and eyes. Therefore possession of airgun and its use should be with care.

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Picture No. 1
Abrasion due to pellet over the chin



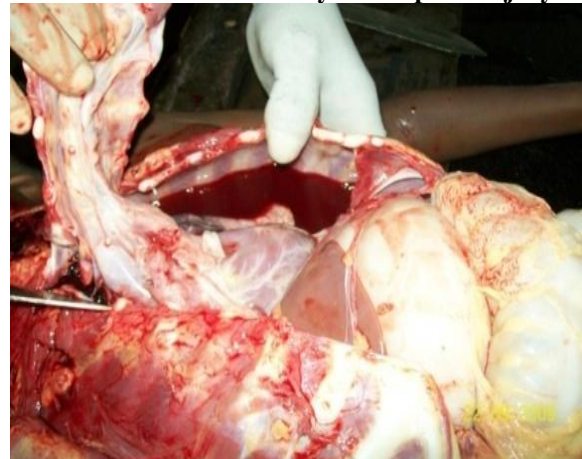
Picture No. 2
Abrasion and Penetrating Injury due to pellet



Picture No. 3
Airgun Pellet



Picture No. 4
Blood in the Plural Cavity due to pellet injury



Picture No. 5
Extra-vasation of blood due to pellet injury



Review paper

Postmortem Examination Cases of Cyanide Poisoning A Biological Hazard

*Dr. K. Padmakumar, MD, DNB

Abstract

Hydrocyanic acid and various cyanides are relatively common poisons both in suicide, accident and occasionally homicide. Acute poisoning with cyanide is most often self administered as the swift and sure action is generally known. Accidental poisoning from inhalation of vapours due to fires in buildings or by the free gas liberated from some commercial processes is also known to occur. The preparations are rarely used with homicidal intent. Whatever be the manner of poisoning, in medical settings the persons involved in postmortem examination of cases of death of cyanide poisoning are exposed to significant degree of cyanide remaining in the body cavities and tissues of the deceased. This risk is not only for the persons attending postmortem examination but also for the first responders like police, rescue persons and also persons extending emergency care both outside and within hospital. Hydrocyanic acid is rapidly absorbed from all mucous surfaces and even from unabraded skin. Hence attending a case of cyanide poisoning involves a hazard of inhalation of cyanide gas from the victim. The hazards involved in such situations are briefly reviewed.

Key Words: Cyanide, Postmortem Examination, Biological Hazard

Introduction:

Hydrogen Cyanide (HCN) is one of the most toxic gases. It has been responsible for an extensive number of poisonings in a variety of settings including chemical warfare, suicides, murders, occupational exposures, judicial executions and environmental exposures. Because cyanide salts are readily available, they are used in intentional poisonings and such suicide cases represent the most common cyanide exposure in our country.

The bitter almond smell of hydro cyanic acid can be detected by sixty percent of population [1]. The threshold for those persons who can sense the odor is estimated to be 1 to 5 ppm concentration in air. It is important to note that the sense of smell is rapidly paralyzed and those able to detect cyanide becomes insensitive to it after a short exposure [1]. It should be stressed that even at high concentration; some individuals cannot smell HCN. The persons involved in transportation, management or postmortem examination of cases of poisoning by ingestion of cyanide salts develop clinically significant cyanide concentration by inhalation of cyanide gas from the body of victim. Such Significant cyanide exposure and their implications are briefly reviewed here.

Cautions concerning the theoretical risk of the inhalation of toxic concentration of fumes by persons involved in the postmortem examination of cyanide poisoning victims are occasionally mentioned in the articles and standard texts. [2, 3]

Such warnings typically refer to victims in which poisoning was the result of ingestion of cyanide salts which, in reaction with gastric acid, could theoretically liberate hydrogen cyanide in sufficient amounts to pose hazards not only to the forensic pathologists or assistants but also for the first responders (police men and members of emergency department). Inhalation of HCN produce a tightness of the throat, nasopharynx and the taste of hydrocyanic acid is noted on moist mucous membrane. [1]

Full recovery usually follows non fatal exposure of hydrogen cyanide. The author could appreciate the smell in suspected cases of cyanide poisoning as that of crushed tapioca leaves and he used to develop headache and pharyngeal irritation which gets relieved on the next day. They all confirmed as cases of cyanide poisonings by chemical analysis.

A former colleague of Bernard knight became ill and was temporarily disabled shortly after conducting an autopsy on a suicide case who had swallowed a massive amount of potassium cyanide. [4] Presumably he had inhaled HCN from the stomach contents when examining the viscera.

A case study was reported in the literature which studied the degree of biohazard from cyanide remaining in body cavities or tissues or both of the deceased. [5] The toxicology analysis of blood of the deceased was done and revealed a blood cyanide concentration of 29.5 microgram per ml. Blood samples were also taken from three persons who attended

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the postmortem examination ten minutes after completion of examination.

The only symptom occurred in these persons was a lightheadness experienced by one individual who could appreciate the cyanide odour. Blood examination revealed cyanide concentration of 1.0 microgram per ml in medical examiner, 0.4 microgram per ml in autopsy assistant (smoker) and 0.3 microgram per ml in the resident (non smoker). The study also says that the relative concentration of cyanide in the blood of examining persons correlated with the duration of their close proximity to the deceased during postmortem examination. Fatal cyanide poisoning has been reported with blood concentration greater than 3 microgram per ml. (Normal Cyanide blood level <0.2 microgram) [6]

Thus, it is shown that persons involved in the postmortem examination of cases of poisoning by ingestion of cyanide salts can develop clinically significant cyanide concentration by inhalation of cyanide gas from the body of the victim, even many hours after the victim's ingestion of cyanide and death.

Another interesting case is that of a wife who attempted mouth to mouth resuscitation on her cyanide poisoned husband developed strange taste in her mouth. [3] Since blood cyanide concentrations were abnormally high in the persons attended post-mortem examination, the possibility of risk to individuals who performed mouth to mouth resuscitation cannot be excluded.

It is estimated that about fifty percent of absorbed cyanide may be inactivated within one hour after exposure, being converted to thiocyanate by the liver enzyme rhodanase and excreted in the urine. [7] This suggests that blood concentration in persons exposed to nonfatal level of cyanide concentration declines slowly and full recovery occurs. At this juncture it is worth noting that a cadaveric renal transplantation was done successfully from a donor who suffered irreversible brain damage due to cyanide poisoning. This indicates that injury to non neural organs in cyanide poisoning can be reversible. [8]

Conclusion:

It is important for Forensic Pathologists and mortuary staff that a corpse dead of HCN poisoning can present a health hazard. Persons exposed to such situations upon development of symptoms and signs of cyanide poisoning should be managed by supportive measures. An immediate blood sampling for the concentration of cyanide could also be appropriate, precaution should be taken to reduce further exposure. Full recovery follows non fatal exposure to HCN.

This hazard is equally important for persons managing cases of cyanide poisoning in emergency department as well as those attending the patient in the initial stage. Decontamination of cyanide poisoned patients occurs concurrently with initial resuscitation. Exposure to cyanide may take place by multiple routes including ingestion, inhalation, dermal or parenteral. The route of exposure determines which decontamination method is to be employed. No matter which modality is used, always protect the health care provider from potential contamination by utilizing protective devices such as water impervious gowns, gloves and eye wear.

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Review paper

Entomotoxicology: A Review

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Abstract

Entomotoxicology is the analysis of toxins in arthropods (mainly flies and beetles) that feed on carrion. Careful analyses of the community of insects encountered on a decomposing body, combined with knowledge of insect biology, ecology, and local environmental conditions can often provide valuable forensic insights. These can include the estimation of time since death, movement of the remains after death, indication of ante mortem injuries, and the presence of drugs or toxins. The accuracy of entomological estimates in deaths involving narcotic intoxication has been subject to debate in recent years as few available studies have explored the effects of drugs contained in decomposing tissues on fly colonization and ovipositional behavior, or on the rates of development of carrion-frequenting insects feeding on such food sources. Additionally, relatively few studies have examined the effects of other tissue contaminants, such as toxins or environmental pollutants, on these behaviors and/or the developmental patterns of the insects colonizing such tissues.

Studies of the use of carrion-feeding arthropods as alternative toxicological specimens and of the impact that tissue toxins and contaminants have on the development of immature insects feeding on these substances currently comprise the major avenues of exploration in the emerging field of entomotoxicology

Key Words: Entomology, Toxicology, Entomotoxicology, Toxins

Introduction:

There is been an increase in drug related deaths in USA and rest of the world. Many a times these deaths are discovered after a period of time and it is not unusual that the corpse could be highly decomposed or skeletonized. Under such circumstances, there will not be sufficient tissues for toxicological analysis. Even then, it is possible to detect various toxins and controlled substances by analysis of insects, larval skins or puparial skin present near the corpse. [1]

In recent years, with the development of newer extraction technologies, attention has been focused on analysis of chitinised insect remains as an alternative toxicological specimens in situations where traditional toxicological sources such as blood, urine or solid tissues are unavailable or not suitable for analysis and studies on use of carrion feeding arthropods as alternative toxicological specimens as the major avenues of exploration in the emerging field called "Forensic Entomotoxicology". [2]

Entomotoxicology deals with the "analysis of toxins in arthropods (mainly flies and beetles) that feed on carrion. Using arthropods in a corpse or at a crime scene, investigators can determine whether toxins were present in a body at the time of death" [3] Clearly much more research is needed before the full forensic potential of Entomotoxicology is realized.

Sample Preservation:

Entomological samples are analyzed in similar standards to human tissue samples. Once the specimens have been removed from the body, or the crime scene, they are washed with deionizer or tap water and the specimens are then frozen for storage at a temperature ranging from -20°C to 4°C until they are needed for analyses. [3]

Specimens are prepared for analysis in a variety of ways. They differ based upon the substance that is in question.

For the analysis of *inorganic substances*, the arthropods are taken out of storage, washed, and then dried to insure the removal of any foreign human fluids. They are then crushed and stored in a porcelain crucible at a constant temperature of 650°C for 24 hours. The resulting ash has a high concentration of metals, which are then analyzed by acid digestion using 70% HNO₃ (nitric acid). [3]

Organic substances investigation starts up with washing and drying the specimens. 1-10 grams of larvae are finely cut and an internal standard solution is added. The specimens are then homogenized, in a 0.9% saline solution, followed by centrifuged. Strong acids or bases break down the chitinous exoskeleton to release any toxins present and the sam-

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ple is allowed to extract overnight at a temperature of 65°C. The acid solution is then removed and the organic substances are available for further analyses. [3]

Analysis of Samples:

Typically the insects have been homogenized and treated as other tissues or fluids of toxicological interest. Various methods are used for analysis including Radio Immune Assay, Gas Chromatography, Thin Layer Chromatography, High Performance Layer Chromatography- Mass Spectrometry. [1]

Analytical techniques differ for organic and inorganic matter. Inorganic substances are scrutinized using Inductively Coupled Plasma (ICP), Atomic Emission Spectroscopy (AES), and Flame Atomic Absorption Spectrometry (FAAS).

Organic substances are analyzed by the screening test, radioimmunoassay (RIA), and by confirmation tests which include chromatography techniques like Thin Layer Chromatography (TLC) and gas chromatography. Liquid-liquid extraction (LLE) and solid phase extraction (SPE) are the analytical techniques of choice when dealing with substances in an aqueous phase. [3]

Effects of Toxins on Arthropods:

Drugs can have a variety of effects on development rates of arthropods. Substances like Cocaine, Heroin, Methylene Dioxymethamphetamine (MDMA), and Amitriptyline are commonly encountered in cases where forensic entomotoxicology is used. [4]

There is been evidence that during first 2-4 weeks of decomposition, various drugs influence the rate and pattern of development of Diptera larvae. [5] *Beetles* (Order: Coleoptera) and *Flies* (Order: Diptera) are the most commonly used insect in entomotoxicology and any altered stage in the development of these insects can often indicate toxins in the carrion on which the insects are feeding.

Morphine and heroin were both believed to slow down the rate of fly development. [6] However, closer examination of the effects of heroin on fly development has shown that it actually speeds up larval growth and then decreases the development rate of the pupal stage. This actually increases the overall timing of development from egg to adult. Cocaine and methamphetamine also accelerate the rate of fly development. [7]

Some effects of toxins on these arthropods depend on the concentration of the toxin while others simply depend on its presence. For example, cocaine (at the lethal dose) causes larvae to "develop more rapidly 36 (to 76) hours after hatching". The amount of growth depends on the concentration of cocaine in the area being fed upon. The amount of methamphetamine, on the other hand, affects the rate of pupal development. [3]

The effects of cocaine on development of the sarcophagid fly *Boettcherisca peregrine*, two patterns of development were noted. Control and sub lethal dosage colonies developed at approximately the same rate, as indicated by total body length. By contrast, the colonies fed on tissues from the lethal and twice-lethal dosages developed more rapidly and effects of heroin using *B. peregrine* maggots resulted in more rapid development of maggots and production of larger maggots in all the treated colonies until maximum size was attained. [8]

The Tricyclic Antidepressants like Amitriptyline shows no noteworthy differences in rate of development until the post-feeding third instars of *B. peregrine* colonies. While it was observed that Methamphetamine increases rate of development for the sarcophagid *P. ruficornis* for colonies. [9]

Limitations:

This fresh field in forensic should be uplifted from its nadir position by more research. Such as area bioaccumulation, insect metabolism of drugs, and quantitative analyses of insect evidence have only begun to be researched. [10]

Entomological specimens make excellent qualitative toxicological specimens. There is, however, a lack of research in developing an assessment to quantify the concentration of a drug in tissue using entomological evidence. One reason for this is that a drug can only be detected in larvae when the rate of absorption exceeds the rate of elimination, also samples of pupae and third instars larvae doesn't contain concentrations of the drugs, suggesting that drugs do not bioaccumulate over the entire life-cycle of larvae. This leads entomologists to theorize that toxins are eliminated from the larvae's system over time if they are not receiving a constant supply of the toxin. [3]

Conclusion:

Arthropods prove to be valuable tools in the investigation of homicides, suicides, and other unintended human deaths. In addition to the recognized applications to the estimation of postmortem interval, insects also may serve as reliable alternative specimens for toxicological analyses in the absence of tissues and body fluids normally sampled for such purposes. While the data reviewed above concerning the potential effects of drugs and toxins on rates of insect development are limited in scope and no adverse impacts on case analyses have been reported to date, it is not unreasonable to assume that such substances, contained in tissues fed upon by carrion insects, have the potential for altering developmental patterns.

Entomotoxicology may prove to be another valuable tool in the forensic science arsenal. So more detailed and comprehensive research is required, for the full potential of this emerging discipline can be recognized.

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Review research paper

Development of Clinical Forensic Medicine in India A need of time

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Abstract

Forensic medicine is the medical specialty that is practiced at the interface with the law. It involves the assessment and interpretation in an individual who has become involved either as a suspect or victim in some form of alleged criminal action. In practice however, the role of practitioners of forensic medicine has widened to include civil jurisdictions and matters of medical ethics.

Clinical Forensic Medicine is the application of forensic medical techniques to living. To address the un-met forensic needs of victims who are survivors of violent crimes and trauma there is urgent need of examination of victims of violence by a *specialty trained person* in medicolegal matters i.e. clinical forensic physicians. In this program, the clinical forensic physicians will evaluate adult and pediatric victims of blunt and penetrating trauma, sexual and physical abuse and collect evidentiary material when indicated.

In this paper the importance of Clinical Forensic Medicine Program and recommendations made by the "Survey Committee Report on Medico-Legal Practices in India, 1964" regarding its implementation are presented.

Key Words: Clinical Forensic Medicine, Victims Of Violence, Forensic Physicians, Survey Committee Report

Introduction:

The term Forensic Medicine is often used as an "umbrella terminology" to mean Forensic Pathology and Clinical Forensic Medicine. The **Clinical Forensic Medicine** is the practice of assessing the physical condition of the living who allege that they are victims of an assault or examining the alleged perpetrator of the offence. It may cover a wide field of subjects including forensic pharmacology, criminology and traffic medicine. [1]

The term 'Forensic Physician' is increasingly used for doctors engaged in the non-pathological aspects of Forensic Medicine. [2]

To address the un-met Forensic needs of victims who are survivors of violent crimes and trauma there is urgent need of examination of victims of violence by a *specialty trained person* in medicolegal matters i.e. clinical forensic physicians. Clinical Forensic Medicine is the application of Forensic Medical Techniques to living patients.

In emergency department, these techniques include the evaluation and documentation of traumatic injuries and the collection of evidentiary material for possible medicolegal presentation. [3]

Need of this program:

This Clinical Forensic Medicine Program will address the unmet forensic needs of patients who are survivors of violent injury and trauma and those patients who have not yet succumbed to mortal injuries. [4, 5, 6, 7] Trauma victims present regularly to emergency department in need of acute care.

Currently physicians and residents, principally from the specialties of emergency medicine, pediatrics, surgery and gynecology, are performing clinical forensic examinations. These physicians generally have little or no forensic training and yet may be expected to render "expert forensic opinions". [3]

The emergency physician is well trained to provide competent medical treatment but may be unable, uncomfortable, or unwilling to provide the patient with an equally competent forensic evaluation. [3]

This unique Forensic examination accurately documents and analyzes the patient's injuries prior at the time of intervention by other medical or surgical specialties.

- Common Forensic errors of omission and commission occur with regularity in emergency departments. [5, 8]
- These errors include the inadvertent failure to recognize, collect and preserve evidentiary material and an inability to accurately describe a wound's characteristics. [8]

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- Interpretative errors frequently occur in the assessment of wound ballistics, bullet trajectory, and pattern injuries associated with blunt and penetrating trauma.
- These errors may deny the patient, the courts, or an accused suspect access to pertinent and critical information and evidence, which would substantiate their claims of innocence or guilt. [3]
- Clearly, the medical practitioner must have an intimate knowledge of policing, and in particular, of methods of investigating major crimes. In this regard, Clinical Forensic Medicine Program can provide better provision.

Under Graduate, Post Graduate Education:

- ◆ Undergraduate and postgraduate education in forensic medicine is of variable quality and quantity.
 - ◆ A comprehensive list of skills and attitude recommended by Medical Council of India Regulation, 1997 desirable for Bachelor of Medicine and Bachelor of Surgery (MBBS) Graduate and postgraduate for Forensic Medicine and Toxicology:
 - At the end of the course, the student shall be able to make observations and logical inferences in order to initiate enquiries in criminal matters and Medico-legal problems
 - He should be able to carry on proper Medico-legal examination and documentation/reporting of injury in living cases in prescribed forms
 - He should be able to preserve relevant ancillary/biological materials for medicolegal examination
 - He should be able for estimation/Certification of Age
 - He should be able to examine the cases of Sexual offences:
 - Examination/Certification of Victim
 - Examination/Certification of Accused
- He should be able for Examination/Certification of Alcoholic [Prescribed Forms 'A' & 'B']
- He should be able to make Sick-ness Certificate, Fitness Certificate and Death Certificate
 - However, as there is no Clinical Forensic Medicine Program in most of the institutes, there are

significant defects in the teaching by present Forensic Medicine Department. Present teaching is only theoretical regarding this aspect, because of which the doctors are making inadequate medicolegal examination or inadequate medicolegal report writing.

- It is hoped that implementation of Clinical Forensic Medicine Program will give an opportunity to the present staff of Forensic Medicine to teach students all clinical medicolegal aspect in an efficient way which will definitely improve the medicolegal examination and medicolegal report writing.

Services provided by this program:

Implementation of the clinical forensic medicine program would provide a uniquely skilled and qualified forensic professional whose responsibilities would be:

- Medicolegal examination and medicolegal report writing of cases of:
 - Physical assault (including domestic violence, alleged assault by police, attempted murder, grievous injuries)
 - Self-inflicted injuries
 - Non-accidental injuries in children (child abuse)
 - Burn injuries
 - Road traffic victims
 - Rape and other sexual offences
 - Fitness to be interviewed or detained
- Medicolegal assessment of alcohol or drug affected individuals particularly in the area of traffic medicine.

[In the event that the patient has been transferred from the emergency department to operating room, then a medicolegal evaluation will be undertaken in the operating suite in concern with the patient's trauma surgeons. The clinical forensic physician will work in cooperation with the patient's treating physicians. This is done in such a manner as will not compromise the patient's hospital care or physical well being]

- Medicolegal assessment of allegations of child sexual abuse:
 - In this area, it is of critical importance that the practitioner has a very clear understanding of the anatomy and patho-physiology of injuries, and the interpretation of findings.

- Most of the medical officers are inadequately trained, so they are not documenting their findings properly and they are not taking photographs.
- Making of anatomical diagrams and taking photographs of medicolegal importance as evidentiary material
- Medicolegal assessment of poisoning cases
 - Collection of all the evidentiary material for medicolegal purpose in cases of poisoning, burn, firearm injuries and other cases of medicolegal interest
- Proper labeling, sealing and forwarding all collected evidentiary material to concerned authority along with respective forms (chain of custody)
- Making summary of all the relevant information of medicolegal important points after discharge or death for giving to concerned authority
- To give certificate of 'compose mentis' while recording dying declaration
- To help clinicians in matters regarding whether particular case is to be made MLC or not (if there is any confusion regarding the same)
- Teaching of undergraduate and postgraduate students in living medicolegal cases by giving them practical demonstration
- Crime scene visit can be made as early as possible after the examination of cases by Clinical Forensic Unit
(At present as in most of the cases death is delayed Forensic Pathologist comes to know regarding the case after a lengthy time period which makes crime scene visit not so fruitful)
- This unit will help the investigating authorities (police) to decide whether in particular medicolegal cases (i.e. admitted patient of long duration where clinicians are able to certify death) the postmortem is necessary to determine the cause of death or manner of death as per the guidelines laid down by the 174 CrPC.
- Would help to decide in medicolegal cases where organ transplantation has to be carried out or not as per the guidelines given by the Transplantation of Human organs Act.
- This unit will help in (legal) formalities in starvation or malnutrition cases
- Training of Nurses in medicolegal field (Forensic Nursing)
- Chain of evidence: One of the most important aspects of any case with forensic potential is the preservation of the chain of evidence, or accounting for the whereabouts of all evidence at all times, until its use by the

courts. This preservation of the chain of evidence includes both proper documentation, and the securing and handling of evidence at all times. Should this be expected from a treating physician or attending nursing staff, without specific forensic knowledge or training?

Academic Activities:

- The Clinical Forensic Medicine Unit will provide teaching in the areas of clinical forensic medicine to a wide variety of student groups, including undergraduates and postgraduates in Medical and its related fields, Law, Science and Criminology.
- In addition, teaching will be provided to police members and trainees, Defence Force personnel, ambulance officers, community service agencies, private organizations and community groups.

Clinical Forensic Nursing Service (CFNS):

- It is imperative that nurses in the clinical environment be taught to recognize and preserve vital fragments of trace evidence by careful handling of the patient's clothing and other biological material in the absence of a Forensic Medicine Specialist.
- Nurses will provide forensic services in areas such as in Police and Custodial Services, forensic psychiatric services and obtaining biological samples. The success of these programs will forge new opportunities for nurses to expand their career path into other areas of clinical forensic service delivery.
- Increasingly, recruitment or access to forensic medical practitioners who can offer timely response to providing forensic services in India has become difficult. This situation is mirrored across foreign countries and has been recognized as a burning issue in these countries.
- The Clinical Forensic Medicine Unit will establish a Forensic Nurse Examiner Network if funding from the Government/ any other organization is provided. This unit will offer specialist training and clinical experience for the nurses to competently provide forensic medical examinations to victims of sexual assault and other assaults.
- Such qualified Forensic Nurse Examiners will work as a part of the larger team with Forensic Medical Officers.

Pediatric Forensic Medicine:

- Pediatric Clinical Forensic medicine encompasses the areas of suspected non-accidental in-

jury of children, sexual abuse and physical and emotional neglect.

- The examination of children for forensic reasons is a specialised area in which both appropriately trained pediatricians and forensic physicians have expertise.
- Such examinations are usually performed as part of a comprehensive, integrated, forensic and child health service.

Sexual and Physical Assault:

- The examination of people who have been sexually assaulted is a specialised area which requires an integrated approach from a number of health professionals.
- The forensic medical assessment of physical injuries may be the only objective evidence in relation to a physical assault.
- It is vital that the injuries are documented accurately and interpreted expertly.
- Given the limited expertise in Forensic medicine of Emergency Departments and of the medical profession in general, it is preferable that forensic physicians or forensic medical officers with appropriate training conduct these services.

Survey Committee Report on Medico-Legal Practices in India, 1964:

The view is held that clinical forensic examinations require no special training. This attitude is basically wrong as few realize the difference between clinical forensic medicine examinations and other clinical examinations. The unfortunate result of this state of affairs is that the police are often unable to present their cases satisfactorily to the court because essential elements in the medico-legal examinations are wanting.

The successful practice of clinical forensic medicine will depend upon a re-orientation in the approach to the work on the part of the Medical Officers concerned. The re-orientation can be brought about by giving training as recommended by the Central Medico-legal Advisory Committee (Chapter V). The special features of such examinations can be emphasized and Medical Officers can be taught to appreciate the importance of such examinations.

Recommendation of Central Medico-Legal Advisory Committee:

The Central Medico-legal Advisory Committee during its first session in 1956, considered the suggestion of the Ministry of Home Affairs, Government of India, to create a special cadre of medico-legal officers. The Committee then felt that the question of creating a special cadre of medico-legal officers whose exclusive field would be to undertake all medico-legal examinations was not practicable at that time.

However, the Committee recommended that each State should give advance medico-legal training to at least one officer in each district and in important cities and towns and such an officer should undertake the specialised medico-legal work himself and also co-ordinate all general medico-legal work by other Government Medical Officers in his jurisdiction.

In discussing this important question and also that of the training of Medical Officers during the sixth session, the Committee recommended that every medical officer on his first appointment to Government service should receive three months training in medico-legal work under a professor of Forensic Medicine. Officers engaged in medico-legal work at the district level should receive further advanced training for six months under a Professor of Forensic Medicine. The Ministry of Health, Government of India, emphasized on the State Governments the need for training of medical officers in medico-legal work.

Status of Clinical Forensic Medicine in India:

- In India at present, Clinical Forensic Medicine program where especially medico legally trained persons will evaluate the living victims of violent crimes has not been developed and implemented all over yet.
- At some places like Mumbai, there is a post of Police Surgeon.
- These Police Surgeons operate at both a forensic and a therapeutic level.
- Their forensic role entails gathering and preserving evidence; the therapeutic role involves treatment and care.
- Performing these two activities by one-person leads to inadequacies in medicolegal examination and report writing
- Therefore, time has come to implement the proposed model by Knight [9] regarding the development of Clinical Forensic Medicine Program.

Status in other countries:

- The use of forensic medical techniques on living patients is well known in Latin America, Australia, Europe, and many Asian countries. [3, 4, 6]
- However, prior to 1991, clinical forensic medicine had not been introduced into the graduate or post-graduate medical curriculum of American medical education. [3]
- The "Police Surgeon" in the United Kingdom and Australia is a physician who is empowered to perform forensic examinations on living patients.
- The Association of Police Surgeons in Great Britain is currently involved in developing a

uniform training program for police surgeons.

- The forensic pathology community within the United States has long recognized the need for a "Police Surgeon" type physician to perform examinations on living patients. [3, 4, 6]
- Currently in the U. S. physicians and residents, principally from the specialties of emergency medicine, pediatrics, surgery and gynecology, are performing clinical forensic examinations. These physicians generally have little or no forensic training and yet may be expected to render "expert forensic opinions". [3]
- The concept of training emergency physicians in the application of forensic techniques was presented at the American College of Emergency Physician's Annual Meeting in Boston, October, 1991. [1]
- Only in Victoria and New South Wales are there full-time forensic clinicians.

Why Clinical Forensic Medicine has not gain recognition:

- It has been previously suggested that there were following reasons why clinical forensic medicine had lagged in establishing itself as a medical speciality. [11]
- Firstly, the knowledge and skills of the discipline overlap extensively into other specialties, so that there is no clear delineation of the work of the speciality. Secondly, an academic environment [1] has not provided support for the development of the speciality.
- Secondly, the lack of Academic Departments that have prevented the development of clinical forensic medicine as a unique discipline.

Academic Departments

- The key to the future lies in the establishment of departments of clinical forensic medicine, paralleling the other forensic medical specialties.
- There can be no compelling reason why the clinical function roles should not be fostered in the same fashion.
- The academic model will assist in producing a body of expertise; the absence of which has been a barrier to any progress in the past [12]
- Knight [9] has previously proposed this model and it is difficult to understand why the proposal has foundered.
- Many senior police officers are supportive of such an idea. The universities may be a little more resistant but pressure must be brought to bear at the right quarter.

- If the institutions are able to facilitate relatively obscure programs then they must be able to provide a similar facility for what have been one of the most neglected areas of clinical medicine and one of substantial significance in the system of justice.
- It is easy to demonstrate that the skills of recent graduates, the knowledge of the medical population generally and that the practice of clinical forensic medicine have suffered enormously because of the absence of this process.
- The relevance of teaching and the provision of services in this area should be compelling arguments to even the most socially isolated medical faculty.
- Surprisingly, the most disappointing aspect has been the lack of impetus and pressure from the medical profession itself.
- Generally, the desire for change has not been taken up by the individuals or organizations which are providing services in this area.
- There are compelling arguments for the formation of university departments of clinical forensic medicine, or for the inclusion of clinical forensic medicine as a major area in existing department.

Discussion:

- The presence of Forensic Physician or a forensically trained emergency physician within the emergency department would relieve the untrained or unwilling resident or physician of many of the unwanted court appearances.
- This Forensic physician would also collect forensic evidence, which might have otherwise been inadvertently overlooked or destroyed in the delivery of patient care.
- In addition, valuable forensic material and evidence would be documented and collected in a manner which would facilitate presentation at a later date.
- It is in the interests of victims, detainees, and the criminal justice system as a whole that a high quality, professional forensic medical service is maintained throughout the India.

Conclusion:

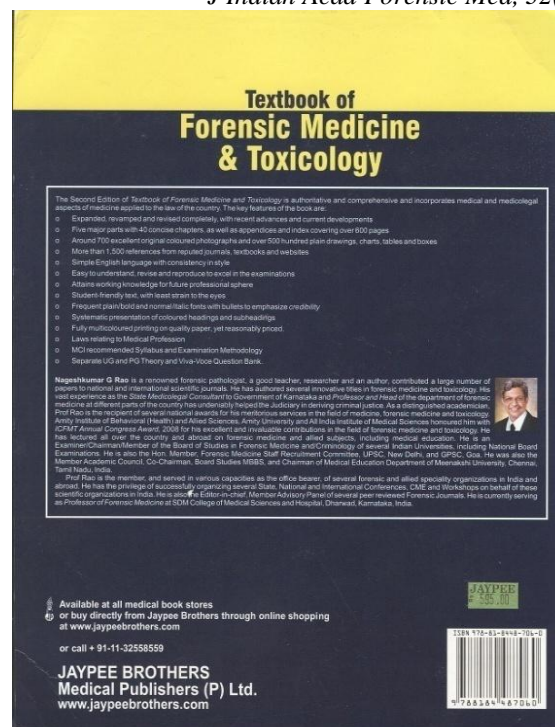
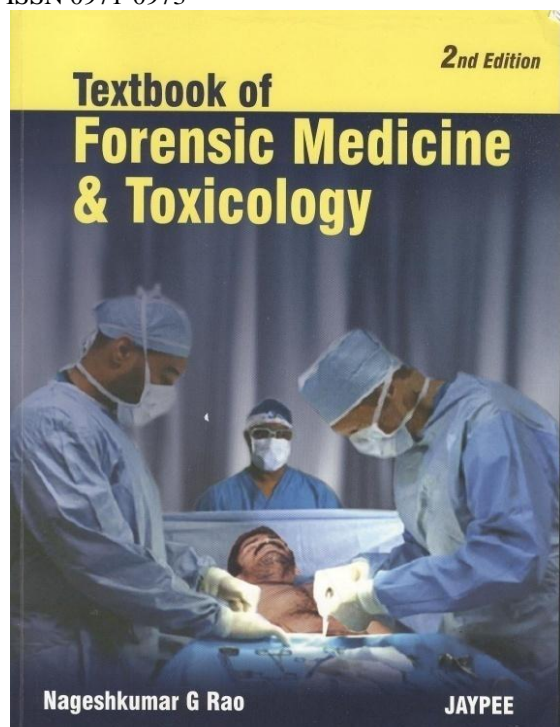
- We can no longer watch and wait whilst others are setting agendas that are, or may be, incompatible with the future of this speciality.
- In some other countries, the deficiencies have been recognized and there are active programs in place to reverse this trend.
- There is urgency in tackling these issues.

- In Europe, themes of commonality in the teaching and practice of forensic medicine are being explored.
- In the United Kingdom, the Royal Commission into the criminal justice system is examining the very foundations of the medico-legal system.
- Worldwide, unsafe convictions and allegations of injustices are eroding confidence in the practice of the various forensic specialties.
- The time has come for us to become guardians of our own profession.
- As Pennington [13] argues, unless we are seen to be setting and maintaining professional standards then others will do so, to our detriment.
- Undoubtedly, the transition will not meet with universal approval and for many the status quo will be the preferred option.
- However, unless we can embrace a professional ethic and cause clinical forensic medicine to be established as a recognized speciality, then it will become a fragmented archival curiosity and the backwater of a larger pool.
- The only certainty is that the destiny of this speciality is very much in the hands of the current forensic persons.
- The question that remains is whether we have the desire or motivation to bring about the changes required to help the society, and to ensure the future and proper recognition of this specialty.
- If this program is implemented, it would provide the core for the development of a high quality medicolegal service.

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Book Review

Textbook of Forensic Medicine & Toxicology

Second edition of Textbook of Forensic Medicine & Toxicology written by Dr. Nageshkumar G. Rao, a renowned Forensic Pathologist, a good teacher, researcher and an author contributed a large number of research papers to national and international scientific journals. He relinquished from service at KMC, Mangalore on November 2009. Currently serving as Professor of Forensic Medicine at SDM College of Medical sciences and Hospital at Sattur, Dharwad, Karnatka from February 2010. He has vast practical experience in the field of Forensic Medicine to share with students and teaching community.

He will also be continuing the office of President, *National Foundation of Clinical Forensic Medicine (NFCFM)* and will be publishing the peer reviewed Scientific Journal – *IJFR* on behalf of *NFCFM*.

Book is well illustrated, to the point and easily understandable by the students both Under Graduate and Post Graduate. Flow charts and excellent quality of photographs make it favorite among students especially during examination hours.

It is also useful for medical officers and police personals working in the medicolegal field and involved in crime investigation. The legal profession, the judiciary and the law enforcement agency can be benefited from this textbook.

Question banks and relevant appendices at the end of textbook make it more useful for students and teachers both.

It is my pleasure to write a review of this textbook, a treasure of an exemplary piece of communication skill conglomerated with experiences and intellectual potentials.

Mukesh Yadav

Editor, JIAFM

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