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From the Editor's Desk

JIAFM

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Dear Friends,

It gives me great pleasure to present the third issue of year 2017 to the Hon'ble Members of the Academy. I wish to thank all the authors and contributors of the scientific material published in the four issues of this year. Without their contribution, we would not have any scientific material. The members of the Editorial Board strive hard in their Endeavour to bring up the standard of the journal. Every member does this task in addition to his professional job and commitments. But, as we have promised you, we are not leaving any stone unturned. We hope that you enjoy and like this Academic Feast as you have enjoyed the previous ones. I, on behalf of the Editorial Team, once again thank you for giving us the opportunity to serve you and this Academy.

The Journal, as you are aware, is indexed with SCOPUS, INDMED and IMSEAR as well as Indian Citation Index. Any suggestions and advice for improving the standard and quality of the journal will be highly appreciated.

Jai Hind & Long Live IAFM

Dr. Dasari Harish
Editor

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A copy will be sent free to the member / subscriber provided the claim is made within 2 months of publication of the issue & self addressed envelop of the size 9" x 12" is sent to the Editor. (Those who want the journals to be dispatched by Registered Post must affix Rs. 50/ worth postage stamps).

Corrigendum

The Corresponding Author of the Article :***Pattern of Filling up of Medical Certification of Cause of Death (MCCD) at a Tertiary Care Hospital: Pitfalls and Suggestions*** has been mentioned as Dr. B. L. Bamoria, whereas the Corresponding Author is **Dr. Vishal B Surwade**.

The Error is deeply regretted.

Editor

Editorial

Extension of Consent: Issues Thereof

¹Dasari Harish, ²Mandar R Sane

Abstract:

"He alone is free who lives with free consent under the guidance of reason" - Spinoza¹

The four major principles of medical ethics are: a) Respect for autonomy of the patient, b) Beneficence, c) Non-maleficence, and d) Equitable Justice.² The most important of these is the principle of Respect for Patient Autonomy. Many ethical questions in medical practice will be answered by asking foremost what a patient 'wants', and not what the doctor/ family/believes to be the best for him.

The most important aspect of modern medical ethics is the respect for patient autonomy and the fundamental principle of informed consent and patient confidentiality. Ethical practice involves a systemic approach to decision making and actions, considering the interests of all affected by that decision.

Many doctors do not follow this fundamental ethical principle and behave in a "Paternalistic" way with their patients, either by extending the previously taken consent or even taking "Proxy" consent. The issues related to it are being dealt with, in the light of the Hon'ble Supreme Court Decision in the Samira Kohli case.³

Key words: Consent, Beneficence, Non-maleficence, Equitable justice

Introduction:

"Every human being of adult years and sound mind has a right to determine what shall be done with his own body and a surgeon who performs an operation without his patient's consent commits an assault for which he is liable for damages."⁴ These words of Judge Cardozo in 1914 echo the patient's right to autonomy in medical decision making and Impress upon us the absolute necessity to take Informed Consent from the patient before the start of any procedure/ treatment.

Consent means an agreement, compliance or permission given voluntarily without any coercion.⁵ Sec 13 of the Indian Contract Act⁶ defines consent as: "Two or more persons are said to consent, when they agree upon the same thing in the same sense".

A clinician must obtain informed consent before undertaking to perform any procedure or treating a patient. It imparts a duty to the doctor to provide information to a competent patient, who after understanding the information, makes a valid decision, whether or not to accept the treatment proposed.

The elements of Informed Consent include:⁷ Disclosure of information, Competence, Understanding, Voluntariness, Decision making.

A major contention about an informed consent is regarding 'disclosure of information'. A physician may be 'paternalistic' in disclosing limited information to the patient or he may elaborate in excessive detail the information to the patient. He is booked for negligence case when he is alleged to have exceeded the authority given to him by the patient. It may happen when information disclosed to the patient is incomplete, or ambiguous or he overstepped the authority the patient imposed in him.

Article 21 of the Indian Constitution⁸ gives the patient the right to Autonomy. He can either accept the proposed treatment or refuse it (Informed Refusal) and a doctor who treats without a valid consent may be charged under

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the civil or the criminal law. The law presumes the doctor to be in a dominant position in the doctor - patient relationship and hence mandates consent.⁹

Extension Doctrine:

The Extension Doctrine¹⁰ deals with the those circumstances wherein the patient originally consented for a specific procedure, but at the time of doing it, further issues crop up that are best resolved at that instant time. If it is not possible at that time to take further consent of the patient, or his/her legal guardian, then the original consent may be extended to cover the unexpected problems that cropped up. This is only allowed or accepted by courts if the additional procedure is the most appropriate and does not interfere with the reproductive capabilities of the patient.

One patient was operated upon by her doctor for appendicitis, after obtaining informed consent for the same. However, on opening the abdomen, it was found that her appendix was normal and not inflamed, but the gall bladder was gangrenous. To relieve the patient from pain and save her from another surgery in the future, he removed her gall bladder. Later, it was found out that the kidney of the patient was also affected. The doctor was held liable as he operated without the consent. In doing so, he acted **without** a valid consent, which is a fit case of professional paternalism and gross disrespect to patient's autonomy.¹¹

This is also completely against what John Stuart Mill advocated about Liberty:¹² 'Over himself, over his own body and mind, the individual is sovereign'.

Proxy Consent:

We have no clear cut guidelines regarding this term. However, this is very much in practice in the Indian context. It is commonly seen that during the course of a surgery, someone peeps out of the OT, calls for the attendant of the patient undergoing surgery and takes proxy consent for either extension of the consent already taken or a new consent for a completely different procedure. In one case, the wife of a patient informed the hospital authorities in unambiguous terms that she had no objection to her husband undergoing bypass surgery, her consent was deemed sufficient for the purpose

of any formalities with which the hospital was required to comply.¹³

The Hon'ble Supreme Court in the Samira Kohli Case³

In this case, a 44 year old unmarried female consulted her doctor for prolonged menstrual bleeding. She was advised to undergo a diagnostic laparoscopy and was made to sign a consent form mentioning the procedure 'diagnostic and operative laparoscopy. Laparotomy may be needed'. When patient was in the operation theatre, another proxy consent was taken from her mother for total hysterectomy. Her uterus, ovaries and fallopian tubes were removed. the plaintiff sought damages for the loss of reproductive organs, irreversible permanent damage, emotional stress and trauma.

Hon'ble Supreme Court observed: "The 'adequate information' to be furnished by the doctor (or a member of his team) who treats the patient, should enable the patient to make a balanced judgment as to whether he should submit himself to the particular treatment or not. This means that the Doctor should disclose:

- (a) Nature and procedure of the treatment and its purpose, benefits and effect;
- (b) Alternatives if any available;
- (c) An outline of the substantial risks; and
- (d) Adverse consequences of refusing treatment.

But there is no need to explain any remote or theoretical risks involved, which may frighten or confuse a patient and result in refusal of consent for the necessary treatment. Similarly, there is no need to explain the remote or theoretical risks of refusal to take treatment which may persuade a patient to undergo a fanciful or unnecessary treatment. A balance should be achieved between the need for disclosing necessary and adequate information and at the same time avoid the possibility of the patient being deterred from agreeing to a necessary treatment or offering to undergo an unnecessary treatment.

Consent given for a specific treatment procedure will not be valid for conducting some other treatment procedure. The fact that the unauthorized additional surgery is beneficial to the patient, or that it would save considerable time and expense to the patient, or would relieve

the patient from pain and suffering in future, are not grounds of defence in an action in tort for negligence. There can be a common consent for diagnostic and operative procedures where they are contemplated. There can also be a common consent for a particular surgical procedure and an additional or further procedure that may become necessary during the course of surgery. Where a surgeon is consulted by a patient, and consent of the patient is taken for diagnostic procedure/surgery, such consent cannot be considered as authorisation or permission to perform therapeutic surgery either conservative or radical (except in life threatening or emergent situations). Similarly, where the consent by the patient is for a particular operative surgery, it cannot be treated as consent for an unauthorized additional procedure involving removal of an organ, only on the ground that such removal is beneficial to the patient or is likely to prevent some danger developing in future, where there is no imminent danger to the life or health of the patient."

However, though the judgement has conveyed a clear message on consent for elective procedures and also on emergent situations, other circumstances in medical practice remain ambiguous. Material risks related to patient, unforeseen developments occurring during operations, and calculated risks being taken by operating surgeon, etc need to be elaborated.

- i) **'Material Risk':** The material risk in a given case is a risk which the court is satisfied that, a reasonable patient would be likely to attach significance in deciding whether to accept the proposed treatment or not. In the Samira Kohli case, the doctors contested that hysterectomy was performed as endometriosis in a patient above 40 years of age is likely to result in infertility and it was no more a 'vital' organ. However, patient had planned for marriage after operation, and, had she been informed about possible hysterectomy before start of procedure, she would have never consented.
- ii) **Unforeseen developments occurring during operations:** During an operation, accidents may occur, or conditions may be discovered, which were not anticipated (or

foreseen) and which were therefore not covered by any consent which the patient had explicitly given. Unforeseen developments in operations are cases in which there is no real consent and no real emergency but where the surgeon claims an expanded authority to operate. Such types of cases are of two types - a) accidents during operations and b) unforeseen conditions discovered during operations.

- a) **Accidents during operations:** When an accident occurs, there is always a chance that a court, viewing the event in retrospect, will discover some element of negligence in the occurrence of the accident itself; if so the surgeon may be held liable for damages, and, such a liability cannot be erased by anything that is done after the accident happens.
- b) **Unforeseen conditions discovered during operations:** If the surgeon obtains consent to do a specific kind of operation, and, an unforeseen condition is discovered during operation, then he find himself in an awkward dilemma. Courts may have liberal view about implying authority to change plans to meet unforeseen condition,¹⁴ or Court may limit the surgeon strictly to the consent he has obtained beforehand.

In the Samira Kohli case, the court has upheld the right of the patient with regard to her/his body and her/his right to decide whether she/he should undergo the particular treatment or surgery or not. It was observed that unless the said unauthorized additional or further procedure is necessary in order to save the life or preserve the health of the patient and that it would be unreasonable to delay the further procedure till the patient regains consciousness and takes a decision, a doctor cannot perform such procedure without the consent of the patient.

Samira Kohli case and other cases^{15,16} cited in the judgement clearly elucidate that the Surgeon has authority to operate without consent or extend the authorisation given in consent in only in emergent or lifesaving conditions. Similar is the essence of S. 92 IPC¹⁷ which deals with an act done in good faith, for the benefit of the patient, without his consent.

However, most cases of unforeseen developments do not really measure up to the rigorous tests for an emergency- i.e. urgent need for action to protect the patient's life or health. Unforeseen developments indicating absolute necessity for a prompt operation does not always implies 'emergency' in the sense that death would likely result immediately if operation is not performed. In Samira Kohli case, the doctors contested that hysterectomy was a necessity, but failed to prove that it was emergent situation.

iii) **Calculated risks:** Calculated risks during surgery might have a rather high incidence of occurrence, but which medical science has not yet discovered ways to avoid. But it is important that the patient should realise the risk that he runs, and that physician who cannot avoid this risk be relieved of danger of liability by obtaining a proper release from the patient in which he expressly assumes the risk involved.

Considering the above circumstances, the necessity for a consent which is broad enough to cover all contingencies, coupled with the difficulty of foreseeing such makes it advisable for the physician to do the following things; He should explain to the patient what normally happens in a case such as his, as well as some of the major developments which may possibly be presented in the procedure. This need not be done in a way to alarm the patient; it should be possible to do it in a manner to make impression on patient that his doctor is sound in clinical practice and foresees everything. Such a full discussion will probably eliminate many of the disappointments and misunderstandings by patients which are potential reasons for lawsuits. If the discussion does not lead to a prudent decision of the patient, then it will atleast make clear to the physician that he is dealing with an unreasonable patient and perhaps should not incur the risks of handling the case.

However, upto what extent can the doctor go while discussing intricacies of procedure or while disclosing information for obtaining consent? In Samira Kohli case, the Hon'ble Court expressed the view that Bolam Test¹⁸ has broadly been accepted as the general rule in negligence cases, i.e, as long as a doctor

acts in a manner which is acceptable to the medical profession and court finds that he has attended the patient with due care and skill, then it would be difficult to hold the doctor to be guilty of negligence. Considering the test, it is enough to disclose the information to the patient which a body of reasonable medical professionals is likely to do. But at the same time, the Court was cautious about future trends which may move towards 'reasonably prudent patient test' or Canterbury test¹⁹ for disclosing information.

Conclusion:

We conclude that nature and extent of information to be furnished by the doctor to the patient to secure the consent need not be of the stringent and high degree, however, it should be as per the prevailing standards of medical practise. The information which the doctor thinks materially important to the patient must be disclosed, and, all the information must be provided to the patient which he specifically seeks. Extension of Consent or Proxy consent will no longer stand in any court of law.

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Original Research Paper

Study of Crime Pattern in Homicidal Deaths

¹Vinay H.N., ²Shivakumar P

Abstract:

In order to study the crime pattern in homicidal deaths, the present study was carried out over a period of 2 years from October 2010 to September 2012. A total of 220 cases of homicidal deaths were studied in the Department of Forensic Medicine, Bangalore Medical College and Research Institute, Bangalore.

Among the 220 cases of homicidal deaths, maximum numbers of victims (35.4%) were done to death at their residence only. In majority of the deaths, the body was found at the same spot where crime was committed (91.2%). Most of the homicides took place in the period 6pm-12am (45.9 %). Majority of the offenders were acquaintances of the victims, constituting 43.6 % of the cases. In most of the homicides (25%), the motive was financial conflicts, followed by revenge (19 %). Multiple offenders were reported in 43.6 % cases.

Key Words: Motive, Offender, Time, Place of Crime, Medico-Legal Issues.

Introduction:

Although there has always been extensive popular and scientific interest in homicide, scientific knowledge about this phenomenon is limited. Many studies of criminal homicide have been conducted; one of the most comprehensive of these is reported in Wolfgang's Patterns in Criminal Homicide.¹ Homicide is also unique in the nature of the crime, that is most often committed against the offender's own circle of acquaintances. The homicide victim is typically an intimate of the offender, most commonly a family member or friend. Stranger-killings, so often portrayed in the media, account for less than one in five killings. Furthermore, in a number of murders, the victim plays a significant part in his/her own demise.

The distinction between the victim and the offender can become blurred in some cases; for example, when a wife kills, in self-defence, a husband who has brutalised her for years. Homicide, more than any other crime, frequently arises out of long and hostile interaction between victim and offender, rather than from a sudden unprovoked and premeditated action by an offender. It is perhaps this intimacy between victim and offender that explains why in such a high proportion of homicides.²

Materials and Methodology:

The present study was conducted in the department of Forensic Medicine Bangalore Medical College and Research Institute (Victoria and Bowring and Lady Curzon hospitals) Bangalore, from Oct 2010 to Sep 2012, a period of 2 years.

All the cases brought to the department for medico-legal autopsy registered under Section 302 IPC ³ with alleged history of homicide and also the cases registered under 174 (3) Cr PC,³ which were later registered as homicide, were studied.

Ethical clearance was obtained. Detailed information regarding the circumstances of crime was sought from the police, victim's relatives and friends, visits to the

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scene of occurrence or deduced by the photographs of the scene of occurrence.

Study design:

This study was a cross-sectional study. Data was analysed using descriptive statistics and presented in the form of tables

Results:

In this study it is observed that maximum number of victims (35.4%) were done to death at their residence only. In 26.3% cases, victims were killed in the street. Others being 28.1%. (**Table-1**)

In majority of the deaths, the body was found at the same spot where crime was committed, (91.2%). In 16 cases (7.2%), the dead body was moved from the scene of the crime (**Table-2**)

It was observed that maximum number of the homicides took place in the period 6 pm-12 am (45.9 %), followed by 12 pm-6 pm, (23%). (**Table-3**)

In most of the homicides, the offenders were acquaintance, 43.6 %. Strangers and unknown offenders, both, constituted 21.3 % cases. In later investigation, most of the strangers and unknown people were identified and of them, most of were found to be acquaintances. Spouse were responsible for 5.4% cases; parents, 6.8 %. (**Table-4**)

It was observed that in most of the homicides, 25%, the motive was financial conflicts; with revenge being seen in 19 % cases. (**Table-5**)

It was also observed that the multiple offenders constituted 43.6 % cases, while single offenders constituted 33.6 % cases. (**Table-6**).

Discussion:

Maximum number of victims in our study were done to death at their residence only, which implies that these homicides were mostly pre meditated, as the assailants were aware of the victim's whereabouts. Some females were the victims due to prostitution in house. Deaths in the street were due to gang rivalry, revenge murders and arguments arising while under the influence of alcohol. Other places in the study were Railway premises, playground,

bar and restaurants, etc. Similar observations seen in study by Hugar, et al.⁴ Contrasting observations were made by Mohanty,⁵ where street deaths were the majority, (46.7 %) and by Mohanty MK, et al,⁶ where outdoor deaths were more (40.2 %).

In 16 cases (7.2%), the dead body was moved from the scene of the crime and attempts were made by the assailants to obliterate the identity as well as the evidence of crime in the form of burying the body in remote place, crushing the face, by burning or putting in barren land, well etc, so that the body decomposes. The presence or absence of blood stains, signs of struggle/disturbance at the spot of recovery of body were taken into account for the above inference, by visiting the scene, observing the spot photographs and information furnished by the police. The observation is supported by that of Mohanty MK, et al,⁷ (14.7%) and Hugar, et al,⁴(15.75 %), wherein, body was moved to different place.

Again, majority of the homicides took place in the period 6pm-12am, 45.9 %, followed by 12pm-6pm, 23.6 %. The factors like due to darkness, the chances of assailant being recognized being less, disposal of the body being easier; in case of multiple offenders, escape being easy, safeguarding their identity, are some of the reasons for this. Most of crimes in during this time could be under the influence of alcohol, wherein arguments ensue easily. In the afternoon, most of the victims are alone at house. Females and housewives are targeted, motivation being gain, robbery and assault. In cases of doubt of infidelity, children would be in school and wives would be victims of their husbands. Similar observations were made by Shiva kumar, et al,⁸ Hugar, et al,⁴ while, contrasting observations were made by Bhupinder, et al,⁹ where most cases occurred during morning time, 39%.

In most cases, the offenders were acquaintance, 43.6 %. In the present study acquaintances included friends, neighbours, employees and enemies, etc. Parents constituted 6.8 % offenders, their victims being their children in dyadic deaths i.e. both homicide and suicide, motive being marital disharmony,

financial loss etc. This observation was similar to a study done by Lee-Gorman, et al,¹⁰ Shiva kumar, et al,⁸ Hugar, et al.⁴ Parents were suspects in cases of victims of age 0-9 years; similar observations were made by Bennet, et al.¹¹

In most of the homicides, the motive was financial conflicts and revenge, which included land disputes, enmity, gang rivalry, business contracts, supary (contract) etc. In most of the revenge murders, financial dispute also played a role. On further investigation, the motive, which was unknown, revealed to be financial conflicts, arguments, or revenge by acquaintances. In the domestic homicides, the motive was gain, robbery, infidelity etc. These observations are supported by Lee-Gorman, et al,¹⁰ Mohanty MK, et al⁷ and Hugar, et al.⁴

Multiple offenders constituted 43.6 % cases. Homicide pattern included sharp weapon injuries, with heavy and light cutting weapons being used for revenge, financial conflicts, and property disputes. Single offender fell in to most of domestic homicides category, arguments and under the influence of alcohol in late nights, being the main reasons. Similar observations made by Mohanty, et al,⁵ Mohanty MK, et al,⁶ and Hugar, et al.⁴

Conclusions & Suggestions :

1. As most of the homicides took place in late evenings and night time, measures to be taken by introducing strict law enforcement by police in furtherance of reducing the crime.
2. Well illuminated streetlights in all areas.
3. Better quality CCTV camera with good night vision at sensitive places.

Conflict of interest: None

Financial assistance: None

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Table-1: Distribution of homicide based on place of occurrence.

Sl. No	Place of occurrence	Number	%
1	Victims house	78	35.4
2	Work place	2	0.9
3	Street	58	26.3
4	Remote area	12	5.4
5	others	62	28.1
6	unknown	8	3.6
	Total	220	100

Table-2: Distribution of homicides according to the place of disposal

SI. No.	Spot	Number	%
1	Same	203	92.2
2	Different	16	7.2
3	Not known	01	0.4
	Total	220	

Table-3: Distribution of homicides according to the time of occurrence of crime.

SI. No.	Time of day	Number	%
1	6am to 12 pm	33	15
2	12pm to 6 pm	52	23.6
3	6pm to 12 am	101	45.9
4	12 am to 6 am	34	15.4
	Total	220	100

Table-4: Distribution of homicides based on victim offender's relationship.

SI. No.	Relation	Number	%
1	Acquaintance	96	43.6
2	Parents	15	6.8
3	Spouse	12	5.4
4	Relatives	3	1.3
5	Strangers	47	21.3
6	Not known	47	21.3
	Total	220	100

Table- 5: Distribution of homicides based on motive.

SI. No.	Motive	Number	%
1	Argument	22	10
2	Revenge	42	19
3	Financial conflict	55	25
4	Property gain	4	1.8
5	Infidelity	9	4
6	Mental illness	2	0.9
7	Supary (contract)	5	2
8	Others	22	10
9	Not known	59	26.8
	Total	220	100

Table-6: Distribution of homicides based on number of offenders involved.

SI. No.	Offenders	Number	%
1	Single	74	33.6
2	Multiple	96	43.6
3	Not known	50	22.7
	Total	220	100

Original Research Paper

Sexual Dimorphism in Digital Dermatoglyphic Traits Among The Christian Population of Mysore, India

¹Somayyeh Samehsalari, ²K. Rajasekhara Reddy, ³Koohyar Mohsenpour

Abstract:

Gender classification from fingerprints is a main step in forensic investigations in order to identify the gender of a criminal and minimize the list of suspects search.¹ The present investigation is attempted to evaluate gender dimorphism in digital dermatoglyphic traits such as basic finger pattern types and various pattern indices from a total of 102 Christian people from Mysore city, consisting of 60 males and 42 females. Data was collected by using of USB fingerprint reader (biometric scanner). The distribution of patterns was found to be in the following order:

Radial loop (54.9%) > true whorl (30%) > central pocket loop (4.5%) > lateral pocket loop (4.3%) > twin loop (2.7 %) > tented arch (1.4 %) > plain arch > ulnar loop (1.3 %) > accidental (0.0%). Finger pattern indices were calculated. Females showed higher values of Dankmeijer's Index and Poll's Index while males showed higher values of Pattern Intensity Index and Furuhta's Index. Finger pattern types and indices were compared with several other Indian populations.

Key Words: Sexual Dimorphism, Digital Dermatoglyphic Traits, Christian Population, Mysore

Introduction:

The word "Dermatoglyphics" (Derma means skin and "glyphics" means carve) is the systematic study of patterns and ridges that occur on the epidermis of the ventral surface of the hands and feet.² The configurations are formed in the early foetus and remain unchanged throughout the life of an individual. Its permanency makes them highly useful in identification. Dermatoglyphic traits are polygenically controlled and putatively non-adaptive.³⁻⁵ Hereditary characteristics of a person can be exposed by finger print patterns and physiological behavior of a person can be determined by these patterns.⁶

Dermatoglyphics reveals great variation in the incidence of patterns in different racial groups and provides a useful tool in the evaluation of degree of relationship.⁷

The study of finger print patterns is important tool for diagnosis of many diseases; especially those are created by chromosomal disorders and aberrations.⁸ It is considered as a substitute of signature of individuals patterns.⁶ There are two kinds of finger print studies: qualitative and quantitative, study about finger print pattern types is a qualitative study whereas, finger ridge count on the finger print is an instance of quantitative study.⁹ Galton classified the patterns into arches, loops and whorls, while Henry classified the patterns into arches, loops, whorls and composites in order of degree of curvature of the ridges.²

In the analysis of finger dermatoglyphics, the patterns have been identified for ridge counting. The core and tri-radius points have been marked with the pencil and then a line was drawn from core point to tri-radius point. All ridges touched by this line are counted except tri-radius and core. When performing ridge counts, whorl pattern has two tri-radii and loop pattern contains one, arch

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receives a score of zero.¹⁰ It has very essential role in study of anthropology, human biology, medicine, forensic and genetics.¹¹

The main purpose of the current study is to determine gender-wise diversity digital dermatoglyphic traits like basic finger pattern types and several indices among the Christian population of Mysore city, Karnataka state of India.

Materials and methodology:

Selection of the sample:

The data for the present study included finger impressions collected from 102 unrelated individuals (60 males and 42 females) of Christian population living in Mysore. The sample falls within the age range of 14-30 years among the males and 13-27 years among the females. All subjects were informed regarding the purpose and nature of the study. Only healthy people with no visible signs of any illness, deformities or trauma to any finger were included.

Methods and analysis:

Finger prints were taken by a USB finger print reader (Biometric Scanner) (**Fig 1**). According to its protocol, software was installed on a computer. USB fingerprint reader was then connected to the computer. The subjects were asked to wash and clean their hands before collecting the prints. The finger balls of the subjects were pressed at the center of the sensors of Biometric Scanner. Every possible care was taken to include extra-limital tri-radial and the print was made suitable for ridge counting. For more accuracy every finger was taken twice. The finger prints were analyzed according to the suggestions recommended by Cummins and Midlo.¹² The *t*-Test was performed to test any significant gender differences. A *p*-Value of <0.05 was considered as significant.

Results and discussion

a. Digital patterns

A total of 1020 finger print were calculated and their patterns recognized. The different pattern types were broadly classified into four main patterns: namely whorls, loops, arches and composites. The frequency distribution of various pattern types on fingers are shown in **Table 1**. Overall, loops were

observed to be the most common pattern (55.7%), followed by whorls (30%), composites (11.6%) and arches (2.7%). Sub-classifying further, radial loops (54.9%) were the most predominant and twin loop (2.7%) was found to be the least common. It was observed that there were no accidentals in either sex.

Digit-wise distribution of basic patterns on the right and left hands among Christian males and females are presented in **Table 2 & 3**. Males and Females, both showed a dominance of the loop (49.7% and 61.7%, respectively), which is in accordance to the observations of Kapoor & Badiye.¹³ Arches had the least frequency in both sexes (2% among males and 3.3% among females). Statistically, there were insignificant sex differences ($p > 0.05$) in the overall distribution of fingerprint patterns in fingers of both hands amongst males and females.

Table 4 shows the digit-wise incidence of whorls, loops and arches among the males and females. Both sexes were characterized with highest frequency of loops. The digit-wise incidence of loops, among the males and females of both hands were the following order: V > III > I > II > IV and V > III > I > IV > II respectively.

Basic pattern types were compared with several previous studies on different Indian populations in **Table 5**.¹³⁻¹⁷ Due to the careful classification utilized by us, (Loops, Whorls, Arches and Composites), the outcome of our study varies slightly as compared to most of the researchers that used general major classifications (i.e. Loop, Arch and Whorl). The core results of our study are almost similar to studies performed by various other researchers [13-16] who also found the loop pattern to be the most common in the various populations studied by them (**Table 6**). Also, the results of our study were found to be in contrast to the studies performed by Banik, et al,¹⁷ who reported whorls to be the most common pattern, followed by loops and arches in both the hands of males and females.

Indices: Four indices were calculated among the males and females on the basis of basic finger pattern types are shown in **Table 6**.

Pattern Intensity Index (PII)

The Pattern Intensity Index, i.e. the value of the number of tri-radial per individual or number of triradial per finger,¹⁸ is shown in **Table 6**. It is known that PII among the males (14.2) is higher than the females (12.7), showing the bisexual variation.

a) Dankmeijer's Index:

The relationship between the frequency of whorls and arches known as Dankmeijer's Index.¹⁸ It's higher in females (9.5) than in males (4.2), showing more arches in females.

b) Furuhashi's Index:

The proportion of total whorls to total loops, known as Furuhashi's Index,¹⁸ is higher in males (97) than in females (56.8) showing a high value of whorls.

c) Poll's Index:

Poll's Index includes the ratio of total arches to total loops.¹⁸ It is higher in females (5.4) than in males (4).

The pattern indices of Christians were compared with several previous studies on different Indian populations. The various indices showed great variability in terms of the other populations compared as can be seen in **Table 7**.

Conclusion:

In conclusion both males and females are characterized by a high frequency of loops. The frequency of Radial loops is found higher than Ulnar loops. Gender differences and was found to be statistically insignificant ($p > 0.05$) Dermatoglyphic patterns of Christians are similar to Muslims, Danguia Tharu and South Indians populations. Females show higher values of Dankmeijer's index and poll's index while males expose higher values of pattern intensity index and Furuhashi's index.

Conflict of interest: None

Financial Assistance: None

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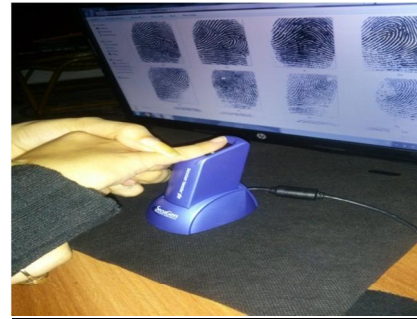


Figure 1 USB finger print reader (Biometric Scanner)

Table 1 Frequency distribution of finger pattern types

Sex	Pattern types (%)											
	Arches			Loops			True whorls	Composites				
	PA	TA	Total	U	R	Total		TL	LPL	CPL	ACC.	Total
M	1.33	0.66	2.00	1.00	48.66	49.66	38.50	2.16	3.16	4.33	0.00	9.65
F	1.19	2.14	3.33	0.47	61.19	61.66	21.42	3.33	5.47	4.76	0.00	13.56
M+F	1.26	1.40	2.66	0.73	54.92	55.66	29.96	2.74	4.31	4.54	0.00	11.59

MPA=Plain arch, TA=Tended arch, U=Ulnar loop, R=Radial loop, TL=Twin loop, LPL=Lateral pocket loop, CPL=Central pocket loop, ACC=Accidental

Table 2 Digitwise distribution of finger pattern types in Christian Males

Digitwise	Hand	Pattern types (Henry's classification) %											
		Arches			Loops			True whorls	Composites				
		PA	TA	Total	U	R	Total		TL	LPL	CPL	ACC.	Total
I	R	0.00	0.00	0.00	0.00	43.33	43.33	46.66	1.66	6.66	1.66	0.00	9.98
	L	0.00	0.00	0.00	0.00	40.00	40.00	36.66	8.33	13.33	1.66	0.00	23.32
	R+L	0.00	0.00	0.00	0.00	41.66	41.66	41.66	4.99	9.99	1.66	0.00	16.64
II	R	6.66	1.66	8.32	5.00	35.00	40.00	41.66	1.66	3.33	5.00	0.00	9.99
	L	3.33	3.33	1.66	5.00	45.00	50.00	36.66	5.00	0.00	1.66	0.00	6.66
	R+L	4.83	2.49	4.99	5.00	40.00	45.00	39.16	3.33	1.66	3.33	0.00	11.56
III	R	1.66	1.66	3.32	0.00	63.33	63.33	25.00	1.66	5.00	0.00	0.00	6.66
	L	1.66	0.00	1.66	0.00	66.66	66.66	26.66	1.66	0.00	3.33	0.00	4.99
	R+L	1.66	0.83	2.49	0.00	64.99	64.99	25.83	1.66	2.50	1.66	0.00	5.82
IV	R	0.00	0.00	0.00	0.00	25.00	25.00	65.00	1.66	0.00	8.33	0.00	9.99
	L	0.00	0.00	0.00	0.00	30.00	30.00	60.00	0.00	1.66	8.33	0.00	9.99
	R+L	0.00	0.00	0.00	0.00	27.50	27.50	62.50	0.83	0.83	8.33	0.00	2.49
V	R	0.00	0.00	0.00	0.00	70.00	70.00	28.33	0.00	1.66	0.00	0.00	1.66
	L	0.00	0.00	0.00	0.00	68.33	68.33	18.33	0.00	0.00	13.33	0.00	13.33
	R+L	0.00	0.00	0.00	0.00	62.16	69.16	23.33	0.00	0.83	6.66	0.00	7.49
Total	R	1.66	0.66	2.32	1.00	47.33	48.33	41.33	1.33	3.33	3.00	0.00	7.66
	L	1.00	0.66	1.66	1.00	50.00	51.00	35.66	3.00	3.00	5.66	0.00	11.66
	R+L	1.33	0.66	2.00	1.00	48.66	49.66	38.50	2.16	3.16	4.33	0.00	9.65

Table 3 Digitwise distribution of finger pattern types in Christian Females

Digitswise	hand	Pattern types (Henry's classification) (%)											
		Arches			Loops			True whorls	Composites				
		PA	TA	Total	U	R	Total		TL	LPL	CPL	Acc.	Total
I	R	2.38	0.00	2.38	0.00	54.76	54.76	16.66	9.52	16.66	0.00	0.00	26.18
	L	0.00	2.38	2.38	4.76	57.14	61.90	16.66	7.14	11.90	0.00	0.00	19.04
	R+L	1.19	1.19	2.38	2.38	55.95	58.33	16.66	8.33	14.28	0.00	0.00	22.61
II	R	2.38	2.38	4.76	0.00	47.61	47.61	30.95	4.76	4.76	7.14	0.00	16.66
	L	4.76	11.90	16.66	0.00	33.33	33.33	38.57	4.76	9.52	7.14	0.00	21.42
	R+L	3.57	7.14	10.71	0.00	40.47	40.47	29.76	4.76	7.14	7.14	0.00	19.04
III	R	0.00	0.00	0.00	0.00	83.33	83.33	11.90	2.38	2.38	0.00	0.00	4.76
	L	2.38	2.38	4.76	0.00	73.80	73.80	16.66	2.38	2.38	0.00	0.00	4.76
	R+L	1.19	1.19	2.38	0.00	78.57	78.57	14.28	2.38	2.38	0.00	0.00	4.76
IV	R	0.00	0.00	0.00	0.00	57.14	57.14	40.47	0.00	0.00	2.38	0.00	2.38
	L	0.00	2.38	2.38	0.00	45.23	45.23	38.09	0.00	4.76	9.52	0.00	14.28
	R+L	0.00	1.19	1.19	0.00	51.19	51.19	39.28	0.00	2.38	5.95	0.00	8.33
V	R	0.00	0.00	0.00	0.00	85.71	85.71	9.52	0.00	0.00	4.76	0.00	4.76
	L	0.00	0.00	0.00	0.00	73.80	73.80	4.76	2.38	2.38	16.66	0.00	21.24
	R+L	0.00	0.00	0.00	0.00	79.75	79.75	7.14	1.19	1.19	10.71	0.00	13.09
Total	R	0.95	0.47	1.42	0.00	65.71	65.71	21.90	3.33	4.76	2.85	0.00	10.94
	L	1.42	3.80	5.23	0.95	56.66	57.61	20.95	3.33	6.19	6.66	0.00	16.18
	R+L	1.19	2.14	3.33	0.47	61.19	61.66	21.42	3.33	5.47	4.76	0.00	13.56

R=right, L=left, PA=Plain arch, TA=Tended arch, U=Ulnar loop, R=Radial loop, TL=Twin loop, LPL=Lateral pocket loop, CPL=Central pocket loop, ACC=Accidental, I =Thumb, II= Index finger, III=Middle finger, IV=Ring finger, V=Little finger

Table 4 Digit-wise incidence of whorls, loops and arches in both males and females

Males

Pattern	Right	Left	Right & left
Whorls	IV > I> II> III > V	IV> I> II> V> III	IV> I> II> III> V
Loops	V > III > I> II> IV	V> III> II> I> IV	V> III> I> II> IV
Arches	II> III> I= IV=V	II> III> I= IV= V	II > III > I = IV = V

Females

Pattern	Right	Left	Right & left
Whorls	II > IV > I> III > V	II> IV> I> V> III	II> IV> I> III> V
Loops	V > III > IV> I> II	III> V> I> IV> II	V> III> I> IV> II
Arches	II> I> III> IV=V	II> III> I= IV > V	II > III > IV > I = V

Table 5 A comparison of the dermatoglyphic patterns of Christians with various other Indian populations

Population	Area	Sex	Number	Frequency of dermatoglyphic patterns(%)				Authors
				Loops	Whorls	Arches	Composites Whorls	
Christians	Mysore	M	60	49.66	38.50	2.00	48.16	Present study
		F	42	61.66	21.42	3.33	35.00	
Muslims	Central India	M	240	52.33	28.17	3.50	16.00	[13]
		F	240	48.18	27.83	5.33	18.67	
south Indians	South india	M	250	51.41	41.08	5.68	-	[14]
		F	250	38.16	35.36	4.52	-	
Rajputs	Himachal Pradesh	M	50	49	49	2	-	[16]
		F	50	53.33	46.86	1.81	-	
Rengma Nagas	Nagaland	M	104	46.96	52.19	0.49	-	[17]
		F	103	42.52	55.69	1.79	-	
Danguia Tharu	Uttar Pradesh	M	379	54.69	41.42	3.87	-	[15]
		F	300	55.33	40.5	4.16	-	

Table 6 Incidence of Finger Pattern Indices

Sex	Pattern Intensity Index (PII)	Dankmeijer's Index or Arch-whorl Index	Furuhata's Index Or Whorl-loop Index	Poll's Index or Arch –loop Index
M	14.16	4.15	96.97	4.02
F	12.68	9.51	56.76	5.40
M+F	13.42	6.83	76.86	4.71

Table7 A comparison of the dermatoglyphics pattern indices of Christians with some other Indian populations

Population	Sex	Pattern Intensity Index (PII)	Dankmeijer's Index or arch-whorl Index	Furuhata's Index or Whorl-loop Index	Poll's Index or arch –loop Index	Authors
Christians	M	14.16	4.15	96.97	4.02	Present study
	F	12.68	9.51	56.76	5.40	
	M+F	13.42	6.83	76.86	4.71	
Muslims	M	10.87	12.42	53.83	-	[13]
	F	10.38	19.15	57.77	-	
	M+F	10.63	15.79	55.72	-	
Rajputs	M	14.70	4.08	100	-	[16]
	F	15.00	3.41	118	-	
	M+F	14.85	3.73	109	-	
Rengma Nagas	M	1.54	0.14	-	-	[17]
	F	1.56	3.34	-	-	
	M+F	0.47	1.47	-	-	

Original Research Paper

Eruption Pattern of Permanent Teeth in the Age Group of 5 to 15 Years of Udupi District of Karnataka

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Abstract:

Introduction: Establishment of identity in the living and the dead individual carries tremendous medico-legal significance. Estimation of the age of an individual is an important step in establishing the identity of an individual. Identification may be complete or incomplete. Comparative techniques like anthropometry and prints involving foot, hand, nail, ear, lip, palate and fingers, superimposition technique, dental data and DNA fingerprinting help to identify an individual. **Materials and Methodology:** Materials for the present study consisted of 1,000 students from various schools, in the age group of 5 to 15 years belonging to Udupi district. Examination of the oral cavity was carried out. The tooth was recognized based on the morphological features. The eruption pattern of each tooth was noted in a proforma. The proof of age of the subjects were obtained from the school documents and birth certificates. **Results:** The sequence of eruption pattern of permanent teeth was similar in boys and girls. The mean ages for eruption in boys for first molar were 6.85 years, followed by the central incisor at 8.14 years whereas in girls it was 6.94 years, and 7.86 years, respectively. All the maxillary permanent teeth in both genders erupted first in the left quadrant, followed by the right quadrant, except the second premolar (boys) and second molar (girls), which erupted first in the right quadrant. All the mandibular permanent teeth in both genders erupted first in the left quadrant, followed by the right quadrant.

Key Words: Eruption Pattern; Permanent Teeth; Environmental Variations

Introduction:

Establishment of identity in the living and the dead individual carries tremendous

medico-legal significance. There is an alarming rise in the crime rates globally along with the various amenities to forge documents, which can pose a challenging task to the investigating officers who seek the help of a forensic pathologist to establish an accurate age and thereby identity of an individual. Identification may be complete or incomplete. Complete or total identification means exact specification of an individual. Incomplete or partial identification means recording of certain information which will help to complete the identification of the given individual. The data used for the identification can be categorized into primary characteristics, secondary characteristics and comparative techniques. Age, sex, race and stature may be considered as primary characteristics whereas hair, complexion, color of eyes, deformities, scars, tattoos, occupational stigmata, etc., are categorized as secondary characteristics. The comparative techniques includes anthropometry

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and prints involving foot, hand, nail, ear, lip, palate and fingers, superimposition technique, dental data and DNA fingerprinting that helps to identify an individual.

In this universe, most of the things, natural or artificial can be dated, numbered, quantified or measured. The concept of the age and time had come into the mind of the human being since time immemorial. One can also measure the life span of a person as well as one's age from the moment of conception. Estimation of age can be of crucial value in victim identification process. In cases of an unknown dead body, age estimation becomes necessary if there is no ante mortem data available and a personal profile has to be reconstructed.

In a developing country like India, a large number of people are illiterate and have no knowledge or records of their date of birth which is required by the law enforcing agencies in matters like criminal responsibilities, judicial punishment, consent, rape, criminal abortion, employment, attainment of majority, employment eligibility and kidnapping.¹⁻⁶ Proof of age is also required for the admission to school, joining services and during retirement. Hence scientific determination of age plays a vital role in administrative matters.

Age has a bearing on fixing the criminal responsibility. A person becomes criminally liable for his act from the age of 7 years according to the section 82 IPC,⁷ whereas according to the section 127- 130 of Indian Railways Act,⁸ a child of 5 to 8 years and above is considered criminally responsible for the damage of railway property.

According to section 369 IPC, abduction of a child below the age of 10 years, with intent of taking dishonestly any movable property from its person, constitute an offence of kidnapping. A child under 12 years of age cannot give valid consent to suffer any harm which may occur from an act done in good faith and for its benefit, like the medical examination, according to the section 89 and 90 of IPC. There is no fixed lower age limit at which a person may or may not give evidence in the court of law. A child below 12 years can also be admitted as a

witness, if the presiding officer of the court is satisfied about the credibility.^{7,9}

As per The Child Labour (prohibition and regulation) Act, 1986,¹⁰ a child is a person who has not completed his 14th year of age. As per the Indian Factories Act, 1948 a child below 14 years of age is not allowed to work in any factory.¹¹ Article 24 of Indian Constitution¹² provides that "no child below the age of 14 shall be employed to work in any factory or mine or engage in any hazardous employment. An adolescent between 15 and 18 years can be employed in the factory only if he obtains a certificate of fitness from an authorized medical doctor."¹³⁻¹⁷

According to section 375 IPC, sexual intercourse of a man with women who is even his wife, but under the age of 15 years, and any other woman who is under the age of 18 years, even with her consent constitutes rape.¹⁸

Accuracy of age determination decreases as age advances. The accuracy could be in weeks during fetal life, months to years in children and young adults, whereas, with young adults and advancing age accuracy varies in decades. There are various parameters by which a forensic pathologist can determine the age of an individual with a fair degree of accuracy. The eruption of tooth pattern and skeletal ossification centers have been accepted worldwide by the scientific fraternity as well the judiciary as an accepted norm to determine age. Unlike the examination of bones, examination of teeth can be done without the assistance of any sophisticated tool.

Abundant data exists globally on the eruption pattern of teeth, however the data existing in India cannot be applied across the country. This can be attributed to the fact that India being a vast country with multiple religions, diversity of social customs, cultures, with different dietary habits which have a bearing on pattern of teeth eruption.

Information on tooth eruption pattern in the local populace of this coastal District of Karnataka is not available. A common problem faced by the law enforcing agencies and the forensic pathologist is the scarcity of data, compelling them to bank on the existing data which is not suitable for this population. In view

of this, we have taken up this study to create a database for teeth eruption pattern for the coastal region of Karnataka. We have taken into consideration the eruption pattern of all permanent teeth except the third permanent molar, which fall in the age group of five to fifteen years. The variation in the eruption pattern of third molar is very wide, and hence the scientific fraternity does not rely much on its eruption for the determination of age.

Materials and Methodology:

This prospective study was conducted from Sept 2006 to Sept 2008. Materials for the present study consisted of 1,000 students from various schools, comprising of 500 males and 500 females in the age group of 5 to 15 years belonging to Udupi district. This age group was selected as all the permanent teeth except the third molar would have erupted by this age. The subjects with good oral hygiene with normal intact teeth, with eruption of a permanent tooth in any quadrant and subjects with any part of tooth piercing the gum were selected for the study.

Subjects with abnormal teeth alignment, impacted tooth, overriding teeth, caries teeth and bad oral hygiene and subjects with orthodontic treatment were excluded from the study. Tooth impaction was assumed based on crowding of teeth and the glaring disparity between normal eruption age and absence of teeth in oral cavity.

After selecting the subjects, the aims and objectives of the study were explained to the students and guardians. A written informed consent was obtained from the guardians if the child was less than 12 years of age and from the subjects for those above 12 years in the prescribed form. The examination of oral cavity was carried out with the mouth wide open with appropriate illumination. The tooth was recognized based on the morphological features. The eruption pattern of each tooth was noted in a proforma. The proof of age of the subjects were obtained from the school documents and birth certificates.

The data obtained were quantified and analyzed statistically using SPSS (Statistical Package for the Social Sciences, Version 11.5)

to determine the pattern of teeth eruption amongst boys and girls. This was done through the use of various descriptive statistics (mean, standard deviation, frequencies and measurement of agreement) and group means.

Results:

The study comprised of 1000 subjects in the age group of 5 to 15 years, amongst whom 500 were males and 500 females, as shown in the **Table 1**. The age wise distribution of the subjects is depicted in **Table 2**. The sequence of eruption pattern of permanent teeth was similar in boys and girls, as the first tooth to erupt was the first molar, followed by central incisors, lateral incisors, first premolar, second premolar, canine and the second molars.

The mean ages for eruption in boys for first molar were 6.85 years, followed by the central incisor at 8.14 years. The lateral incisor showed the mean age of eruption at 8.89 years followed by the first and second premolars with the mean age of eruption being 10.79 and 11.12 years respectively. The canine showed the mean age of eruption to be 11.87 years followed by the second molar with the mean age of eruption of 13.67, as depicted in the **Table 3**.

The mean ages for eruption in girls for first molar were 6.94 years, followed by the central incisor at 7.86 years. The lateral incisor showed the mean age of eruption at 9.30 years followed by the first and second premolars with the mean age of eruption being 10.38 and 11.20 years respectively. The canine showed the mean age of eruption to be 12.81 years followed by the second molar with the mean age of eruption of 13.82, as depicted in the **Table 4**.

All the **maxillary** permanent teeth in boys erupted first in the left quadrant followed by the right quadrant, except the second premolar which erupted first in the right quadrant. The mean age in years for eruption of first molar was 7.01 (right) and 7.00 (left) followed by central incisor at 8.25 (right) and 8.24 (left). The lateral incisor showed the mean age of eruption as 8.99 (right) and 8.98 (left) followed by the first and second premolars with mean age of eruption being 10.94 (right), 10.93 (left) and 11.27 (right) and 11.28 (left) respectively. The canine showed a mean age of eruption to be 11.96

(right) and 11.94 (left) years followed by second molar with mean age of eruption as 13.78 (right) and 13.77 (left) years, as depicted in **Table 5**.

All the **mandibular** permanent teeth in boys erupted first in the left quadrant followed by the right quadrant. The mean age in years for eruption of first molar was 6.91 (right) and 6.85 (left) followed by central incisor at 8.21 (right) and 8.14 (left). The lateral incisor showed the mean age of eruption as 8.93 (right) and 8.89 (left) followed by the first and second premolars with mean age of eruption being 10.89 (right), 10.79 (left) and 11.22 (right) and 11.12 (left) respectively. The canine showed the mean age of eruption to be 11.92 (right) and 11.87 (left) followed by second molar with mean age of eruption as 13.74 (right) and 13.67 (left), as depicted in **Table 6**.

All the **maxillary** permanent teeth in girls erupted first in the left quadrant followed by the right quadrant, except the second premolar and second molar which erupted first in the right quadrant. The first premolar had the similar mean value for both the sides. The mean age in years for eruption of first molar was 7.01 (right) and 7.00 (left) followed by central incisor at 7.93 (right) and 7.91 (left). The lateral incisor showed the mean age of eruption as 9.37 (right) and 9.36 (left) years followed by the first and second premolars with mean age of eruption being 10.49 (right), 10.49 (left) and 11.25 (right) and 11.27 (left) respectively. The canine showed the mean age of eruption to be 11.87 (right) and 11.90 (left) followed by second molar with mean age of eruption as 13.89 (right) and 13.89 (left), as depicted in **Table 7**.

All the **mandibular** permanent teeth in girls erupted first in the left quadrant followed by the right quadrant. The mean age in years for eruption of first molar was 7.01 (right) and 6.93 (left) followed by central incisor at 7.92 (right) and 7.85 (left). The lateral incisor showed the mean age of eruption as 9.35 (right) and 9.01 (left) followed by the first and second premolars with mean age of eruption being 10.45 (right), 10.37 (left) years and 11.20 (right) and 11.11 (left) respectively. The canine showed the mean age of eruption to be 11.88 (right) and 11.85 (left) followed by second molar with mean age of

eruption as 13.87 (right) and 13.81 (left), as depicted in **Table 8**.

Discussion:

Identification of a person means determination of individuality. Civil matters like marriage, divorce, inheritance, paternity disputes, business contracts etc. need identification. Criminal cases like assault, murder, sexual offences etc. usually turn baseless in the absence of proper identification.¹⁻⁵

A tooth records and retains its history of development and structural changes associated with its basic functioning during the course of its evolution. For these reasons, normal tooth development has long been the primary basis for age determination of children of unknown age. Perusal of the literature reveals numerous studies of dental aging, including formation and eruption. Garn et al., Lewis and Garn, and Krogman established that tooth formation was less variable than skeletal maturation, making the former potentially more accurate for age estimation.¹⁹⁻²²

In spite of the abundant literature available on the eruption pattern, the specific need of a group of population in a given area has not been addressed, as the variations in the ethnic and different cultural groups can have an impact on the eruption pattern, hence this study is an attempt to address the needs of the local populace.

In this study an attempt has been made to create a database for teeth eruption pattern among the coastal Karnataka population by taking into consideration the eruption pattern of all the permanent teeth in the age group of five to fifteen years except the third molar.

The sequence of eruption pattern of permanent teeth was similar in boys and girls, as the first tooth to erupt was the first molar, followed by central incisors, lateral incisors, first premolar, second premolar, canine and the second molars.

Left mandibular teeth were the first one to appear among all the quadrants in both the genders which was in agreement with other studies done in India and Nepal.^{23,24} The pattern

of eruption of all the teeth in both the genders did not show any specific disparity.

The first molar appeared earliest in boys at a mean age of 6.85 years (± 0.77) and at a mean age of 6.93 years (± 0.75) in girls. This finding was in non-agreement with other studies.²⁵⁻²⁸ The central incisor appeared earliest in girls at a mean age of 7.85 years (± 0.66) and at a mean age of 8.14 years (± 0.79) in boys. This finding was in agreement with other studies.²⁵⁻²⁸ The lateral incisor appeared earlier in boys at a mean age of 8.89 years (± 1.23) and later in girls at a mean age of 9.01 years (± 0.97). The 1st premolar appeared earlier in girls at a mean age of 10.37 years (± 0.53) and later in boys with a mean age of 10.79 years (± 0.75). The 2nd premolar appeared first in girls at a mean age of 11.11 years (± 0.58) whereas the mean age for boys was 11.12 years (± 0.59). The canine appeared first in girls at a mean age of 11.85 years (± 1.17) followed by boys at a mean age of 11.87 years (± 1.18). The second molar appeared first in boys at a mean age of 13.67 years (± 0.99) and later in girls at a mean age of 13.81 years (± 0.72).

We compared our study with that of Shourie, KL, et al;²³ for the eruption pattern of teeth, who studied the eruption pattern amongst the boys and girls of south India and boys of Lahore.

The correlation of the eruption pattern of our study with that of Shourie KL, revealed a delayed eruption of the **left mandibular** teeth for both boys and girls, except for the 1st premolar in boys which erupted earlier among the south Indian boys. The 2nd Premolar among the boys in our study group erupted earlier than the South Indian and Lahore boys. The 1st and 2nd premolars in girls erupted earlier in our study group than the south Indian girls, as depicted in **Table 9**.

There was a delayed eruption of the **right mandibular** teeth for both boys and girls in our study. The lateral incisor in boys in our study group erupted earlier than the Lahore boys. The 2nd premolar in boys erupted earlier than the south Indian and Lahore boys. The 2nd premolar in girls erupted earlier than the south Indian girls, as depicted in **Table 10**.

There was a delayed eruption of **left and right maxillary** teeth for both boys and girls in our study, except for the 1st and 2nd premolars in girls which erupted earlier than the south Indian girls, as depicted in **Tables 11 & 12**.

The delayed eruption pattern for most of the teeth in our study compared to the Lahore boys could be attributed to the nutritional status of the population. There was no significant difference in the pattern of eruption among the south Indian kids and our study group, as the region we live in is also a part of south India. There was a significant difference in the pattern of eruption of our study group when compared to the Lahore boys, who had an early eruption for all the teeth. These variations could be attributed to the dietary habits of the south Indians which is different from that of the North Indian Lahore (Pre-Independent India) kids. The other reason could be the genetic and environmental variations.

Conflict of Interest : None

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Table 1. Total Number of Cases

Gender	Cases
Males	500
Females	500
Total (n)	1000

Table 2. Age Wise Distribution of Subjects

[Age group]	Males	Females
>5 - <8 years	89	89
>8 - <12 years	152	72
>12 - <15 years	259	339
Total (n=500)	500	500

Table 3. Mean Age Eruption of Permanent Teeth for Boys in Years

	Minimum	Maximum	Mean	SD
First molar	5.8	8.8	6.85	0.77
Central incisor	6.3	9.8	8.14	0.79
Lateral incisor	6.8	11.4	8.89	1.23
First premolar	10.0	12.3	10.79	0.75
Second premolar	10.8	12.0	11.12	0.59
Canine	6.8	14.8	11.87	1.18
Second molar	8.5	15.0	13.67	0.99

Table 4. Mean Age Eruption of Permanent Teeth for Girls in Years

	Minimum	Maximum	Mean	SD
First molar	5.8	9.00	6.94	0.76
Central incisor	6.8	9.1	7.86	0.67
Lateral incisor	7.5	11.3	9.30	0.98
First premolar	10.0	10.8	10.38	0.53
Second premolar	10.6	11.8	11.20	0.53
Canine	6.7	14.8	12.81	1.38
Second molar	11.3	15.0	13.82	0.72

Table 5. Mean Age Eruption of Maxillary Permanent Teeth for Boys in Years

Maxilla		
Teeth	Right	Left
First Molar	07.01 (± 0.74)	07.00 (± 0.70)
Central Incisor	08.25 (± 0.77)	08.24 (± 0.77)
Lateral Incisor	08.99 (± 1.21)	08.98 (± 1.20)
First Premolar	10.94 (± 0.80)	10.93 (± 0.79)
Second Premolar	11.27 (± 0.62)	11.28 (± 0.61)
Canine	11.96 (± 1.19)	11.94 (± 1.19)
Second Molar	13.78 (± 0.98)	13.77 (± 0.98)

Table 7. Mean Age Eruption of Maxillary Permanent Teeth for Girls in Years

Maxilla		
Teeth	Right	Left
First molar	07.01 (± 0.74)	07.00 (± 0.74)
Central incisor	07.93 (± 0.67)	07.91 (± 0.67)
Lateral Incisor	09.37 (± 0.98)	09.36 (± 0.98)
First premolar	10.49 (± 0.55)	10.49 (± 0.57)
Second premolar	11.25 (± 0.60)	11.27 (± 0.61)
Canine	11.87 (± 1.17)	11.90 (± 1.18)
Second molar	13.89 (± 0.72)	13.89 (± 0.72)

Table 6. Mean Age Eruption of Mandibular Permanent Teeth for Boys in Years

Mandible		
Teeth	Right	Left
First Molar	06.91 (± 0.76)	06.85 (± 0.77)
Central Incisor	08.21 (± 0.80)	08.14 (± 0.79)
Lateral Incisor	08.93 (± 1.22)	08.89 (± 1.23)
First Premolar	10.89 (± 0.76)	10.79 (± 0.75)
Second Premolar	11.22 (± 0.52)	11.12 (± 0.59)
Canine	11.92 (± 1.19)	11.87 (± 1.18)
Second Molar	13.74 (± 0.99)	13.67 (± 0.99)

Table 8. Mean Age Eruption of Mandibular Permanent Teeth for Girls in Years

Mandible		
Teeth	Right	Left
First molar	07.01 (± 0.73)	06.93 (± 0.75)
Central incisor	07.92 (± 0.67)	07.85 (± 0.66)
Lateral Incisor	09.35 (± 0.98)	09.01 (± 0.97)
First premolar	10.45 (± 0.63)	10.37 (± 0.53)
Second premolar	11.20 (± 0.59)	11.11 (± 0.58)
Canine	11.88 (± 1.17)	11.85 (± 1.17)
Second molar	13.87 (± 0.71)	13.81 (± 0.72)

Table 9: Comparison of Eruption Pattern of Mandibular Teeth in Left Quadrant.

	First Molar	Central Incisor	Lateral Incisor	First Premolar	Second Premolar	Canine	Second Molar
Shourie KL et al. (South Indian Boys)	6.59	7.22	7.94	10.96	11.71	11.66	11.48
Shourie KL et al. (South Indian Girls)	6.71	7.26	7.37	10.67	11.47	10.62	11.90
Shourie KL et al. (Lahore Boys)	5.93	6.78	7.06	10.58	13.92	10.50	11.26
Present Study boys	6.85	8.14	8.89	10.79	11.12	11.87	13.67
Present study girls	6.93	7.85	9.01	10.37	11.11	11.85	13.81

Table 10 : Comparison of Eruption Pattern of Mandibular Permanent Teeth in Right Quadrant.

	First Molar	Central Incisor	Lateral Incisor	First Premolar	Second Premolar	Canine	Second molar
Shourie KL et al. (South Indian Boys)	6.59	7.04	7.77	10.79	11.80	10.77	11.59
Shourie KL et al. (South Indian Girls)	6.91	7.20	7.70	9.46	11.36	10.42	12.26
Shourie KL et al. (Lahore Boys)	5.90	6.80	9.16	10.38	12.44	10.40	11.41
Present Study boys	6.91	8.21	8.93	10.89	11.22	11.92	13.74
Present study girls	7.01	7.92	9.35	10.45	11.20	11.88	13.87

Table 11 : Comparison of Eruption Pattern of Maxillary Permanent Teeth in Left Quadrant.

	First Molar	Central Incisor	Lateral Incisor	First Premolar	Second Premolar	Canine	Second molar
Shourie KL et al. (South Indian Boys)	6.66	7.39	8.29	10.66	10.38	11.00	12.37
Shourie KL et al. (South Indian Girls)	6.91	7.24	7.39	10.60	11.36	10.82	11.96
Shourie KL et al. (Lahore Boys)	6.21	6.87	8.29	10.27	11.11	10.84	11.12
Present Study boys	7.00	8.24	8.98	10.93	11.28	11.94	13.77
Present study girls	7.00	7.91	9.36	10.49	11.27	11.90	13.89

Table 12: Comparison of Eruption Pattern of Mandibular Permanent Teeth in Left Quadrant

	First Molar	Central Incisor	Lateral Incisor	First Premolar	Second Premolar	Canine	Second molar
Shourie KL et al. (South Indian Boys)	6.59	7.28	8.38	10.52	10.66	11.26	12.37
Shourie KL et al. (South Indian Girls)	6.91	7.30	7.62	10.50	11.57	10.92	11.86
Shourie KL et al. (Lahore Boys)	5.90	6.87	8.83	10.60	11.10	11.19	11.95
Present Study boys	7.01	8.25	8.99	10.94	11.27	11.96	13.78
Present study girls	7.01	7.93	9.37	10.49	11.25	11.87	13.89

Original Research Paper

Study of Dermatoglyphics Patterns of Parents of Children With Anorectal Malformations

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Abstract:

Objectives –To study the different dermatoglyphic patterns of parents of babies with anorectal malformation and to compare them with dermatoglyphic patterns of normal population. **Methodology** –A prospective study was done on dermatoglyphic patterns of parents of babies with some type of anorectal malformation who were admitted in department of Surgery of N.S.C.B. Medical College, Jabalpur from October 2001 to August 2002. **Observations and Discussion** – In comparison to the finger prints of normal population, some statistically significant differences were observed in finger print patterns of parents of anorectal malformation patients like Increased frequency of Whorl (W) in right middle finger, of Ulnar loop (UL) in left middle finger and of Radial loop (RL) in left hand of Father, Decreased frequency of Ulnar loop (UL) in left thumb and in left hand, of loop pattern in left thumb of Father and Decreased frequency of Twinned loop (TL) and Composite patterns in right hand of Mother. **Conclusion** - By and large, no major significant difference was observed in case group as compared to the control group or the general population, considering the individual details of fingers and patterns. But still, some significant information can be obtained if such study is conducted in future on a larger number of population.

Key Words: Finger prints, Anorectal malformations, Dermatoglyphics pattern

Introduction:

Dermatoglyphics is the scientific study of the palmer and plantar ridges of the hands and feet. The term was coined in 1926 by Harold Cummins, who is universally acknowledged as the father of dermatoglyphics.¹

A number of congenital problems leave their marks on the hand. Some common examples of such association are the significant increases in palmer single flexion creases

(“Simian line”) and Sydney creases (distal or proximal transverse crease that completely crosses the palm) and mental retardation in a Down syndrome, missing interphalangeal flexion creases in mentally retarded individuals and “sandal” plantar creases on the sole of those with Down syndrome and Rubinstein-Taybi syndrome.² Elevated incidence of Sidney creases has also been observed in children with delayed development, learning difficulties, or minor behavioral problems, leukemia,³ and in environmental congenital rubella and possible cytomegalovirus.⁴

Those using dermatoglyphics in biology and medicine have long been interested in abnormal psychology and congenital defects. Amrita Bagga surveyed and studied the subject of the dermatoglyphic patterns of schizophrenics.⁵ Hirsch could report in 1978 that studies had been performed in relationship to mental retardation, congenital heart defects, diabetes mellitus, several child psychiatric groups, retarded growth, and a number of syndromes⁶. Autosomal trisomies, Trisomy 21

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(Down's syndrome), Trisomy 13 and 18 and trisomy 8 (Mosaicism) have long been the subjected to studies in relationship to dermatoglyphic patterns.⁷

In one study in 1986, the inheritance of dermatoglyphic configurations was studied on the palmar III interdigital pad of the rat (*Rattus norvegicus*), which concluded that the dermal patterns are genetically determined, and also, are influenced by environmental factors, especially in the hybrids.⁸ Also, in a sample of 539 Polish families, 1000 individuals (515 males and 485 females) were analysed to determine the distribution of whorl patterns on specific fingertips, to compare their frequencies in males and females, and to determine whether asymmetry of these dermatoglyphic pattern elements is genetically controlled. In each case, there was positive correlation pairs of relatives, demonstrating a genetic component in whorl determination and their asymmetrical occurrence.⁹ Similarly, in a study in Zagreb on transmission on dermatoglyphic information from parents to children, the link between parents and sons was found stronger than the link between parents and daughters.¹⁰ This association has led the scientists to extend the use of dermatoglyphics a step ahead, in prenatal diagnosis of congenital anomalies. In last few decades, various studies have been conducted on the parents of babies with congenital anomalies like Down's syndrome,¹¹⁻¹⁴ Cleft lip and cleft palate,¹⁵ mucoviscidosis,¹⁶ trisomy 18,¹⁷ thalassemia,¹⁸ phenylketonuria,¹⁹ Prader-villi syndrome,²⁰ Saethre-Chotzen syndrome,²¹ etc.

Classification of Finger prints :

Different workers have suggested their own classification systems of finger prints. But in India and in most of other countries, Henry system of classification is prevalent, in which, finger prints are classified into four main types and nine subtypes.^{22,23} (Table 1& 2)

Objectives:

To study the different dermatoglyphic patterns of parents of babies with anorectal malformation and to compare them with dermatoglyphic patterns of normal population.

Materials and Methodology:

This study was conducted on the parents of babies with anorectal malformations, who were admitted in the pediatric surgical ward of department of Surgery of N.S.C.B. medical College, Jabalpur between October 2001 and August 2002. After taking proper informed consent, prints of all ten fingers of both the parents were recorded. These fingerprints were compared with the fingerprints of those parents who bear children born with no congenital anomaly and were admitted with some acquired disease like malnutrition, anemia etc.

Sufficient permissions and consents were procured and clearance from the Institutional Ethics Committee was obtained in advance. The finger prints of all ten fingers of parents of both the groups were obtained by using standard printing ink. Black ink was spread on inking sheet and one by one, all fingers were rolled on it from nail edge to nail edge. Impressions were taken on paper sheet. The collected prints were analyzed by a finger print expert and observations were subjected to statistical analysis.

Results and Discussion :

Case group included 20 babies with anorectal malformation and for comparison, 21 babies admitted in hospital for some acquired disease (like malnutrition, hepatitis, head injury etc.) were chosen as controls. Particular care was taken while choosing the group that neither these babies nor any of their siblings should have any kind of congenital abnormalities.

In this study, fingerprints of all fingers of both the parents of their babies were analyzed on the basis of nine subtypes of finger print pattern i.e. Plane arch, Tented arch, Radial loop, Ulnar loop, Whorl, Central pocket loop, Lateral pocket loop, Twinned loop and Accidental pattern

The observation were classified and consolidated as :

1. Frequency of these patterns in each finger of each parent.
2. Frequency of these patterns in each hand of each parent.
3. Frequency of Basic patterns (i.e. loop, whorl, arch, composite) in each finger of each parent.

4. Frequency of Basic patterns in each hand of each parent.

Statistical analysis was done by applying “Z” test and a value of ≥ 1.96 was considered as significant.

Although, by and large, no major significant difference was observed in case group as compared to the control group, considering the individual details of fingers and patterns, following few statistically significant observations were noticed –

1. Decreased frequency of ulnar loop (UL) in thumb of left hand of father in case group (3/20) as compared by to control group (15/21). Z value: 4.45.
2. Increased frequency of whorl (W) in middle finger of right hand of father in case group (6/20) as compared to control group (0/21). Z value: 2.93.
3. Increased frequency of ulnar loop (UL) in thumb of left hand of father in case group (16/20) as compared to control group (11/21). Z value: 1.96.
4. Decreased frequency of loop pattern in thumb of left hand of father in case group (5/20) as compared to control group (18/21). Z value: 4.92.
5. Decreased frequency of Ulnar loop (UL) in left hand of father in case group (45/100) as compared to control group (69/105). Z value: 3.05.
6. Increased frequency of Radial loop (RL) in left hand of father in case group (11/100) as compared to control group (3/105). Z value: 2.31.
7. Decreased frequency of Twinned loop (TL) in right hand of mother in case group (2/100) as compared to control group (9/105). Z value: 2.14.
8. Decreased frequency of Composite pattern in right hand of mother in case group (2/100) as compared to control group (10/105). Z value: 2.36.

Conclusion :

In the present study, an attempt has been made to characterize and to search for any significant association of a particular finger print pattern with the parents of babies born with anorectal malformation. Case group included 20 babies with anorectal malformation and for

comparison, 21 babies admitted in hospital for some acquired disease (like malnutrition, hepatitis, head injury etc.) were chosen as controls. Observations were classified and consolidated in various tables and statistical analysis was done by applying Z-test. By and large, no major significant difference was observed in case group as compared to the control group or the general population, considering the individual details of fingers and patterns. But still following few statistically significant observations were noticed-

- Increased frequency of Whorl (W) in right middle finger, of Ulnar loop (UL) in left middle finger and of Radial loop (RL) in left hand of Father.
- Decreased frequency of Ulnar loop (UL) in left thumb and in left hand, of loop pattern in left thumb of Father.
- Decreased frequency of Twinned loop (TL) and Composite patterns in right hand of Mother.

To give some more significant opinion, a larger sample size is required for study.

Conflict of interest: None

Financial Assistance: None

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Table 1 : Types and Subtypes of finger print patterns

Main Types	Sub Types	
1. ARCH Type	1.	Plain Arch
	2.	Tented Arch
2. LOOP Type	3.	Radial loop
	4.	Ulnar loop
3. WHORL Type	5.	Whorl
4. COMPOSITE Type	6.	Central Pocket Loop
	7.	Lateral Pocket Loop
	8.	Twinned loop
	9.	Accidental

Table : 2 Frequencies of different finger print patterns²²

S.	Pattern	%age
1.	LOOP Pattern	65% (Ulnar loop= 60%, Radial loop=5%)
2.	WHORL and COMPOSITE Patterns	25%
3.	ARCH Pattern	10% (Plain Arch = 5%, Tented Arch=5%)

Original Research Paper

Study of Patterns & Profile of Road Traffic Accidents in Saurashtra region of Gujarat

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Abstract:

Background: Road Traffic Accident (RTA) remains one of the commonest Cases for autopsy. Many Prior studies have been done in various parts of India and the current study was undertaken to study the patterns & profile of RTA in Saurashtra region of Gujarat. Materials & Methodology: Of all the cases coming to autopsy of M.P. Shah Medical College, Jamnagar, cases of RTA were taken for the study. Information was filled in predesigned proforma. Results – RTA were more common in persons of age group 21-30 years and male sex was predominantly involved. RTA were more common in pedestrians, followed by occupants of heavy four wheelers, two wheelers and three wheelers. Drivers and occupants of heavy four wheelers were the commonly involved victims. Conclusion: RTA are commonly caused by heavy four wheeler type of vehicles; Chakdo, a three wheeler vehicle used for transportation in this region was a commonly involved vehicle in road traffic accident.

Key Words: Road Traffic Accidents, Medicolegal Autopsy, Pedestrians, Heavy Four Whhellers

Introduction:

The RTA involve three major components : the road system, the human factor and the vehicle element. An increase in gross national product is accompanied by a greater movement of people, goods and greater investment in both vehicles and transport infrastructure. In the developing world, current trends in population growth, industrialization and urbanization are putting heavy pressure on transport network in general and on road system, in particular. Some of the unwanted side effects of this growth in traffic, such as congestion and noise are immediately obvious to the individual citizen.

Others, such as the growing number of deaths from road traffic accidents, are apparent only through aggregated statistics. Scores of workers have highlighted important medical as well as medicolegal aspects of RTA in India and overseas, as well. Available literature on the subject covers various aspects of road traffic accident. Therefore present study was undertaken to study epidemiological aspects, various factors, pattern and other significant features of road traffic accident and to compare with the observations of various authors by scientific discussion.

Aims & Objectives:

1. To study the pattern of road traffic accidents in the Saurashtra Region.
2. To compare incidence, pattern and autopsy findings related parameters with the work of other workers who have studied before, in other regions of India.

Materials & Methodology:

For the present study, 812 autopsy cases conducted at the Department of Forensic Medicine, M.P. Shah Medical College, Jamnagar, from 1-09-2003 to 31-08-2004 were

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included and looked for RTA. Summarily, the present study comprises of 60 cases of RTA of different types.

General particulars of cases were collected from concerned police officer, relatives of the deceased, attendants and in few cases from hospital indoor cases papers. Specific information regarding mode of event, vehicle involved etc. were collected for every road traffic accident. Detailed and complete external examination of bodies were done, including clothes, presence of ornaments, wearing of helmet or not and its condition and other belongings.

The details of cases showing road traffic accident were entered in predesigned proforma. Master chart of cases of road traffic accident was prepared. The significant details were further grouped and tabulated for obtaining observations. A comparison was made between the observations of available literatures and present study.

Results:

1. Age & Sex Wise Distribution (Table no. 1)

In the present study, the maximum number of cases were observed in the age group 21-30 years – 19 cases (31.7%), followed by age group 31-40 years – 13 cases (21.7%). Least incidence was found in the age group of 1-10 years – 5 cases (8.3%) No cases were observed above 70 years of age.

Higher incidence was observed in male – 52 cases (86.7%), as compared to female – 8 cases (13.3%) with the male-female ratio of 6.5: 1. In the age group of 21-40 years 53.3% incidence was observed, out of total cases.

2. Month wise Distribution

Maximum number of cases were observed in the month of April – 9 cases (15%), followed by September – 7 cases (11.7%) and January – 7 cases (11.7%). In the months of March and June 6 cases (10%) observed. In the month of February incidence observed was relatively less with one case (1.66%) of RTA.

3. Seasonal Variation

Maximum number of cases were observed in summer season 18 cases (30%) followed by 15 cases (25%) in monsoon season and 14 cases (23.3%) in spring season.

Relatively less incidence observed in winter season 13 cases (21.7%).

4. Distribution According to The Time of Event

Maximum number of incidence was observed during afternoon time between 12.01 p.m. to 6.00 p.m. – 21 cases (35%) followed closely by morning time of 6.01 a.m. to 12.00 noon 20 cases (33.3%). Relatively less incidence observed at night hours from 12.01 a.m. to 6.00 a.m. – 08 cases (13.3%).

5. Distribution According to The Mode of Accident (Table no. 2)

Maximum cases were of collision between two vehicles in 28 cases (46.7%), followed by pedestrians affected by vehicles in 18 cases (30%) and vehicular turn over or a skidded vehicle in 13 cases (21.7%).

6. Distribution According to The Type of Victim (Table no.3)

Maximum incidence of RTA was in pedestrians involving 18 cases (30%) followed by occupants of heavy four wheelers in 13 cases (21.7%) and occupants or drivers of two wheelers in 12 cases (20%) Minimum incidence is observed in Light four wheelers and bicycles riders 4 cases (6.7%) each.

Discussion:

A total of 60 cases of RTA were observed during the study period, of which maximum victims were pedestrians, 30%, followed by occupants of heavy four wheelers, 21.7%, and the least number of victims, 6.7% were occupants of bicycles and light four wheelers.

1. Comparison of Age Wise Distribution

Observations of majority workers like Kachre, et al,¹ Jha, et al,² Bishwas, et al,³ Pensuriya, et al,⁴ and Salgado, et al⁵ show higher incidence of road traffic accidents in the individuals of age group 21 to 30 years. This can be explained by the fact that at the young age people are more mobile, go out for work and take risks, while elderly people and children usually stay home, hence young are more vulnerable to unnatural events like, road traffic accident. Furthermore, observation of other workers like Kochar, et al,⁶ Gupta, et al,⁷ show higher incidence in almost 40% to 60% of total

cases of individuals having age group 31 to 40 years. In the present study, maximum cases were between 21-40 years age-group. It can be explained since in semi-urban areas of saurashtra region transportation involves overloaded bus and three wheelers like tractors and chakdo in which frequent travels by women with their children is commonly observed.

2. Comparison of Sex wise Distribution

Observations of various workers¹⁻⁵ as regards to sex-wise distribution of cases of road traffic accident are consistent with current study, they show at least 80:20 male:female ratio or more. In all studies conducted in different regions of India, male predominance is a common and constant feature, which suggests that males are more active in various social activities, also many of whom would have been the sole bread winner of family, bringing to light the socioeconomic problems that confronts the dependents of the victims.

3. Comparison According to Time of Accident

There is a clear and significant variation of time interval between urban and rural areas, in which studies conducted in urban area showing higher incidence in the evening and night hours. As the present study covers large rural area, it shows variation with higher incidence in working hours in the afternoon and evening time. Similar observation is made by Kachre, et al¹ & Gupta, et al² in the rural region of Maharashtra state. This can be explained by the fact that maximum activity and overcrowding of people have been observed during day time associated with the type of work involved in agricultural and industrialized area. Whereas, Kochar, et al,⁶ Ghaghale, et al,⁸ & Biswas, et al³ reported higher incidence in Evening Period of 6 PM to 12 Mid-night.

4. Comparison of Month wise Incidence

Observations of month-wise higher and lower incidence of RTA showed some variation according to the regions with geographical distribution. Kachre, et al,¹ in their study described maximum incidence in August and September during which Pravera Karkhana starts working where majority population is of farmers. In the present study, maximum

incidence was noted in the month of April, closely followed by September and January.

5. Comparison In Relation To Seasonal Variation

Observations of seasonal variation by Biswas, et al³ and the present study show similar results where higher incidence was noted in summer and lower incidence in winter, which can be explained by the fact that since summer makes a person tired, irritate and rash, leading to increase in number of accidents. In contrast during winter, people prefer staying indoor and wear more clothing, which gives them some extra protection against fatality. It was also observed that during summer vacation mobility of the people increased due to more fair, melas and festival type of activities in Saurashtra region with highest rate of tour and travels in this part of the year.

Comparison of Profile of Victims

A. Pedestrians:

Table no. 4 shows observations of all workers, having common and constant feature with pedestrians forming maximum incidence out of all type of victims. The table shows comparison of incidence on pedestrian among all workers. Similar observations were observed in the present study with 30% involvement of the total cases. It can be explained by the fact that maximum pedestrians died while crossing the road or walking over road with carelessness on the part of pedestrian as well as on the part of the driver of the vehicle. It has been experienced that pedestrians usually do not use zebra crossing, drivers do not obey traffic rule and people usually avoid taking road safely measures. Because zebra crossings are not well marked and speed breakers with other traffic safety measures usually made without any warning signs over the road.

B. Bicyclist and Two wheeler occupants

Table no. 5 shows observation of different workers in bicycle and two wheeler occupants having considerable variation among regions due to the fact that some regions have higher number of bicycle as a mode of transport described in studies conducted by Kachre,¹ at Pravera region of Maharashtra and Biwas³ in the region of North-East Delhi. All other workers

including present study showed similar range of observation. It can be explained due to the fact that bicycle riders are quite frequently at risk in accident with four wheeler especially truck and bus involving more than half of total fatalities observed by most of the workers.

C. Four Wheelers (Light & Heavy Vehicles)

Kachre, et al,¹ Kochar, et al,⁶ & Biswas, et al³ further categorized occupants as drivers or other vehicle occupants with significant involvement from 13% to 49% out of total victims, which is similar to our study. This may be explained by the fact that since untrained, unqualified and uneducated business oriented drivers overload their poorly maintained vehicles leading to an accident; moreover, in semi-urban area with large population with non-availability of private vehicle, available transportation by four wheelers are overloaded quite frequently causing total outcome. While, higher incidence of four wheelers was seen in the study by Salgado⁵ outside India. In India, though the number of vehicles per population is less, road conditions and other factors are such that accidents occur frequently involving heavy four wheelers.

D. Driver & Occupant

Findings of Kachre¹ and Kochar,⁶ are comparable to the present study, with significant involvement of drivers of four wheelers. In the present study, it was observed that industrial transportation with heavy four wheelers such as oil tankers, loaded truck, state transport and private luxuries were responsible with higher incidence (15%) in drivers of four wheelers. It may be explained due to the fact that rash driving in big space on road with risky turning and overtaking by drivers of heavy four wheelers is frequently observed, causing fatality with immediate death in a road traffic accident.

E. Three Wheelers & Other Vehicles

Kachre,¹ observed that tractors and bullock carts were used for transportation in agricultural area with incidence of 4.7% cases by both, tractors and bullock carts of total cases. In the present study, it was observed that chakdo, a type of three wheeler used as a good carrier or public transport frequently and auto rickshaw for

public transport were found responsible causing higher incidence of 15% of cases, indicating major component of road traffic accidents in saurashtra region.

Conclusions:

Highest incidence was noted in males, age group 21-30 years, maximum victims were pedestrian, children and old age victims had higher incidence, summer noted higher incidence.

Conflict of Interest: None.

Financial Assistance: None

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Table no. 1. Age & Sex Wise Distribution

Age Group	No. of Cases (%)	Male	Female
01-01 Yrs.	05 (8.33%)	02 (3.33%)	03 (5.00%)
11-20 Yrs.	04 (6.66%)	04 (6.66%)	00
21-30 Yrs.	19 (31.66%)	19 (31.66%)	00
31-40 Yrs.	13 (21.66%)	13 (21.66%)	00
41-50 Yrs.	07 (11.66%)	05 (8.33%)	02 (3.33%)
51-60 Yrs.	05 (8.33%)	02 (3.33%)	03 (5.00%)
61-70 Yrs.	07 (11.66%)	07 (11.66%)	00
Total	60 (100%)	52 (86.66%)	13.33%

Table no. 2. Distribution According to The Mode of Accident

Sr. No.	Mode of Accident	No. of Cases	Percentage
01	Vehicle – Pedestrian	18	30.00%
	A. On road	05	8.33%
	B. On lane	03	5.00%
	C. On pavement	03	5.00%
	D. Crossing the road	03	5.00%
	E. Not known	04	6.66%
2.	Vehicle – Vehicle	28	46.66%
	A. Front impact	10	16.66%
	B. Side impact	08	16.66%
	C. Hit from behind	06	10.00%
	D. Not known	04	6.66%
3.	Vehicle – Turn over or skidded	13	21.66%
4.	Collision with tree, pall etc.	01	1.66%
	Total	60	100%

Table no. 3. Distribution According to Type of Victim

Sr. No.	Category of Victim	No. of Cases	Percentage
1	Pedestrian	18	30.00%
2	Heavy four wheeler (Bus/Truck/Tanker)	12	21.66%
3	Two Wheelers	12	20.00%
4	Three wheeler (Tractor/Chakdo/Rickshaw)	09	15.00%
5	Bicycle	04	6.66%
6	Light four wheeler (Car/Van/Matadors)	04	6.66%
	Total	60	100%

Table no. 4. Comparison of Profile of victims - Pedestrians

Study / Author	Incidence of pedestrian out of total victims (percentage)
1 Ghangale	46.6%
2 Kachre	22.9%
3 Salgado	51.4%
4 Gupta	69.23%
5 Biswas	44.7%
6 Present Study	23.33
on road	8.33%
on lane	5%
on pavement	5%
crossing the road	5%

Table no. 5. Comparison of Profile of victims – Cyclists & Two wheelers

Study/Author	Bicycle	Scooter / Motorcycle
1 Ghangale	6.6%	18.8%
2 Kachre	16.3%	11.7%
3 Salgado	24.4%	10.1%
4 Gupta	8.65%	14.42%
5 Kocher	5%	23%
6 Biswas	18.2%	19%
7 Present Study	6.66%	20%

Original Research Paper

Forensic Dentistry- Awareness Among Dental Practitioners in and around Lucknow

¹Amit Kumar Singh, ²Anju Singh, ³Dinesh Kumar Singh, ⁴Prachi Singh

Abstract:

Background: Forensic Dentistry is the application of the knowledge of dental sciences to legal investigation. It can be considered as an area of specialization under Dentistry as well as Forensic Medicine because the knowledge of both the fields is vital for its proper application. Although it appears new to us, it is probably as old as mankind itself as inscribed in the Bible. It is an established specialty in some of the countries but in India, it is still in the seminal stages. **Method:-**A cross-sectional study was conducted in a sample of 150 dental practitioners in and around Lucknow and data was collected by means of a questionnaire. The questionnaire consisted of 10 relevant questions with demographic data. Description statistics were used and findings are presented as number and percentage. **Results-** Our study showed that 20% of the Dentists were aware about the vital information they can get from teeth examination. 90% of the participants were aware of the importance of maintaining dental records. 70% were aware about their duty to inform police on detecting a child abuse case. 30% dental practitioners did not know the role of Forensic Odontology in mass disaster cases. Among the 150 dental practitioners, not one was ever a part of any forensic team. **Conclusion:** - Forensic Odontology is still in seminal stage in India, but, can be a very useful tool, if in depth analysis of trends in teaching forensic odontology is possible. This situation, could be improved by making Forensic Odontology a part of our academic curriculum, provided constantly updated for the benefit of the discipline and the community it serves.

Key Words: Awareness, Forensic Dentistry, Dentists, Mass Disaster

Introduction:

The term "Forensic" is derived from the Latin word forum, which means "court of law".¹ Odontology has proven to be very helpful, especially when fire or putrefaction has destroyed the soft tissue.² Forensic Dentistry was defined by Keiser-Neilson as "the branch of forensic medicine which deals with the proper

handling, examination and presentation of dental evidence in the best interest of justice."³ The term forensic dentistry is also used interchangeably with forensic odontology.⁴

Forensic dentistry is a challenging and fascinating branch of forensic science that involves the application of dental sciences in the identification of deceased individuals through the comparison of ante- and postmortem records.⁵ Recently, forensic odontology has evolved as a new ray of hope in assisting forensic medicine, but, this vital and integral field of forensic medicine is still in a state of infancy in India.⁵

Human dentition is considered as hard tissue analog to the fingerprints. It is almost as unique to an individual as fingerprints.⁴ Each adult human dentition consists of thirty two teeth of which some may be missing or malformed. Effects of various environmental events, like nutrition, drugs, etc. will also be manifested on the teeth. Each race has characteristic

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appearances on the dentition. With such an extensive array of differences, it is extremely rare to have two similar dentitions. The teeth are one of the most durable parts of our body which can withstand more assaults than any other part of the body. This is particularly useful in the identification of bodies in mass disasters and natural calamities.^{1,6}

The current study was designed to evaluate the awareness among dentists in the field of forensic dentistry in and around lucknow city.

Materials and Methodology:

Data was collected from 150 dentists in and around Lucknow over a period of 6 months from July 2016 to December 2016. The participants were given a questionnaire and asked to choose the answer which they found appropriate. Description statistics were used and findings are presented as number and percentage.

Result:

After collecting answers to the questionnaire from the 150 dentists, the data was analyzed and the findings are as follows:

1. What is the terminology given for forensic study of teeth?
 - 141 (94%) of dental clinicians knew the terminology "Forensic Odontology".
2. Teeth examination can provide information on:
 - 117 (78%) answered as person's age
 - 3 (2%) as person's ethnic background
 - 30 (20%) answered as the above all
3. Where did you learn about Forensic odontology?
 - 75 (50%) got the information by listening to UG lectures
 - 45 (30%) by TV serials such as CID ,crime patrol and Savdhaan India
 - 15 (10%) by reading newspapers.
 - 15 (10%) got the information by other sources
4. How confident are you in handling forensic dentistry –related cases?
 - (2%) 3 Very confident
 - (10%) 15 Confident

- (88%)132 did not respond
5. Do you maintain dental records:
 - 135 (90%) are maintaining
 - 15(10%) not maintaining
 6. What steps are to be taken while detecting 'child abuse' signs and symptoms?
 - 105 (70%) have informed to the police.
 - 33 (22%) informed the parents
 - 12 (8%) informed the NGO
 7. Are you aware of any Forensic Odontology courses available in India? If available name them?
 - 63 (42%) were aware
 - 87 (58%) were not aware
 8. As a dentist do you know the role of forensic odontology in mass disaster?
 - 105 (70%) know the role
 - 45 (30%) didn't know
 9. Are you a part of forensic team in your city?
 - (0%) Yes
 - (98%) No
 - (2%) No Response
 10. Do you read forensic dentistry related Journals/publications?
 - (26%) 39 Regularly
 - (24%) 36 Occasionally
 - (50%) 75 No Interest

Discussion:

This study was conducted in and around Lucknow among dental practitioners to assess their awareness about Forensic Odontology. More than 94% dentists were aware about the terminology 'Forensic odontology'.⁷ 20% dentists answered that teeth examination can provide information on a person's age as well as ethnic background, but in a study conducted by Jyothi Prasad, et al, 63% dentists said that they could identify person's age and ethnic background. Of these, 3 (2%) said that they were very confident about handling forensic cases, while 15 (10%) were not confident; 132 (88%) participants did not answer the question because of inadequate formal training in the field of forensic dentistry, inadequate exposure to the subject, minimal importance given to the subject in the undergraduate curriculum and lack of practical exposure to forensic cases.⁸

In our study, 90% dental practitioners said that they maintained dental records. A study done by Nagarajappa, et al, in Kanpur proved that all the dental practitioners maintained dental records and could become valuable members of the dental identification process by developing and maintaining standards of record-keeping, which would be valuable in restoring their patients' identity.⁹ 70% of dentists were aware about their duty to inform police on detecting a child abuse case as a high proportion of abused children suffer injuries to the face and head including the oral and perioral regions.⁴ In our study, 42% dentists were aware about availability of forensic odontology course in India.⁷

In Mass disaster cases, 70% dentists were aware of the key role of forensic dentistry. Dental identifications have always played a key role in natural and man-made disaster situations and in particular mass casualties normally associated with aviation disasters.¹⁰ Our survey revealed that no dental practitioner was a part of the forensic team dealing with medico-legal cases in their respective cities because of lack of practical exposure to forensic cases.⁸ 50% of dentists were not interested in studying forensic odontology related journals because of poor carrier growth and due to lack of fully equipped labs related to forensic odontology.

Conclusion:

This study was conducted in and around Lucknow and reflects the current situation in the field of forensic dentistry. Forensic odontology has evolved and its importance in police investigation is widely acknowledged by the general public and legal authorities. This situation can be improved by improving the curriculum content and constantly updating the same for benefit of the discipline and community it serves or by conducting regular guest lectures, workshops and CME/ CDE .

For an efficient forensic investigation, we need a dental team, comprising personnel from all branches of dentistry, working in close association with experts from other branches of forensic science

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Conflict of Interest: None

Original Research Paper

A Study of Fatality due to burn in Hadoti Region of Rajasthan

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Abstract:

Females and males have broadly similar rates for burns. Burns in female occur mainly at home while cooking and in males, during electric work. Other causes found were stove blast, burns due to fire in house, murder, suicide, clothes catching fire, fire at work place.

Majority of cases were found in the age group of 21-30 years, in both males (24%) and females (21%). Minimum cases were reported in the age group of above 60 years in both males and females (1%).

In the present study, majority of the cases (97%) belonged to Hindu community, rural areas (66%). Among the Hadoti region in Rajasthan, majority were from Kota district (51%). Septicemia 57.1% was the most common cause of death in females, whereas electrocution (33.3%) and septicemia (35.2%) were the most common cause of death in males. It was observed that more severe burn cases were found in females as compared to males. There was a statistically significant negative correlation was found between percentage of burn and days of survival after burn.

Key Words: Burns, Survival, Fire, Death

Introduction:

Burns are a global public health problem, accounting for an estimated 2,65,000 deaths annually.¹ Burns is the fourth most common trauma in the world. Majority of the burn cases occur in low and middle income countries and almost half occur in the South East Asia Region. In India, over 10,00,000 people are moderately or severely burnt every year. Females and males have broadly similar rates for burns according to the most recent data.²

Within all countries however, burn risk correlates with socioeconomic status. Burns occur mainly in the home and workplace. Community surveys shows that 80-90 % of burns in female occurs at home. Women are usually burned in domestic kitchens. Men are most likely to be burned in the workplace due to fire, scalds, chemical and electrical burns.³ Other factors related to burns are occupations that increase exposure to fire, poverty, overcrowding, lack of proper safety measures, placement of young girls in household roles such as cooking and care of small children and underlying medical conditions. including epilepsy, peripheral neuropathy, and physical and cognitive disabilities, alcohol abuse and smoking, easy access to chemicals used for assault (such as in acid violence attacks), use of kerosene (paraffin) as a fuel source for nonelectric domestic appliances, inadequate safety measures for liquefied petroleum gas and electricity.⁴

Hadoti region comprises of Kota, Bundi, Baran and Jhalawar districts. No study related to burn injuries has been done in this region. So the present study was carried out to assess the

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epidemiological factors including causative factors, means, mode and manner, burn surface area and survival period after burn injury and analyze in the light of other similar studies and suggest remedial measures.

Materials and Methodology:

The sample consisted of 100 burn cases mainly from Hadoti region however 6 cases from adjoining districts of Rajasthan and Madhya Pradesh also included in the study. Fatality due to burn since January 1 to December 31, 2015 were studied. Dead bodies were brought by police to mortuary of the M.B.S hospital, Kota for post-mortem examination.

All the 100 cases were thoroughly examined. The external and internal findings of burns on autopsy were noted. The demographical profile & other related information were collected from accompanying persons, relatives, hospital records and police papers.

Results:

A total of 100 burn cases were analyzed. Of these, 51% were males & female male ratio was found to be 1:1.04.

The eldest burn victim was 80 years old and the youngest was 6 years. Majority of the cases were in the age group 21-30 years, in both males (24%) and females (21%). Minimum cases were reported in the age group of above 60 years. (Table 1)

Majority of the cases (97%) belonged to Hindu community and only 3 % were from Muslim community. (Table 3). Majority (66%) of cases were of rural areas. (Figure 1)

As regards the distribution of cases in Hadoti region, it was found that majority (51%) of cases were of Kota district while 24 % cases were from Baran, 17 % from Bundi and 2% from Jhalawar district. Remaining 6 % were belonged to neighboring districts of Rajasthan (i.e chittorgarh, Bhilwara) & Madhya Pradesh. (Table 4)

It was found that most common cause of burns in females was due to cooking food (51%). (Table 5)

The most common cause of burn in males was found due to electric work (31.3%). Other causes found were stove blast (male 5%,

female 5%), burn due to fire in house (male 4%, female 1%), murder (male 2%, female 3%), suicide (male 9%, female 8%), cloths caught fire (male 2%, female 4%), fire at work place (male 3%, female 3%) & 2% of burn injury in males was due to others causes. (Table 5)

Septicemia, 57.1%, was the most common cause of death in females, whereas electrocution (35.2%) and septicemia (33.3%) were the most common cause of death in males. (Table 6)

It was observed that more severe burn cases were found in females, as compared to males. In females, maximum (12%) cases were found in the category of 71-80%, followed by 11% cases in the category of 91-100% and 10% cases of 81- 90% (total 33%) and only % in the category of 0-50%; where as in males, maximum (10%) cases were found in the category of 0-50% followed by 7 % cases each in the categories of 61-70%, 81- 90% & 91-100% (Total 31%). If we study the degree of burns, it is evident that more severe burn (71-100%) was found in females (68%) as compared to males (32%). This can be explained as electric burn was exclusively found in males which does not have significant percentage of burn but having more fatality. (Table 6)

The present study revealed a significant finding that mean survival days after burn was 5.9 days in 0-50% burns, while it was only 2.9 days in case of 91-100% burns (Table 8). There was a statistically significant negative correlation between percentage of burns and days of survival after burns - that means that higher the percentage of burns there were less days of survival.

Discussion:

A total of 100 burn cases were analyzed, of which 51% cases were males & the female male ratio was found 1:1.04. A comparison of our observations with other similar studies revealed male predominance (M-F - 1: 0.88)³, but most of other studies reported female predominance - M-F - 1:1.77,⁵ 0.8:1,² 1:2.01,⁶ 1:3.65,⁷ 1:1.44.⁸

In present study eldest burn case was of 80 years and youngest was of 6 years. Majority of cases were found in the age group of 21-30

years in both males (24%) and females (21%). Minimum cases were reported in the age group of above 60 years in both males and females (1%). **(Table 1)** similar findings were also reported by Chawla, et al⁵ with maximum fatality in the age group of 21-30 years in both male (12%) and female (40%). Likewise Gowri, et al² reported maximum deaths in the age group of 15-44 years in both male (66.4%) and female (72.3%). Ibran, et al³ reported maximum deaths in the age group of 16-30 years. Shruthi, et al⁸ reported that in males maximum deaths (24.1%) occur in the age group of 31-40 years, whereas in female maximum deaths (28.5%) occur in 21-30 years.

2. Religion :-

Majority of the cases (97%) belonged to Hindu community. Similar observations were noted by Shruthi et al⁸ - 83.1 % Hindus, 11.3% & 5.6% Muslims & Christians, respectively. Paul, et al⁹ also reported that majority (66.9 %) of the cases were Hindus community. The reason can that majority of population in these areas belong to Hindu community.

3. Area wise distribution:

Majority (66%) of our cases belonged to rural areas. **(Figure 1)**. Rural predominance was also reported by Gowri, et al² (68.0 %), Bain, et al⁶ (71.3 %) & Paul, et al⁹ (73.9 %). In contrary to our findings, Chawla, et al⁵ reported urban predominance (72%) in their study.

If we look at the distribution of cases in Hadoti region, it is evident that majority (51%) of cases belonged to Kota district, while 24 % cases were from Baran district, 17 % from Bundi district and 2% from Jhalawar district. Remaining 6 % were belonging to neighboring districts of Rajasthan (i.e Chittorgarh & Bhilwara) & Madhya Pradesh. This is the first study conducted in Hadoti region of Rajasthan and no similar study is available for comparison.

4. Causes of Burn:-

The most common cause of burns in females Stove burst while cooking food (51%). This finding is consistent with the studies by others.^{2,5-9}

The most common cause of burn in males was found during electric work (31.3%). Similar observations were noted by Shruthi, et al⁸ who reported maximum number (34.4%) of deaths in male by electrocution at their work place. Ibran, et al³ reported maximum number of burn by fire burn (total 89.3%).

5. Cause of death:

Septicemia 57.1% was the most common cause of death in females, whereas electrocution (18%) and septicemia (17%) were the most common cause of death in males. **(Table 5a)**

6. Percentage of burn:-

In our study it was observed that more severe burn cases were found in females as compared to males. In females, maximum (12%) cases were found in the category of 71-80% followed by the category of 91-100% and only 04% in the category of 0-50; where as in males, maximum (10%) cases were found in the category of 0-50%, followed by 7 % cases each in the categories of 61-70%, 81- 90% & 91-100%.

Chawla, et al,⁵ Shruti, et al,⁸ Paul et al⁹ and Doshi¹⁰ reported that severe burn was more common in female than male. The reason of more severe burn in females because majority of female getting burn while cooking food, during this period most of the time they were alone & in case of burn nobody was there to help them. Bain, et al⁶ reported maximum cases in the category of 51-60% in both male (14.08%) & in female (16.9 %).

7. Survival Period:

The present study revealed a significant finding that mean survival period for burns was 5.93 days in 0-50% burns while it was only 2.94 days in case of 91-100% burn. There was a statistically significant negative correlation was found between percentage of burn and days of survival after burn that means higher the Percentage of burns there were less days of survival.

Nayak, et al⁷ reported that maximum number (33.9%) of deaths occurred during 4-7 days after burns. Bore, et al¹¹ reported that majority of patients survived for 4-7 days and

septicemia was the cause of death. Others¹²⁻¹⁴ also similar findings. Chawla, et al⁵ reported that maximum (40%) burn cases died within 24 hrs.

Conclusions:

Industrialization & use of electricity in agriculture is the main cause of burns in males because proper safety measures are not used & common cause of burns in females is working with the stoves fire extinguishers are not implanted in majority of houses.

A proper survey should be made govt. agencies to check whether proper fire safety rules are followed in every house & industry along with agriculture field. Non govt. organization also play major role in educating the public so cause of death due to fire can be prevented.

The important step in reducing the morbidity & mortality due to burn is through mass education, proper advertisement in electronic & print media. Primary treatment of burn should be included in school curriculum. The 5 E'S formula given by Biswadeep Paul et al⁹ e.g. Education, Engineering and Execution of Efficacious Emergency care should be followed properly.

Conflict of Interest: None

Financial Assistance: None

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Table 1: Age and Sex Wise Distribution of Burns

Age (Years)	Sex		Total
	Male	Female	
	No. (%)	No. (%)	No (%)
≤20	4	7	11
21-30	24	21	45
31-40	12	11	23
41-50	7	6	13
51-60	3	3	6
≥61	1	1	2
Total	51	49	100

Figure 1: Area Wise Incidence and Distribution of Burns

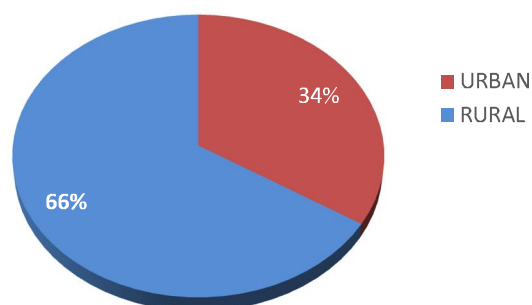


Table 2. Sex wise distribution of Burns cases

Gender	NO	%
MALE	51	51.0
FEMALE	49	49.0
TOTAL	100	100.0

Table 3. Religion wise distribution of Burns cases

Religion	NO.	%
HINDU	97	97.0
MUSLIM	03	03.0
TOTAL	100	100.0

Table 4. District Wise Incidence & Distribution of Burns

District	NO.	%
KOTA	51	51
BARAN	24	24
BUNDI	17	17
JHALAWAR	2	2
OTHERS	6	6
TOTAL	100	100.0

Table 5. Alleged causes of Burns cases

History	Male	Female	%
During making food	8	25	33.0
Stove blast	5	5	10.0
During electric work	16	0	16.0
Burn in hut	4	1	5.0
Murder	2	3	5.0
Suicide	9	8	17.0
Fire in cloths	2	4	6.0
Fire at work place	3	3	6.0
Others	2	0	2.0
Total	51	49	100

Table 5 (a).Cause of death wise distribution of Burn cases.

CAUSE	Sex	
	MALE	FEMALE
	No. (%)	No.(%)
BURN – FIRE ELECTRIC SEPTICAE ELECTROCUTION SHOCK SCALD SHOCK BURN	9 (9)	9 (9)
	3 (3)	0 (0)
	17 (17)(33.3 of male)	28 (28) (57.14%)
	18 (18)(35.2% of male)	1 (1)
	1 (1)	0 (0)
	3 (3)	11 (11)

Table 6. Percentage of burns

Burn Range (%)	Sex	
	MALE (%)	FEMALE (%)
0-50	10 (10)	4 (4)
51-60	6 (6)	8 (8)
61-70	7 (7)	3 (3)
71-80	2 (2)	12 (12)
81-90	7 (7)	10 (10)
91-100	7 (7)	11 (11)

Table 7. Period of survival in Burn cases

Duration days	No.	%
≤ 1	29	29.0
2	8	8.0
3	4	4.0
4	12	12.0
5	12	12.0
6	13	13.0
7	6	6.0
8	5	5.0
9 & More days	11	11
Total	100	100

Table 9: Correlation between Socio-demographical Profile & Period of Survival

Sr. No.	Socio-demographical Profile	Period of Survival (Pearson Correlation)
1.	Age	-.006
2.	Sex	.089
3.	Area	.207*
4.	Burn % Group	-.217*
5.	Cause	-.183

*. Correlation is significant at the 0.05 level (2-tailed).

Table 8. Burn Percentage V/S Mean Days of Survival

Survival Days (1 to 20 Days)					
Burn % Group	Mean	N	Std. Dev	Min	Max
0-50 %	5.93	14	4.875	1	16
51-60 %	4.79	14	2.225	1	8
61-70 %	6.30	10	5.250	1	20
71-80 %	5.79	14	4.791	1	20
81-90 %	5.00	17	3.464	1	13
91-100 %	2.94	18	1.984	1	6
Total	4.97	87	3.877	1	20

Original Research Paper

An Autopsy Based Study on Fatal Road Traffic Accidents in Koppal

¹Vinay Kumar M.S, ²Ajay Kumar. S, ³Raghavendra Babu Y.P

Abstract:

Background: Road Traffic Accidents (RTA) continue to be one of the leading causes of death in developing countries and constitute a bulk of medico-legal autopsy cases conducted in India. **Objective:** To study the demographic profile and pattern of injuries among victims of RTA. **Materials and Methodology:** This analytical, autopsy based study was carried out in the department of Forensic Medicine & Toxicology, Koppal Institute of Medical Sciences, Koppal, from January 2015 to December 2016. The data source included postmortem reports, police inquest reports, history noted in the sheet as given by relatives and friends of the deceased, crime scene photographs, hospital case records and laboratory investigation reports. The data collected was analysed and descriptive statistics such as percentages, ratios and proportion were used. **Observation and Results:** A total of 202 autopsies were conducted during the study period and among them, 82 (40.6%) cases were of RTA. Of these, 64 (78%) were males. Majority of the victims, 31.7%, were in the age group of 21-30 years. Head injury (50%) was the most common cause of death and Subdural haemorrhage (69.5%) was the commonest among the intracranial haemorrhages. **Conclusion:** Road traffic accidents are preventable causes of mortality and there is urgent need to enhance road safety by multi sector approach along with improving trauma care management in hospitals.

Key Words: Road traffic accident, autopsy, injuries.

Introduction:

About 1.25 million people die every year as a result of RTA across the globe and it is expected to become the seventh leading cause of death by the end of 2030, if proper intervention is not made.¹ India accounts for the highest number of road traffic accidents in the world, with over 130,000 people dying every year.

The main contributing factors, as revealed by World Health Organisation are over speeding, drunken driving, low use of helmets, seat belts and child restraints and inefficient law enforcement. Trucks and two wheelers constitute for the majority of the cases. The most common occurrence is during peak afternoon and evening.² The present study was undertaken with an objective to study the demographic profile and pattern of injuries among victims of fatal RTA.

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Materials and Methodology:

This analytical study was carried out in the department of Forensic Medicine & Toxicology, Koppal Institute of Medical Sciences, Koppal. The data collected for study was from January 2015 to December 2016. The data source included postmortem reports, police inquest reports, history noted in sheet as given by relatives and friends of the deceased, crime

scene photographs, hospital case records and laboratory investigation reports. A structured proforma was designed to enter the data which was pretested and validated by subject experts. The proforma consisted three parts, part A, B and C. Part A included date of post mortem examination, age of the deceased, sex of the deceased, marital status. Part B consisted of injuries sustained and Part C cause of death. The data collected was analysed and statistical methods used are descriptive statistics which includes percentages, ratios and proportion.

Observations and Results:

A total of 202 autopsies were conducted during the study period and among them 82 (40.6%) cases were of RTA. Of these, 64 (78%) were males. Majority of the victims, 31.7% were in the age group of 21-30 years, followed by fourth decade (22%). Head injury (50%) was the most common cause of death, followed by multiple injuries (40.24%). Subdural haemorrhage (69.5%) was the commonest type among intracranial haemorrhage, followed by subarachnoid haemorrhage (64.6%). No case of Extradural haemorrhage was seen. Fissured fracture (24.4%) outnumbered other types of skull fractures. Peak incidence of RTA was observed in during the month of April (25.6%), followed by February (11%) and January recorded the least (2.4%).

Discussion:

In the present study, RTA constituted 40% of the total cases of medicolegal autopsy, thereby emerging as the most common variety for which medicolegal autopsies are conducted. This is in contrast with the study conducted by James, et al³ in Fiji where only 7% of the autopsies conducted were due to RTA during the study period.

This study shows male predominance over females, similar to studies conducted by Suresh, et al,⁴ Yogesh G,⁵ and Mariam, et al,⁶ where males outnumbered females. Major portion of the victims were in age group between 21-30 years, which is in accordance with the study done by Yogesh G,⁵ Shruti, et al,⁷ Singh, et al⁸ and Mishra, et al.⁹ This can be explained by the fact that, historically, India is a male

dominated society where men are exposed to outside as compared to women, who spend most of the time inside the house. Third decade is the most vulnerable age group as they encounter more stress, strain and pressure due to personal and professional commitments and more so is the fact that it is in this age group people tend to start driving two and four wheelers, begin to consume alcoholic beverages, tend to take more risks, prefer to go outings as compared to elderly people who tend to take less risks and stay indoors.

In the present study, head injury was the most common type of regional injury encountered and also the most common cause of death, which is similar to the study done by Mariam, et al⁶ and Mishra, et al.⁹ However this study differs from the study made by Yogesh G⁵ where multiple injuries was the most common cause of death and extremities were the most common body region affected. Head injury is a morbid state resulting from gross or subtle structural changes in scalp, skull and /or contents of the skull due to application of mechanical forces.¹⁰ Brain is the most susceptible visceral organ to trauma.¹⁰ In another study by Khajuria, et al,¹¹ limb injuries were the most common, accounting for 31%.

Among the various types of intracranial haemorrhages, subdural haemorrhage was the most common type, followed by subarachnoid haemorrhage. This is in contrast with the study by James, et al,³ where subarachnoid haemorrhage was the most common type, followed by subdural haemorrhage. In the present study, there was zero incidence of extradural haemorrhage, which is in sharp contrast with the study done Khajuria, et al,¹¹ where extradural haemorrhage constituted for 48% of cases.

Among the fractures of the skull, fissured fracture was the most common, followed by comminuted type, which is in contrast with observation made by James, et al,³ where comminuted variety was the most common.

With respect to seasonal variation, April month recorded the highest number of cases and January recorded the least. This may be attributed to summer vacation for schools and

colleges where families plan for outings leading to traffic congestion and mishaps.

Conclusion:

Road traffic accidents are preventable causes of mortality and morbidity. Hence ensuring road safety which includes avoiding over speeding and drunken driving along with usage of helmets and child restraints is the need of the hour. There should be strict law enforcement to check road mishaps.

Conflict of interest: None

Financial Assistance: None

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Table 1: Age vs. Sex distribution of RTA victims

Age in years	Male	Female	Total
Up to10	1	4	5
11-20	5	4	9
21-30	25	1	26
31-40	14	4	18
41-50	9	2	11
51-60	7	2	9
61-70	2	1	3
>70	1	0	1
Total	64	18	82

Table 2: Cause of death in RTA victims

Cause of Death	No (%) [n=82]
Head injury	41 (50)
Multiple injuries	33 (40.2)
Chest injury	3 (3.7)
Abdominal and genito urinary injury	1 (1.2)
Spinal injury	2 (2.4)
Fractures of long bones and complications	1 (1.2)
Neck injury	1 (1.2)

Table 3: Intracranial haemorrhages in RTA victims

Intracranial haemorrhages	No (%) [n=82]
Subdural haemorrhage	57 (69.5)
Subarachnoid haemorrhage	53 (64.6)
Extra dural haemorrhage	0 (0)
Intra cerebral and intra ventricular haemorrhage	3 (4.9)

Table 4: Skull fractures in RTA victims

Skull fractures	No (%) [n=82]
Fissured	20 (24.4)
Comminuted	16 (19.5)
Depressed	11 (13.4)
Sutural	2 (2.4)

Original Research Paper

Estimation of Postmortem Interval in Early Postmortem Period Using Serum Enzymes and its Correlation with Rigor Mortis and Postmortem Lividity

¹Sachin Subhash Giri, ²Chaitanya Vidyadhar Tingne, ³Pradeep Gangadhar Dixit

Abstract:

Determination of reasonably accurate time since death has a bearing on the issues of 'alibi' and 'opportunity'. Post mortem interval is a critical step in most homicide or un-witnessed death investigations and remains one of the most challenging variables to establish. The present prospective study was designed to estimate time since death from postmortem serum enzyme levels and its correlation with rigor mortis and postmortem lividity. The sample group consisted of 127 cadavers from whom venous blood sample was collected at 6 hourly intervals and analyzed for SGOT, SGPT and Acid Phosphatase levels. The serum enzyme levels in individuals dying of different mechanisms were compared and a regression equation was derived to estimate time since death. From the equations derived, it was concluded that serum enzyme values can be a good indicator for determination of postmortem interval than that of routine parameters like rigor mortis and postmortem lividity.

Key Words: Postmortem Interval, SGOT, SGPT, Acid Phosphatase, Rigor Mortis, Postmortem Lividity

Introduction:

Determination of reasonably accurate time since death has a bearing on the issues of 'alibi' and 'opportunity'. Knowing time of death focuses the police investigation on to the correct time frame, can support or refute a suspect's alibi, help in the identification of an unknown victim, improve efficacy of the police investigation and most importantly, is vital in determining time line prior to death, victim's whereabouts, associates seen with victim, etc. Determining time of death is, therefore, vital.¹

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The postmortem interval or time since death is a critical step in most homicide or un-witnessed death investigation and remains one of the most challenging variables to establish.² The exact time since death cannot be fixed by any method, but only an approximate range of time of death can be given, because there is considerable biological variation in individual cases. The longer the post mortem interval, wider is the range of estimate, i.e. less accurate the estimate of interval.³

The attention of the researchers has been drawn towards finding certain biochemical parameters which may narrow the duration that can be opined. Many chemical changes begin to take place in the body immediately or shortly after death and progress in a fairly orderly fashion until the body disintegrates. Each change has its own time factor or rate. These changes occur in various body fluids as blood, spinal fluid and vitreous humor of eye etc. Thus determination of the chemical abnormalities could help forensic pathologists to ascertain time since death more precisely.⁴

With the development of automation in the hospital laboratory, ease of performance and low cost make routine post-mortem examination of blood and body fluids both practical and desirable. A sufficient body of published knowledge has now been accumulated to enable an investigator to interpret post-mortem values for a wide variety of substances. It has been found that some biochemical material remains remarkably stable in the blood after death while others shows varying degrees of change. When change occurs, the alteration follows predictable patterns for certain substances while being totally erratic for others.⁵ Present prospective study was designed to determine correlation between postmortem serum enzyme levels and time since death.

Materials and Methodology:

Study group:

The sample for this study consisted of 127 (83 male and 44 female) cadavers brought for medicolegal autopsy to the department of Forensic Medicine at a major teaching hospital in Central India. The cases included were those who had died in the emergency department or wards of the hospital, so that the exact time of death is known in each case. Cases where the exact time of death is not known were excluded. Along with the basic demographics, details such circumstances, time and place of death were noted. Meticulous postmortem examination of dead bodies was performed. The appearance, site and color of postmortem lividity, the presence and extent of rigor mortis; any external injury, status of clothes, the cause and mechanism of death were noted in the prescribed proforma. The development of rigor mortis and postmortem lividity was assessed and scored numerically from 1 to 6. (Table 1)

Sample collection and analysis:

Blood samples were collected at 6 hourly intervals from one of the peripheral vessels like femoral vein with a wide bore cannula in a sterile glass test tube and was centrifuged at 3000 rpm for 20 minutes to extract serum. Biochemical analysis of the serum was done on a semi-automatic analyzer from TRANSASIA ERBA CHEM-5 plus and the serum

enzyme levels of transaminases (SGOT and SGPT) and acid phosphatase were determined.

Statistical analysis

Pearson correlation coefficient was used to assess the degree of correlation between postmortem interval and study variables (SGOT, SGPT, and acid phosphatase). Spearman's correlation coefficient (ρ) was calculated to assess the degree of correlation between postmortem interval and rigor mortis and postmortem lividity. Serum enzymes values were compared between males and females by performing unpaired t-test. Serum enzymes values in different causes of deaths were compared by performing one way Anova test. Multiple comparisons were done by Bonferrano test. Linear regression analysis was used to obtain equation for calculation of postmortem interval. $P < 0.05$ was considered as statistically significant. Statistical software- Stata version 10.1 was used for statistical analysis.

Observations:

The serum SGOT levels showed a marked increase within 6 hours of death with a steady rise in enzyme levels from 07 to 24 hours. Mean SGOT levels increased from 109.40 IU/L in 0-6 hour intervals to 337.25 IU/L after more than 24 hours (Table 2).

SGPT levels too showed a distinct increase within 6 hours of death with a gradual rise in enzyme levels from 07 to 24 hours. Mean SGPT levels increased from 106.20 IU/L in 0-6 hour intervals to 325.25 IU/L after more than 24 hours (Table 3).

Table 4 depicts levels of acid phosphatase enzyme which increased steadily during first 24 hours. However they tend to fall beyond 24 hours of death. Mean acid phosphatase levels were 21.78 K.A units at more than 24 hour after death.

The serum levels for all the three enzymes were found to be more in males as compared to females but the difference was statistically borderline significant (Table 5).

Mean serum levels for SGOT and SGPT were maximum in those dying of mechanical trauma (204.14 IU/L and 195.76 IU/L respectively) and least in those dying of burns

(132.32 IU/L and 127.57 IU/L respectively) while acid phosphatase levels were maximum in asphyxia deaths (13.84 KA unit and 10.30 KA unit respectively) and minimum in burns (**Table 6**).

When these mean serum enzyme levels were compared among different mechanisms of deaths highly significant difference in values of serum SGOT levels between trauma and burns ($p < 0.001$), trauma and poison (< 0.001), burns and asphyxia deaths and burns and electrocution was observed (**Table 7**).

Similarly highly significant difference was noted in serum SGPT levels between trauma and burns ($p < 0.001$) and burns and pathological deaths (**Table 8**).

As far as the comparison of mean serum acid phosphatase levels among different mechanisms of deaths was concerned, no statistically significant difference was noted with F value 2.04 and $p = 0.0726$.

A significant relation was noticed between scores of hypostasis and postmortem interval with $\chi^2 = 156.78$ and $p < 0.001$ (**Table 9**).

Similarly significant relation was observed between scores of rigor mortis and postmortem interval with $\chi^2 = 124.82$ and $p < 0.001$ (**Table 10**).

A regression equation is calculated (**Table 11**) for determination of postmortem intervals by using studied parameters. R^2 is the estimate of reliability. Adjusted R^2 was calculated by using Stein formula, which is measure for the predictive power of the equation in any other sample if derived from the same population. It was used as a mean to cross validate the resulted equations, using data of the study sample. The higher the value of adjusted R^2 more is the accuracy of the equation. It was observed that equation (2) has higher values of adjusted R^2 than equation (1). The difference in the prediction power between the R^2 and adjusted R^2 of the equation is called percent shrinkage which is a measure for cross validation of the equation. The lower percent shrinkage indicated better cross validation. The percent shrinkage was lower for equation 2.

Mean absolute deviation for the residuals between the actual and estimated

values of postmortem intervals (**Table 12**) was lower for equation 2 (i.e. from enzymes parameters) than equation 1 (rigor mortis and postmortem lividity). Residual value is the difference between actual postmortem interval and their estimated postmortem interval resulted from the application of the obtained equations of the present study.

Discussion:

Determination of postmortem interval is the important question in relation to forensic autopsy. Postmortem lividity and rigor mortis are the two criteria that have been examined the most but are of minor significance regarding reliable limitation of the time of death interval⁶. A total of 127 cases were included in the present study, out of which 83 (65.87%) were males and 44 (35%) were females. In accordance to the previous studies⁷⁻¹⁰ there was a rapid rise of serum SGOT and SGPT levels within first 24 hours followed by gradual rise from 6 – 24 hours. The gradual rise in serum acid phosphatase levels for 24 hours after death followed by a fall coincide with the pre-existing literature.⁸ The fact behind increase of SGOT activities in trauma cases was that SGOT is an enzyme that appears in cytolysis process of any tissue and that the tissue destruction is greater in the trauma than other cases, findings being consistent with the prevailing literature.^{10,11}

At 0-6 hours of postmortem interval (PMI), the mean value of serum SGOT, SGPT and Acid phosphatase were 109.40 IU/L (SD 39.97), 106.30 IU/L (SD 38.52) and 6.71 KA (SD 2.00) respectively. At 7-12 hours of postmortem interval (PMI), the mean value of SGOT, SGPT and Acid phosphatase was 194.83 IU/L (SD 47.05), 188.19 IU/L (SD 11.81) and 11.81 (SD 2.98), respectively. At 13-18 hours of postmortem interval (PMI), the mean value of SGOT, SGPT and Acid phosphatase was 238.18 IU/L (SD 48.88), 225.80 IU/L (SD 43.99) and 20.45 (SD 4.45). At 19-24 hour of postmortem interval (PMI), the mean value of SGOT, SGPT and Acid phosphatase was 271.60 IU/L (SD 48.63), 261.17 IU/L (SD 48.22) and 23.47 (SD 4.05), respectively. After 24 hours of postmortem interval (PMI), the mean value of SGOT, SGPT and Acid phosphatase was 337.25 IU/L (SD

39.96) and 325.5 IU/L (SD 39.27) and 21.78 (SD 3.63, respectively.

At postmortem interval less than 6 hours, postmortem lividity was found to be coalesce in majority of cases while only in 3 cases it was well developed but not fixed. At this period mean values of serum SGOT was 109.40 IU/L, that of SGPT was 106.20 IU/L and that of acid phosphatase was 6.71KA. At 7-12 hours after death the postmortem lividity was well developed, but may be fixed or not fixed. At 7-12 hours of postmortem interval mean value of Serum SGOT was 195.83 IU/L, that of SGPT was 238.18 IU/L and that of acid phosphatase was 20.45 KA. Postmortem lividity was found to be fixed in almost all cases in postmortem intervals more than 13 hours and more. At 13-18 hours of postmortem interval the mean value of SGOT was 238.18 IU/L, that of SGPT was 225.80 IU/L, and that of acid phosphatase was 20.45 KA.

At postmortem interval <6 hours the rigor mortis was partially present in majority of cases, At postmortem intervals 7-12 hours rigor mortis was well developed in most of the cases and only in 3 cases it was partially present. At 7-12 hours of postmortem intervals mean value of Serum SGOT was 195.83 IU/L, that of SGPT was 238.18 IU/L and that of acid phosphatase was 20.45 KA. At postmortem intervals 13-18 hours and 19-24 hours after death, rigor mortis was fixed in all cases. At 13-18 hours of postmortem interval the mean value of SGOT was 238.18 IU/L, that of SGPT was 225.80 IU/L, and that of acid phosphatase was 20.45 KA. Only 2 cases were noted after 24 hours of postmortem intervals which belong to score 5 (i.e. partial resolution.)

Conclusion:

Mean values and rate of rise of serum Enzymes SGOT, SGPT and acid phosphatase is indicator to reflect the time interval in 0-24 hours of death. The regression equation calculated for serum SGOT, SGPT and acid phosphatase for determination of postmortem interval (PMI) was found to be $PMI = 0.024(SGOT) + 0.004(SGPT) + 0.59(\text{Acid phosphatase}) - 3.38$ with $R^2 = 0.8819$ and $p < 0.001$. From the equations derived it was concluded that serum enzymes

values can be a good indicator for determination of postmortem interval than that of routine parameters like rigor mortis and postmortem lividity.

Conflict of interest: None

Financial Assistance: None

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Table 1: Rigor mortis and postmortem lividity scoring

Score	Rigor mortis	Postmortem lividity
1	Absent	Absent
2	Appeared	Mottled
3	Partially present	Coalesce
4	Well marked in whole body	Well developed & not fixed
5	Partial resolution	Well developed & fixed.

Table 2: Serum SGOT levels at different PM intervals

PMI Interval [Hours]	Serum SGOT Range [IU/L]	Mean (IU/L)	(SD)
0-6	51-231	109.40	39.97
7-12	91.8-288	194.83	47.05
13-18	90-412	238.18	48.88
19-24	147-375	271.60	48.63
>24	283-378	337.25	39.96

Table 3: Serum SGPT levels at different PM intervals

PMI Interval [Hours]	Serum SGPT Range [IU/L]	Mean [IU/L]	SD
0-6	53-237	106.20	38.52
7-12	92-269	188.19	46.82
13-18	103.2-303	225.80	43.99
19-24	132-351	261.17	48.22
>24	268-357	325.25	39.27

Table 4: Serum Acid Phosphatase levels at different PM intervals

PMI interval [Hours]	Range [K.A Unit]	Mean [K.A unit]	SD
0-6	4-15	6.71	2.00
7-12	6.3-19.5	11.81	2.98
13-18	10.2-30	20.45	4.45
19-24	10.2-28.5	23.47	4.05
>24	19.3-26.3	21.78	3.63

Table 5: Sex wise Difference in serum enzymes levels

	SGOT (Mean \pm SD)	SGPT (Mean \pm SD)	Acid Phosphates (Mean \pm SD)
Female	159.32 \pm 69.77	155.25 \pm 68.45	11.99 \pm 6.80
Male	186.60 \pm 71.98	178.04 \pm 73.30	13.80 \pm 7.09
	P=0.0031	P=0.0089	P=0.1892

Table 6: Postmortem serum enzymes levels in relation to different mechanisms of death

Mechanism of death	SGOT	SGPT	Acid Phosphates
Mechanical Trauma	204.14	195.76	10.40
Poisoning	197.33	171.20	12.30
Burns	132.32	127.57	10.30
Asphyxial Deaths	173.86	170.05	13.84
Pathological Cause	176.34	170.29	11.71
Electrocution	178.81	163.70	12.77

Table 7: Comparison of Serum SGOT values between Different mechanisms of death

Multiple comparisons of mechanisms of death	Mean difference	p-value
Mechanical Trauma vs Burns	71.81	<0.001
Mechanical Trauma vs Poison	27.62	0.001
Mechanical Trauma vs Asphyxial death	30.26	0.332
Mechanical Trauma & pathological	27.28	0.651
Mechanical Trauma & electrocution	25.32	0.547
Burns vs Poisoning	44.15	1.000
Burns vs Asphyxial death	41.54	0.0210
Burns vs pathological cause	44.02	0.170
Burns vs electrocution	46.49	0.0470
Poison vs Asphyxial	02.60	0.328
Poison vs Pathological cause	0.12	1.000
Poison vs electrocution	02.33	1.000
Asphyxial vs pathological cause	02.47	1.000
Asphyxial vs electrocution	04.95	1.000
Pathological vs electrocution	02.46	1.000

Oneway ANOVA test, F=7.08 p<0.0001, HS

Table 8: Comparison of Serum SGPT values between Different mechanisms of death

Multiple comparisons of mechanisms of death	Mean difference	p-value
Mechanical Trauma vs Burns	69.97	<0.001
Mechanical Trauma vs Poisoning	27.26	0.255
Mechanical Trauma vs Asphyxial death	25.70	1.000
Mechanical Trauma & pathological	25.46	0.635
Mechanical Trauma & electrocution	32.58	1.000
Burns vs Poisoning	42.70	0.016
Burns vs Asphyxial death	44.26	0.065
Burns vs pathological	44.50	0.024
Burns vs electrocution	37.34	0.759
Poisoning vs Asphyxial	01.56	1.000
Poisoning vs Pathological	01.79	1.000
Poisoning vs electrocution	05.31	1.000
Asphyxial vs pathological	0.23	1.000
Asphyxial vs electrocution	06.87	1.000
Pathological vs electrocution	07.11	1.000

Oneway ANOVA test, F=2.04 p=0.0726 NS

Table 9: Relationship between postmortem hypostasis scores and postmortem intervals

PM hypostasis score	Postmortem interval in hours					
	0-6	7-12.	13-18	19-24	>24	Total
1	0	0	0	0	0	0
2	0	0	0	0	0	0
3	11	0	0	0	0	11
4	3	18	0	0	0	21
5	0	13	59	21	2	95
chi2 = 156.78; p<0.001						

Table 10: Relationship between rigor mortis scores and postmortem intervals

Rigor Mortis Score	Postmortem interval in hours					
	0-6	7-12.	13-18	19-24	>24	Total
1	0	0	0	0	0	0
2	0	0	0	0	0	0
3	10	3	0	0	0	13
4	4	28	59	18	0	109
5	0	0	0	3	2	5
chi2=124.82; p<0.001						

Table 11: Regression equations obtained for prediction of postmortem interval (PMI) with their adjusted R² values and percent of shrinkage

Equation number	Equation for estimation of PMI	R2	P value	Adjusted R2	Percent shrinkage
(1)	PMI = -22.46+5.61(PML)+ 2.66(RM)	0.6332	<0.001	0.6332	3.29
(2)	PMI = -3.38+0.024(SGOT) + 0.004(SGPT) + 0.59 (Acid P.)	0.8819	<0.001	0.8815	2.76

Table 12: Mean values and the 95% confidence intervals of the absolute for the residual of the equations

Equation	Mean values of the absolute deviation for the residuals	95% confidence Interval (CI)	
(1)	3.3	2.93	3.66
(2)	1.49	1.24	1.90

Original Research Paper

Analysis of Homicidal Deaths in a Tertiary Care Center of a Non-Metropolitan City of South India: A Retrospective Study

¹Meena Kiran, ²Mahabalesh Shetty, ³Suraj S Shetty, ⁴Varsha Shetty

Abstract:

A retrospective observational study was conducted in the Department of Forensic Medicine and Toxicology, K.S Hegde Medical Academy, Mangalore, between June 2014 to June 2017 with regard to demography, injuries, mortality trends and profiles among the Medico-legal autopsies conducted in homicide related deaths and the findings are presented in this paper.

Key Words: Autopsy, Blunt force, Demography, Homicidal deaths, Sharp force, Weapons

Introduction:

Approaches to prevent unnatural deaths due to interpersonal violence are enduring a radical change. In the contemporary world, interpersonal violence is undoubtedly documented as a global public health problem, which accounts for 9% of global mortality and 12% of all disability adjusted life years.¹ Vehemence is a significant public health problem and homicide is the severest form of vehemence, depriving a human being of his fundamental right to live.² While there is only one way to be born, there are several ways to die.³ Homicide literally means killing of one human being by another human being.⁴ Unlawful killing of human being is murder (S.300 IPC). Culpable homicide cases may amount to murder (S.299 IPC) or not amount to murder (S.304 IPC).⁴

Legally, homicide can be defined as destruction of human life by the act, agencies, procurement or culpable omission of some other person or persons.² To commit murder, mens-rea and actus-rea are the two important elements, which when implemented together, constitute the crime.⁵ The various patterns of homicidal deaths include assault by sharp weapon, blunt weapon, firearm, strangulation, homicidal hanging, smothering, drowning, burns, poisoning etc.⁶ Cases of homicidal death are increasing; this is probably due to rapidly increasing population, urbanization, poverty, unemployment, frustration, illiteracy, prevalent economic, social and political environment, insurgency, terrorism, drug addiction, easy availability of weapon, and the widening gap between the rich and the poor.⁷

Homicide investigation can never be complete without a detailed post-mortem examination. Also, a scientific and detailed analysis of circumstances is important. Hence a retrospective study was undertaken to analyze the trends and profiles of homicidal deaths to understand the relations of murders occurring in and around Mangaluru. The observations thus made, can be highlighted to reveal magnitude of its impact on the society as well as to aid the lawmakers in taking appropriate steps to prevent such unnatural causes of death.

Material And Methodology:

The study material consisted of 567 medico-legal autopsies conducted in the

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department of Forensic medicine and toxicology, K.S Hegde Medical Academy, Mangaluru, Karnataka, during a period of 3 years (from June 2014 to June 2017). Of these, 50 cases were homicidal deaths, which were reviewed retrospectively after obtaining clearance from the Institutional Ethics Committee. Data for the study gathered previously from police, inquest reports, recorded interviews from relatives, friends, and neighbors of the victims was compiled. A detailed proforma for recording history, demographic details, weapons, cause of death and other relevant details was prepared. The information thus collected, was statistical analyzed using necessary digital tools.

Observations and Results:

During the study period, 567 cases were brought for Medico-legal postmortem examination, of which 50 (9%) cases were of homicidal deaths.

Year-wise analysis revealed that the numbers were increasing considerably in an ascending order with highest number of homicidal deaths in the year 2016 (38%) (**Table 1**). Maximum number of victims (26%) belonged to the age group ranging between 31-40 years (**Table 2**). Majority of the victims were found to be males (72%). Overall, the male: female ratio was 5:2 (**Table 3**). A closer look into the motive behind homicidal deaths revealed that most victims succumbed due to various family disputes (24%) (**Table 4**). Considering the type of weapon or force used, maximum number of deaths were found to have been caused by sharp edged weapons (40%) (**Table 5**). Most common cause of death was found to be due to hemorrhagic shock (38%) (**Table 6**).

Discussion:

In our study, the total number of homicidal deaths were 50 and this is similar to the total number of homicidal deaths observed by Shivakumar, et al,⁸ and Parmar, et al⁹ during a similar study duration period. However, it is grossly differing from the observations made by Rastogi, et al, Mohanty, et al, Kalpesh, et al and Jhaveri, et al.^{7,10-11} This could be due to a longer study duration and the places, which were in the northern parts of India. While our study revealed that maximum number of victims belonged to the age group ranging between 31-40 years, it did

not correlate with the observations made by any researchers cited above irrespective of the city in India, whose studies revealed deaths consistently between 21-30 years age group. This could be purely an incidental finding.

On the contrary, our study correlated in male death preponderance with all the above cited researchers. Further, our study also did not correlate with any of the other researchers cited above with regard to motive of homicide researchers observed the main motive as enmity we observed that familial disputes was the main motive. With regard to the type of weapon or force of violence involved, our study revealed sharp edged weapon to be the main offending object which is consistent with the findings made by most authors cited above.⁸⁻¹¹ Hemorrhagic shock was the most common cause of death in our study which is consistent with the findings made by all authors cited above.⁷⁻¹¹

Recommendations/ Suggestions to Lessen the Incidence of Homicides

An effective canon of law, built on legitimate law enforcement, survivor protection, swift and impartial arbitration, reasonable castigation and benevolent prisons are dire to accomplish justifiable declines in lethal violence followed by, following broader deterrent measures like

1. Assuaging illiteracy by education programmes.
2. Uplifting the socio economic life of the poor.
3. Restriction on sale of alcohol and drugs.
4. Providing better job opportunities.
5. Community awareness programmes to eradicate various superstitions and inter-religious disharmony.

Limitations of the Study

Effects of the surroundings, inherent characteristics, psychiatric illnesses of the accused and the deceased can be carried out to point out precisely the predisposing factors which also can play a vital role in preventing the acts of homicide and this aspect has not been considered in the present study.

Conflict of interest: None

Financial Assistance: None

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Table 1: Year-wise Distribution

Years	Number of cases	Percentage (%)
2014	12	24
2015	14	28
2016	19	38
2017	5	10
Total	50	100

Table 2: Age-wise Distribution

Age (Years)	Number of cases	Percentage (%)
< 10	3	6
11-20	1	2
21-30	10	20
31-40	13	26
41-50	6	12
51-60	11	22
> 60	6	12
Total	50	100

Table 3: Sex Wise Distribution

Sex	Number of Cases	Percentage (%)
Male	36	72
Female	14	28
Total	50	100

Table 4: Motives of Homicide

Motive	Number of cases	(%)
Revenge(intended)	8	16
Altercation(unintended)	6	12
Family disputes	12	24
Love or affairissues	3	6
Robbery	8	16
Gang war	2	4
Not known	11	22
Total	50	100

Table 5: Weapons / Force Used

Weapon	Number of cases	(%)
Sharp force only	20	40
Blunt force only	12	24
Sharp force and blunt force	4	8
Firearm	2	4
Ligature strangulation	4	8
Smothering	2	4
Throttling	2	4
Smothering and throttling	1	2
Drowning	3	6
Total	50	100

Table 6: Causes of Death

Cause of Death	Total	(%)
Hemorrhagic Shock	21	42
Cranio cerebral injury	16	32
Mechanical asphyxia	12	24
Fat embolism	1	2
Total	50	100

Original Research Paper

Profile of Alleged Victims of Sexual Assault Cases in Dept. of Forensic Medicine & Toxicology in a Medical College in North Kolkata - Study of Two Year Cases

¹Kallol Roy, ²Baishakhi Koley, ³Sobhan Kr. Das

Abstract:

Sexual assault on women is an evil trend in any society. Rape is 'Not an act of sex, but an act of violence with sex as the primary weapon'.¹

This is a descriptive, observational and retrospective study on the cases of alleged victims of sexual assault reporting for medico-legal examination to Dept. of FMT of our institution. The aim of the study was to correlate the profile of alleged victims with findings of medico-legal examinations of the same. The study was conducted on a total of 100 cases, all of them being registered in the police stations under the medico-legal jurisdiction of our institution. Cases examined here vary from alleged cases of abduction, kidnapping, rape, woman trafficking, sex offence on children etc.

This study reflects the recent rise of cases lodged for sexual assault after expansion in the definition of rape as per the Criminal Law (Amendment) Act 2013.² This study shows that a large number of cases were filed under statutory rape and the cases lodged after consensual physical relation ended, followed by false promise of marriage or simply breach of trust.

Key Words: Sex assault, Victims, Consent, Injuries, Runaway, Elopement

Introduction:

Of all the crimes, sex related crimes are the most barbarous and humiliating. Sexual offenses aptly take the form of sexual violence, which sometimes causes severe and irreparable damage to the physical and mental health of victims. Women and children remain the most vulnerable group to this crime. In present globalized world, especially in third world countries like India, sexual offence has become a daily menace.

From the 'Manorama incident' in North East India³ to the Godhra riots of Gujarat⁴ or brutal gang rape in Delhi⁵ - barbaric, horrific violence is occurring continuously. In 2014, a total of 132939 cases of sexual violence were reported; among them, 36735 are of rape cases only; with an increase of 8% over the incidences of rape cases in 2013.⁶ If we extrapolate globally, different studies show that one in every five women have suffered an attempted or completed rape by an intimate or acquainted partner.⁷ Thus, sexual offences are global problem, not a mere geographical issue.

WHO defines sexual violence⁷ as "Any sexual act, attempt to obtain a sexual act, unwanted sexual comments/ advances and act to traffic or otherwise directed against a person's sexuality, using coercion, threats of harm or physical force by any person regardless of relationship to the victim on any setting including but not limited to home and work."

Medical persons have no authority over the explanation or interpretation of the law, but as a registered medical practitioner, they have

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the moral and legal duty to the country to help in the administration of justice by providing medical evidences and scientific interpretation of medical findings.⁸ Thus, an early and detailed medical examination is of vital importance for the purpose of investigation and to prevent the loss of important trace evidence, as poor medical evidence is often responsible for low conviction rate and as it is rare for cases of rape to be tried without medical evidences. Judges naturally dislike to convict persons of this serious crime unless statement of the prosecutrix is supported by medical facts and opinion. And in practice, the law demands some type of corroboration of the girl's story before a case is allowed go a full length before a court.⁹

In the present paper, the incidents and patterns of sexual offence along with demographic variables, findings of physical and genital examinations of alleged sexual assault victims had been analysed.

Materials & Methodology:

A detailed descriptive, observational and retrospective study was carried out from the records of alleged sexual assault victims who had been brought for medico-legal examinations in the Dept. of FMT of our institution. The area covered was the jurisdiction of our department. This also included the cases referred to us from different districts of West Bengal.

The study was conducted on all the cases that came to our Dept. from Jan'15 to Dec'16 for medical examination. Details regarding the cases were obtained from the police records and history taken from the victims and their relatives. Standard examination procedure was followed during examination of the cases. Total one hundred cases which fulfilled the above criteria were studied, entered in a proforma prepared for the purpose, critically analysed and discussed.

Observations:

The total number of cases examined in the study period was 100. All of them were females. Most of the subjects were Hindu (69%), the rest being Muslim. (**Table 1**) Most of the subjects were above 18 years age (31%), however below 12 years subjects accounted for 10% of the cases.

In most cases, boyfriends were the main accused, 58%, followed by neighbours, 12% and strangers, 8%. There were no alleged accused in 13% of cases. (**Figure 1**) Most cases were primarily registered under IPC S.376 (46%), along with other sections. (**Table 2**) 27 cases were reported by alleged victims. (**Table 3**) This was followed by primary charges under IPC S.366/366A (34%), where 30 cases were reported by parents of alleged victims.

Of all the reported cases, only 53 subjects gave consent for Medico-legal examination (**Table 1**), of which 38 were Hindu. We encountered a case where a 10 years old alleged victim consented for medical examination but her mother denied.

22 cases were brought within 96 hrs of the alleged incident, while a total of 36 cases were brought within 7 days. We encountered some subjects after 6 months of last incident where cases were lodged following breach of trust.

Of the 53 subjects who consented for medical examination, we could not elicit any recent corroborative injuries in 6 subjects (**Table 4**), most of them were below 12 yrs of age. We found old healed hymen injuries in 43 cases, most of them aged above 18 years. However this types of old injuries are not uncommon in minors. We found only 4 cases where recent corroborative injuries could be elicited, (**Table 5**) 3 of them being genital injuries and another one being extra-genital.

Discussion:

Sexual assault is probably the most under-reported crime. Only 10-50% of sexual assault victims lodge formal complaint¹⁰. Though under-reported, it comprised 4.4% of total crime in India in the year 2015.¹¹ Sexual assault not only physically affects the victims, but also destroys them mentally and socially. In most cases, victims do not lodge complaints to prevent social, psychological and legal harassment.

In our study, majority of alleged victims were Hindu. In a Hindu dominant population, it is quite obvious. In previous studies, Bhowmik, et al¹² and Tamuli, et al¹³ observed the same, 67% and 73%, respectively. Again, the most common age group was above 18 yrs (31%), closely

followed by 14-15 yrs and 16-17 yrs age group, 27% each. Bhowmik, et al¹² observed that 21-30 yrs age group was the most vulnerable to sexual assault, 40%. Sarkar, et al¹⁴ found it to be 11-20 yrs, 69%, while RoyChowdhury, et al¹⁵ observed that the most vulnerable age group was 16 to 20 yrs, 37.5%. This shows that no age group is safe from being sexually assaulted.

Though in their study, Bhowmik, et al¹² found that S. 366A IPC is the commonest registered case, 37%, followed by S. 376, 27%, we found S. 376 IPC to be used more commonly, 46%, than S. 366/ 366A (**Table 2**). To know the cause of this contradiction, we tried to dig out the circumstances. We found that most cases with S. 376 were registered by the alleged victims themselves, 27 out of 46, where most cases with S. 366/ 366A were lodged by the parents of the alleged victims. (**Table 3**) After carefully analysing the history, we concluded that in most of the S. 366/ 366A cases and few of S. 376, parents lodged the complaint after the alleged victim eloped with her boyfriend. On the other hand, allegation of rape was made upon breach of trust after a successful consensual intercourse. A long time consensual sexual relation ends somehow and the female partner lodges rape allegation against her ex-boyfriend suing him for attaining consent for sexual intercourse with false promises.

Naturally, we found old healed hymen tear without any sign of violence in those cases that suggests previous consensual sexual activities (**Table 6**). These contributed significant numbers in the sexual assault cases. Sukul, et al¹⁶ observed that in rape allegations, most cases are actually cases of elopement. Sometimes, being upset over their parents, alleged victims ran away from their residence and took shelter in their relative's house. Unable to find them, the parents report a case of missing, which eventually ends up with sexual assault cases brought for medical examination.

Contrary to our social stigma, we had found that the accused person was well known to the victims. (**Figure 1**) 58% of the accusations were against the boyfriends, followed by neighbours 12%. Only 8% of cases were registered where accused persons were not

known to victims. Bhowmik, et al¹² and Sarkar, et al¹⁴ support this fact.

No sexual assault victim can be examined without her consent. In case the girl is below 12 years or is mentally retarded, consent of parents or legal guardian is required. However, no girl should be examined against her will.⁸ We found totally different statistics regarding consent for medical examination. Though Bhowmik, et al¹² and Bandyopadhyay, et al¹⁷ observed that most of the sexual assault victims gave consent for medical examination, we found that 47% of the alleged victims declined to be examined. (**Table 1**) This finding supports the comment "most sexual assault cases are actually case of elopement", so alleged victims never want to go for medical examination, trying to save their beloved one. On the other hand, we had encountered a case, where a minor victim, aged 10 years, was ready for her medical examination but her mother did not give consent. So we could not proceed with examination. Here we found the limitation of guardianship, where social stigma or some hidden benefit alters the path of justice for victims.

On fresh rupture, the hymen bleeds or a blood clot is found to be attached at margins. It becomes inflamed and swollen till 4-6 days following trauma and generally heals by 7-10 days.⁸ In present study, 36% cases were examined within 7 days. Sarkar, et al¹⁴ came across 25% cases in first 5-7 days, whereas Tamuli, et al¹³ examined 23% of cases within 3 days, almost corroborating to present study. We also had to examine few alleged victims after 6 months of last incident, following breach of trust.

RoyChowdhury, et al¹⁵ found 72% cases of recent genital injury, and only 10% alleged victims had old genital injuries. Bandyopadhyay, et al¹⁷ observed 33% cases having recent genital injuries. In contrary to that, we found 43 victims having old healed genital injuries, along with no injuries in 6 cases. (**Table 4**) This is in consonance with the studies of Bhowmik, et al¹² and Tamuli, et al¹³. Most old genital injuries were found in alleged victims aged more than 18 years. So, while examining a young girl, it must be borne in mind that as puberty develops, some girls exhibit precocity of sex interest and

that it is by no means uncommon for illicit sexual intercourse to take place with the girl's full concurrence in the very early teens.⁹

We also come across four cases with recent injuries that corroborated with the history given. (**Table 5**) All the cases came within 3 days of the incidence. Three of them were with genital injuries and the rest, with extra-genital injuries. We found fresh scratch abrasions over vaginal wall in a 4.5 years old victim with history of fingering in private parts with the case registered under S. 354, POCSO Act, 4. In another incident, with history of being stupefied and kidnapped and then gang raped, we found fresh hymenal tears with fresh abrasions near anal orifice. On the other hand, we found old healed hymen tears with recent abrasions and bruises over chest, shoulders and neck region. There was history of frequent sexual intercourse with false promise of marriage and lastly sexual assault when confronted against cheating; the case was registered under S. 417, 376. All these findings suggest a strong agreement with dynamics of forceful sexual acts.⁸

Conclusion:

Sexual assaults reflect the dark side of our society. We come across a number of cases with this allegation, on regular intervals. Surprisingly, a large number of victims declared having love affairs with the accused person and then eloped with them to get married and subsequently avoided medico-legal examination. The cases were lodged by their parents against the accused persons. This type of false allegations not only defame the accused but also cause harassment and criminal charges, as well as a huge burden on the legal and judicial systems.

Sometimes, false allegations were made against an accused person for bad intension or a motive, just to defame or falsely prosecute him. Innocent children become instruments of this act. Even a consensual sexual intercourse is termed as rape, either after breach of trust or even from criminal motive. There must be some strict laws to punish such persons registering a falsified cases against an innocent person.

There are the cases where teenage girls run away from home out of frustration or being upset over their parents. Out of anticipation,

parents lodge missing as well as kidnapping cases. There are no obvious suspects, these cases are registered against anonymous. Upon recovery, girls are brought for medico-legal examinations to rule out any mishap.

It is not that all the cases are falsified, there is a large number of true sex assault cases also. But those are really under reported. Even if reported, delaying in medical examination results in loss of vital medico-legal evidences. These two causes are mainly responsible for low conviction rate in a true sexual assault cases. So, we must take some initiative and promote sex education from lower tire of schools and programmes to educate vulnerable populations about the crime of sex assault, necessity of earlier reporting as well as earliest medico-legal examination.

Conflict of interest: None

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Table 1: Relation between Age, Religion and consent for ML examination of alleged victims

Age of Victims	Consent given (by self or guardian, where applicable)			Consent not given (by self or guardian, where applicable)		
	Hindu	Muslim	Others	Hindu	Muslim	Others
Less than 12 yrs	6	0	0	2	2	0
12 yrs – 13 yrs	1	0	0	1	3	0
14 yrs – 15 yrs	9	5	0	9	4	0
16 yrs – 17 yrs	4	1	0	18	4	0
18 yrs& above	18	9	0	1	3	0

Table 2: Relation between Age of alleged victims with respective IPCs

Case booked Under IPCs Age of Victims	IPC 376 or allied with/without other IPCs	IPC 366/366A with/without other IPCs (except 376)	IPC 363 with/without other IPCs (except 376, 366/366A)	Other IPCs (except previous ones)
< 12 yrs	5	0	1	4
12 yrs – 13 yrs	2	3	0	0
14 yrs – 15 yrs	7	14	6	0
16 yrs – 17 yrs	4	15	7	1
18 yrs and above	28	2	1	0

Table 3: Relation between IPCs and relation of alleging person with alleged victims

Case booked Under IPCs Case registered by	IPC 376 or allied with/without other IPCs	IPC 366/366A with/without other IPCs (except 376)	IPC 363 with/without other IPCs (except 376, 366/366A)	Other IPCs (except previous ones)
Self	27	2	0	1
Parents	17	30	15	3
Others	2	2	0	1

Table 4: Relation between Age of alleged victims and Injuries present

Injuries found Age of victims	No Injuries	Genital Injuries		Extra-genital Injuries
		Old	Recent	
Less than 12 yrs	5	0	1	0
12-13 yrs	0	1	0	0
14-15 yrs	1	12	1	0
16-17 yrs	0	5	0	0
18 yrs and above	0	25	1	1

Table 5: Details of cases with fresh injuries with corroborating history

SI no	Age of victim	Registered under IPCs	Accused	Case registered by	Delay between incident and ML examination	Findings
1	4.5	354, POCSO 4	Neighbour	Mother	1	Fresh nail scratch abrasions over vaginal wall
2	14	376, POCSO 4	Step father	Mother	2	Recent evidence of Hymen tear: redness, mild inflammation with tenderness
3	19	328, 365, 376D	Strangers	Self	1	Recent hymen tear: Red, inflamed, tender. 2 abrasions found near anal orifice
4	28	376, 417	Boyfriend	Self	1	Old healed hymen tear with recent abrasions and bruises over chest, shoulders and neck region

Table 6: Relation between IPCs applied with Injuries found during ML examination

Case booked Under IPCs Types of Injuries		IPC 376 or allied with/without other IPCs	IPC 366/366A with/without other IPCs (except 376)	IPC 363 with/without other IPCs (except 376, 366/366A)	Other IPCs (except previous ones)
No Injuries		3	1	0	2
Genital Injuries	Old	31	11	1	0
	Recent	2	0	0	1
Extra-genital Injuries		1	0	0	0

Figure 1: Relation of accused person with alleged victims

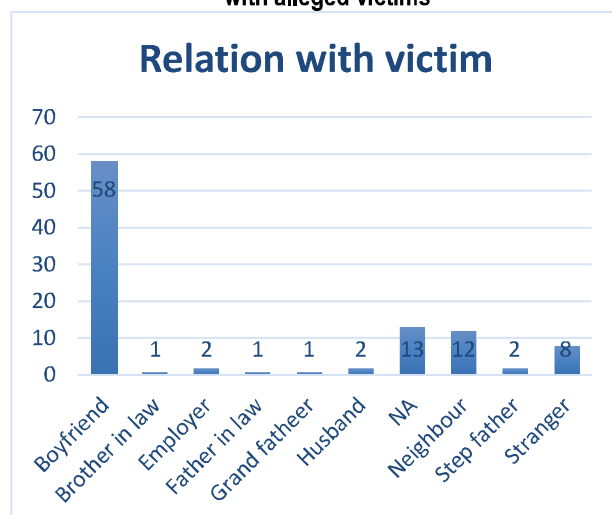
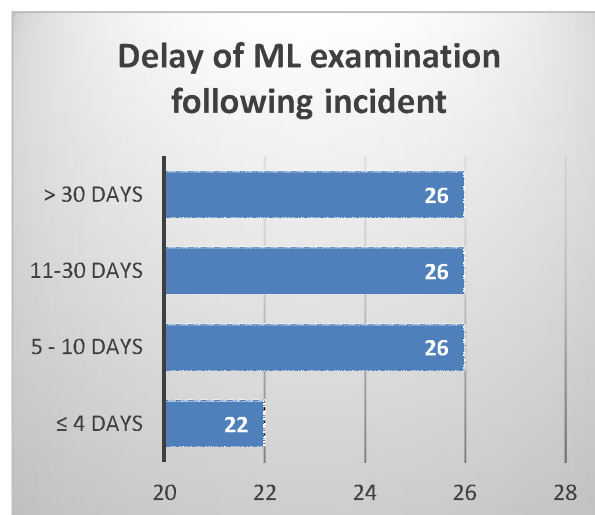


Figure 2: Delay of ML examination following incident



Original Research Paper

Determination of Sex From Fingerprint Ridge Density in North Indian Population

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Abstract:

Fingerprints found at the crime scene are 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 sex of an individual. Fingerprints of randomly selected 213 (109 male and 104 female) medical students from Maulana Azad Medical College, New Delhi, were studied. Fingerprint ridge densities were calculated for all the cases and statistically analyzed for sex determination. It was found that there is a statistically significant difference in the fingerprint ridge density between male and female; with females having greater fingerprint ridge density.

Key Words: Fingerprints, Fingerprint ridge density, Sex determination

Introduction:

The skin of palms, fingers, sole of the feet and toes is different from that of the other parts of the body. The skin of these areas contain numerous ridges (lines) arranged in various patterns.

A fingerprint is an impression of the friction ridges of all or any 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 ridges of the skin. Fingerprints may be deposited due to natural secretions from the eccrine glands present in friction ridge skin or they may be made by ink or other contaminant transferred from the peaks of friction skin ridges to a relatively smooth surface.¹

They are constant, individualistic and form the most reliable criteria for identification as they are genotypically determined and remain unchanged from birth till death.² Even in cases of monozygotic identical twins, fingerprints remain individualistic despite similar genetic identity where DNA analysis fails.

History of Fingerprints:

Fingerprints and handprint patterns have been used as means of personal identification since prehistoric period. Earthenware estimated to be 6000 years old was discovered at an archaeological site in northwest China and found to bear clearly discernible friction ridge impressions. These prints are considered the oldest friction ridge skin impressions found to date. The earliest example comes from a Chinese document entitled "The Volume of Crime Scene Investigation—Burglary", from the Qin Dynasty (221 to 206 B.C.). The document contains a description of how handprints were used as a type of evidence.³

Friction ridge skin impressions were used as proof of a person's identity in Japan as early as 702 AD and in the United States since 1902. In India, there are references to the nobility using friction ridge skin as signatures since 1637 AD. It is believed that the use of prints on important documents was adopted

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from the Chinese, where it was used generally, but in India it was mainly reserved for royalty.⁴

In 1684, Dr. Nehemiah Grew, a European scientist, described the friction ridge skin for the first time, followed by Govard Bidloo, a Dutch anatomist in 1685, who described the details of skin and papillary ridges of thumb but failed to address the individualization or permanence. In 1687, the Italian physiologist Marcello Malpighi discussed the function, form and structure of friction ridge skin.⁵

In 1788, J.C.A Mayer, a German doctor and anatomist, was the first to recognize that friction ridge skin is unique. Dr. Johannes E. Purkinje, Professor at the University of Breslau in Germany in 1823, classified fingerprint patterns into nine categories, which led foundation for the Henry classification system.⁶

German anthropologist, Hermann Welcker (1822–1898), was the first person to study friction ridge skin permanence. However, the credit for being the first person to study the persistence of friction ridge skin goes to Sir William James Herschel who published prints of himself taken in 1859, 1877, and 1916 to demonstrate this permanence. In 1877, he was able to institute the recording of friction ridge skin as a method of individualization on a widespread basis.⁶

Henry Faulds, in 1880, was the first person to publish in a journal, the value of friction ridge skin for individualization, especially its use as evidence. Sir Francis Galton, in 1892, was the one to define and name specific print minutiae known as Galton details, consisting of a uniting or dividing ridge (bifurcation), the end or beginning of a ridge (ending ridges), a short island (short ridge) and an enclosure (two bifurcations facing each other).⁶

In 1894, Sir Edward Richard Henry, collaborated with Galton on a method of classification for fingerprints. With the help of Indian police officers Khan Bahadur Azizul Haque and Rai Bahaden Hem Chandra Bose, the Henry classification system was developed and in 1897, the government of India sanctioned the sole use of fingerprints as a means of identification for prisoners. This system of fingerprint study is still in effect in most of the

countries of the world and is popularly known as Henry-Galton system.⁶

AFIS (Automated Fingerprint Identification System)

It is an automated identification system which, through the use of computer technology and specially coded digital images, search and compare the fingerprints. In 1977, the Royal Canadian Mounted Police began the first operational AFIS system. The Indian version of AFIS is called FACTS, which was co-developed, by NCRB and CMC Ltd, India in 1992. The current version of FACTS is 5.0. The system uses Image Processing and Pattern Recognition technique to capture, encode, store and match fingerprints, including comparison of chance prints. It uses pattern class, core and delta information, minutiae location, direction, neighbouring information, ridge counts and distances, density, type, print background/foreground information etc. for matching Fingerprints. Apart from the above details, FACTS also stores non fingerprint information or demographic details like gender, region and conviction details.⁷

Identification of the subject is one of the important aspects of forensic investigation. Fingerprints are being used for civil as well as criminal cases because of their unique pattern leading on to absolute identity. Study of fingerprint is a simple method when compared with other methods of identification such as DNA analysis because it requires biological samples and DNA analysis is expensive, time consuming and limited resources for its testing.

Fingerprints are commonly used in the identification of criminals, whose fingerprints are found at the scene of crime; identification of unknown deceased, missing persons; persons who are suffering from amnesia; establishing correct identity in cases of kidnapping and in detection of bank forgeries. They are also useful in mass disasters where in identification of the dead is of primary importance. They also help in prevention of either accidental or purposeful exchange of newborn infants in hospitals.

In recent times, fingerprint is being used as source of person identification by UID Aadhaar. UID Aadhaar is one of the prestigious

projects of India where Biometric Card with Unique Identification Number will be issued to every citizen after receiving biometric data consisting of his fingerprints and retinal scan. These biometric details are locked by default and nobody even the service provider cannot gain access to the information to match the fingerprint, unless the person gives explicit permission for the same. However, if a person uses this biometric data for verification, for example, as a proof of identity to get a SIM card, then he can use his fingerprint to allow the telecom company to verify his identity.

With increasing crime rate, fingerprint is increasingly becoming an indispensable tool in the hands of investigating officers to apprehend the culprits. Without the knowledge of criminals, fingerprints are left behind at the scene of crime which though may not be clearly visible (latent prints) which can be subsequently developed and studied successfully. If the prints can be used to determine sex by studying fingerprint ridge density, it may be further helpful to the investigating officer to narrow down the suspects.

Materials and Methodology:

Fingerprints were taken from randomly selected 213 (109 male and 104 female) medical students from Maulana Azad Medical College, New Delhi, during the period November 2016 to April 2017. Subjects with history of skin lesions which are known to affect finger prints like Celiac disease, Dermatitis, Eczema, Acanthosis Nigricans, Scleroderma, Dry or Atrophic skin, Rickets, Acromegaly and Leprosy were excluded from the study.

Procedure:

After getting informed expressed consent, the subjects were asked to wash and dry their hands to remove dirt and grease. A glass plate of size 12 inches X 12 inches was cleaned and uniformly smeared with a thin layer of black printer ink using a roller. Subjects were asked to apply their finger on the smear plate and then transfer on the predesigned proforma. In this way, for each and every individual, the entire prints of ten fingers were prepared. Only

plain prints were taken (no roll prints) as shown in **Image 1 & 2**.

After taking fingerprints, the upper portion of radial border of each print was chosen as an area for data collection because all fingerprint pattern types show a similar ridge flow in this region and cores of loops & whorls pattern are away from this region. In this selected areas of prints, epidermal ridges were counted carefully using a magnifying lens within a square of 5 mm X 5 mm drawn on a transparent film as shown in **Image 3**. Counting was started from one corner of the square to the diagonally opposite corner. While counting, dots were excluded and handle of the fork & lakes were counted as two ridges. The counted value represented the number of ridges per 25 mm² of area and thus reflects the fingerprint ridge density value.

Values were obtained for all 10 fingers and their mean was calculated. This mean represented a single data point for that particular individual. The data was assumed to be normally distributed and was analyzed using SPSS Software.

Results:

The study sample consisted of 109 Males and 104 Females with age ranging from 18 to 28 years.

Table No. 1 shows that females have high ridge density as compared to males. It is clear from the table that males with ridge count ≤ 14 ridges/25 mm² constituted 94.5% of the total males whereas females constituted only 34.6% of total females. Males with ridge count ≥ 14 ridges/25 mm² constituted only 5.5% of total males when compared to females who constituted 65.4% of total female subjects. On the other hand, no female subject was found with ridge count less than 11 ridges/25 mm² and no male subject was found to have ridge count more than 15 ridges/25 mm².

From **Table No 2**, looking at the probability density, likelihood ratio and favoured odds, it's clear that a fingerprint with ridge density of ≤ 13 ridges/25 mm² is more likely to be of male and fingerprint with ridge density of ≥ 14 ridges/25 mm² goes in favour of female.

Table No 3 shows that ridge count of 13.5 ridges/25 mm² can be used as cut off point for differentiation of sex with fair sensitivity and specificity.

Discussion:

Various studies have attempted to determine the sex from fingerprint pattern, friction ridge characters and ridge count. The present study aimed at establishing the association between sex and the fingerprint ridge density, mainly among North Indian population.

In our study, ridge density ranged from 11.7 to 18.6 ridges/25 mm² for females with a mean of 14.7 ridges/ 25 mm² (SE = 0.149), and from 9.9 to 14.4 ridges/25 mm² for males with a mean of 12.2 ridges/25 mm² (SE = 0.10). Females were found to have significantly higher ridge density than males ($p < 0.001$).

Few scholars have studied the relation between fingerprint ridge density and sex of individual which have been tabulated.

The present study showed significant difference in the ridge density among both sexes and males tends to have lesser fingerprint ridge density as compared to females, which is consistent with the studies by Acree,⁸ Cummins & Midlo,⁹ Sudesh Gungadin,¹⁰ Suthiprapha I,¹¹ Nayak VC¹²⁻¹³ and Nitin,¹⁴ as shown in **Table No 4**. Cummins⁹ also found in his study that epidermal ridges are coarser among men compared to women.

Lesser fingerprint ridge density in males could be explained by coarser ridges in males which result in fewer ridges in a given area as compared to their female counterparts who have finer ridges, hence more ridge density.

Findings of the study by Reddy GG,¹⁵ Plato CC¹⁶ and Steinberg FS¹⁷ were against the findings of our study where in males had higher fingerprint ridge density compared to females. These contradictory results might be due to racial variations and difference in the counting methods.

The statistically significant result of present study demonstrates that there does exist a difference in fingerprints in both sexes based on the ridge density. This conclusion could be of tremendous help as a tool for the fingerprints

experts either in the field of Forensic Science or Law Enforcement agency, to restrict their field of investigation and concentrate on a particular sex.

Determination of sex from a fingerprint can direct the search for culprits to a particular sex especially in excluding one sex suspects or solving cases of newborn swapping in hospitals in want of male child.

Conclusion:

Though, males and females are different and can be very well differentiated anatomically, when in person, and genetically if any biological fluids are left behind at the place of incident or accident; but if what is left is just a fingerprint, that can also help to identify a suspect or exclude one based on their fingerprint ridge density as summated in our study.

Conflict of Interest: None.

Financial Assistance: None.

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Table No 1: Distribution of Average Finger Print Ridge Count Among Males and Females

Average Finger Print Ridge Count	Male		Female	
	No of Cases	Percentage	No of Cases	Percentage
09 to 9.9	01	0.94%	00	-
10 to 10.9	11	10.09%	00	-
11 to 11.9	41	37.61%	01	00.96%
12 to 12.9	30	27.52%	09	08.65%
13 to 13.9	20	18.34%	26	25.00%
14 to 14.9	06	05.50%	24	23.07%
15 to 15.9	00	-	23	22.14%
16 to 16.9	00	-	14	13.46%
17 to 17.9	00	-	05	04.80%
18 to 18.9	00	-	02	01.92%
Total	109		104	

Table No 2: Probability Densities and Likelihood Ratios Derived from Observed Fingerprint Ridge Count

Ridge count	Probability density		Likelihood Ratio		Favoured Odds	
	Male (C)	Female (C ¹)	LR (C/C ¹)	LR (C ¹ /C)	M	F
10	0.037	0.000	NA	0	1	0
11	0.193	0.000	NA	0	1	0
12	0.422	0.048	8.778	0.114	0.900	0.100
13	0.193	0.192	1.002	0.998	0.510	0.490
14	0.156	0.212	0.737	1.356	0.440	0.560
15	0.000	0.240	0	NA	0	1
16	0.000	0.183	0	NA	0	1
17	0.000	0.077	0	NA	0	1
18	0.000	0.038	0	NA	0	1
19	0.000	0.010	0	NA	0	1

Table No 3: Sensitivity and Specificity of Fingerprint Ridge Density for Males

Fingerprint ridge density	Males	
	Sensitivity	Specificity
9.50	100%	100%
10.50	100%	100%
11.50	96.3%	100%
12.50	77.1%	95.2%
13.50	30.3%	76%
14.50	15.6%	50%
15.50	--	30.8%
16.50	--	10.6%
17.50	--	4.8%
18.50	--	1%
19.50	--	--

Table No 04: Mean fingerprint ridge densities of males and females in different studies

Author	Study Population	Sample size	Males	Females
Acree ⁸	African American and	200(100 Males & 100 Females)	10.90	12.61
	Caucasian	200(100 Males & 100 Females)	11.14	13.32
Cummins & Midlo ⁹	American	200(100 Males & 100 Females)	20.70	23.40
Sudesh Gungadin ¹⁰	Karnataka, India	500(250 Males & 250 Females)	12.80	14.60
Suthiprapha I ¹¹	Thailand	260(130 Males & 130 Females)	15.81	16.58
Nayak VC ¹²⁻¹³	Karnataka, India	200(100 Males & 100 Females)	11.05	14.20
	Chinese	200(100 Males & 100 Females)	11.73	14.15
	Malaysian	100(50 Males & 50 Females)	11.44	13.63
Nitin ¹⁴	Karnataka, India	550(275 Males & 275 Females)	12.57	14.14
Present Study	North Indian Population	213(109 Males & 104 Females)	12.19	14.68
Reddy GG ¹⁵	Bagatha's of Araku Valley India	470(235 Males & 235 Females)	13.41	12.04
Plato CC ¹⁶	American Caucasians	720(360 Males & 360 Females)	12.93	11.49
Steinberg FS ¹⁷	American Negros	408(184 Males & 224 Females)	11.9	10.64

Image 1

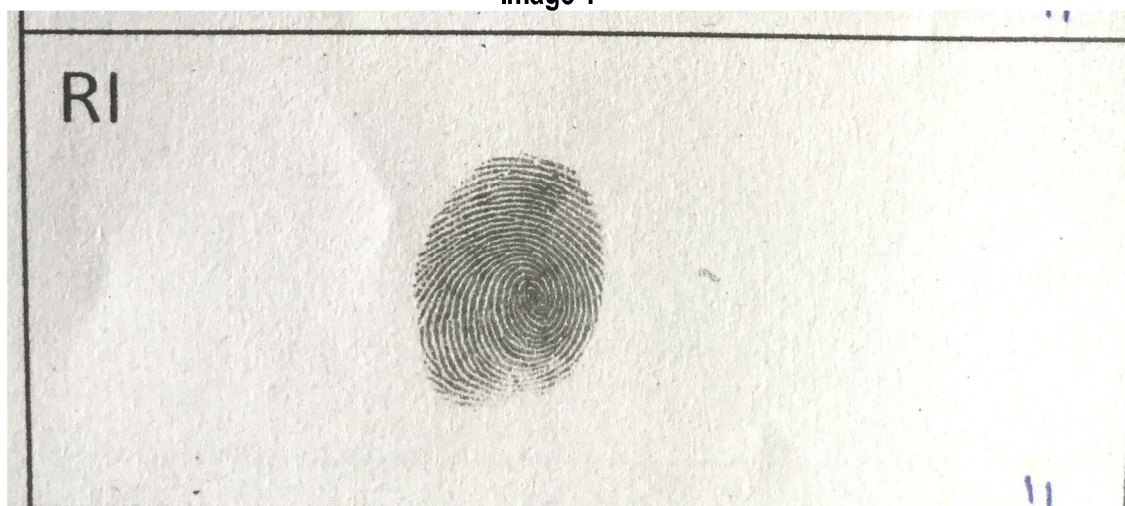


Image 2

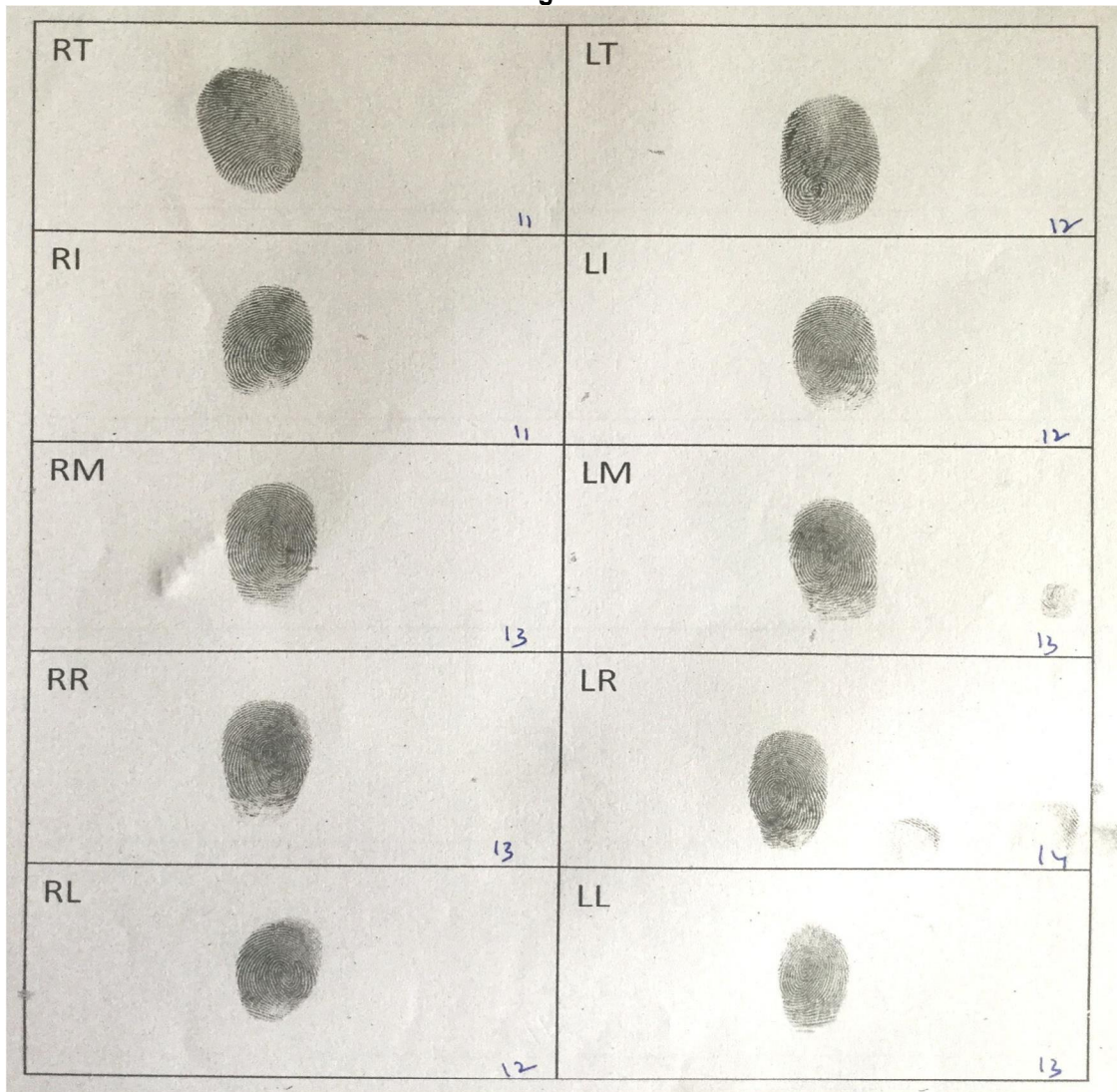


Image 3



Original Research Paper

Profile of Deaths Due to Burns in Mortuary of a Tertiary Care Hospital

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Abstract:

Background and Objectives: Burn injuries are one of the commonest causes of fatality and morbidity today. These injuries, however preventable, constitute a major cause of death throughout world. Estimation of incidence of burns is difficult to obtain for our country due to its huge and diversely composed population. Unfortunately, no national figures are available for India. But the number is likely to be high due to various socio-economic & cultural factors. So, study such as ours helps in understanding the role of various factors in causation of burn injuries. **Materials & Methodology:** The present study was carried out in the Department of Forensic Medicine & Toxicology, Pt. B.D. Sharma PGIMS, Rohtak, Haryana, from 5th November 2011 to 5th November 2013. Of the 486 cases reported of death due to burns, randomly 100 cases were selected for this study. **Observations:** In the present study, Incidence of burns among autopsy cases was 152 per 1000 per year during 1st yr of study and 170 per 1000 per yr during 2nd year of study. Commonest age group affected was 21-30 years (41%). Females were the most common victims (65%). Housewives constituted largest population, amounting to nearly 54%. The male to female ratio was 1:1.7. 83% cases were from rural habitat and 17% from urban. Maximum victims had burns to the extent of 91-100% of Total Body Surface Area (44%). **Conclusion:** To minimize burn mortalities and burn incidences, the government along with various bodies needs to come together with more sincere efforts.

Key Words: Incidence, Burns, Total Body Surface Area

Introduction:

Fire has been known to mankind for

about 4,00,000 years. Man knows about injuries caused by burns since the time he discovered fire. Because of the myriad uses that fire can be put to, and also because of the great havoc and devastation that it can cause, ancient man began to worship it as a deity. Along with water (jal), air (vayu), earth (prithvi), fire (agni) is perceived as one of the four basic components of universe.¹

Burns always have posed a threat to the sensitive human body. It is a common catastrophe today, as burn injury cases are one of the common emergencies admitted to any hospital. Approximately 70,000 patients are hospitalized annually in the United States with burns.¹ An accurate estimate of incidence of burns is going to be difficult to obtain for the huge and diversely composed population of our country. Unfortunately, no national figures are available for India. But the number is likely to be

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high due to socio-economic conditions, lack of awareness, cooking and dress habits etc. Studies have been done on burns in regards to types of burns, total body surface area involved, effect of burns, age of burns, post-mortem and histological findings, causes and factors responsible for death, manner and circumstances of incidence.² This study was undertaken to study the incidence, distribution, and extent of burns.

Material and Methodology:

The present cross sectional study was carried out in the Department of Forensic Medicine & Toxicology, Pt. B.D. Sharma PGIMS, Rohtak, Haryana. Total 3033 autopsies were conducted in the mortuary of Department of Forensic Medicine & Toxicology, PGIMS, Rohtak from 5th November 2011 to 5th November 2013. During that period, out of 486 cases of death reported due to burns, randomly 100 cases were selected for this study. The information along with valid consent was collected from accompanying relatives, hospital records and inquest papers. The ethical approval was taken from the Institutional Ethics Committee before the start of study.

Results:

In the present study, the incidence of burns among autopsy cases for the time period of 1st year (5th Nov 2011 – 4th Nov 2012) was 152 per 1000 per year and for the time period of 2nd year (5th Nov 2012 – 5th Nov 2013) was 170 per 1000 per year (**Fig. 1**). The study demonstrated preponderance of females (65%), the male to female ratio being 1:1.7 (**Table 1**). The maximum incidence of burn injuries was seen in the age group of 21 – 30 years (41%). In males, the predominant age group was 31 – 40 years (37%) and in females 21 – 30 years (46%). Rural population (83%) was more commonly affected than urban (17%) as depicted in **Fig. 2**. Housewives constituted the largest category (54%), followed by labourers (22%), as shown in **Fig. 3**. Majority of the victims (44) sustained burns to the extent of 91-100% of

TBSA, out of which 36 (55.4%) were females and 8 (22.8%) were males (**Table 2**).

Discussion:

In the present study, Incidence of burns among autopsy cases was 152 per 1000 per year during 1st yr of study and 170 per 1000 per yr during 2nd yr of study which was almost similar with studies of other researchers.³⁻⁵ Maximum cases of burns (41%) were seen in the age group of 21-30 years, which is in concordance with other studies.⁵⁻⁷ The study demonstrated preponderance of females (65%) over males (35%). The male to female ratio was 1:1.7. Higher preponderance of female sex due to involvement of females in kitchen work is similar with other studies.⁵⁻⁸ 83% cases were from rural habitat and 17% from urban which is in concordance with other studies.^{5,6,9-11} Housewives constituted the single largest population category amounting nearly 54% of cases which was also seen in studies by other researchers.^{9,12} Extent of burns was 91-100% of TBSA in 44% cases, followed by 81-90% of TBSA in 15%, 71-80% of TBSA in 10%, 61-70% of TBSA in 12% and 51-60% of TBSA in 9% cases. Only 10% cases sustained less than 50% burns which is in concordance with other studies.^{3,11}

Conclusion:

Burn injuries are a serious public health problem with alarmingly high mortality and morbidity. They are preventable injuries. So, study such as ours helps in understanding the role of various factors in causation of burn injuries. We found that despite the modernization, the domestic fire is the major cause of burns with maximum involvement of females and rural population due to various factors such as socio-economic conditions, lack of awareness, cooking and dress habits etc. To minimize burn mortalities and burn incidences, the government along with various bodies needs to come together with more sincere efforts.

Conflict of interest: None

Financial Assistance: None

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Table 1: Age and Gender wise distribution of cases

Age group (Years)	Male (n=35)	Female (n=65)	Total (n=100)
	No. (%)	No. (%)	No. (%)
1-10	0 (0)	0 (0)	0 (0)
11-20	3 (8.6)	17 (26.1)	20 (20)
21-30	11 (31.4)	30 (46.1)	41 (41)
31-40	13 (37.1)	10 (15.4)	23 (23)
41-50	4 (11.3)	5 (7.7)	9 (9)
51-60	1 (2.9)	2 (3)	3 (3)
61-70	2 (5.8)	1 (1.4)	3 (3)
>70	1 (2.9)	0 (0)	1 (1)
Total (%)	35 (100)	65 (100)	100 (100)

Table 2: Case distribution according to %age of burns

Extent of burns	Male No. (%)	Female No. (%)	Total No. (%)
0—50%	7 (20)	3 (4.6)	10 (10)
51-60%	5 (14.4)	4 (6.2)	9 (9)
61-70%	8 (22.8)	4 (6.2)	12 (12)
71-80%	4 (11.4)	6 (9.2)	10 (10)
81-90%	3 (8.6)	12 (18.4)	15 (15)
91-100%	8 (22.8)	36 (55.4)	44 (44)
Total	35 (100)	65 (100)	100 (100)

Fig.1: Incidence of burns among autopsy cases

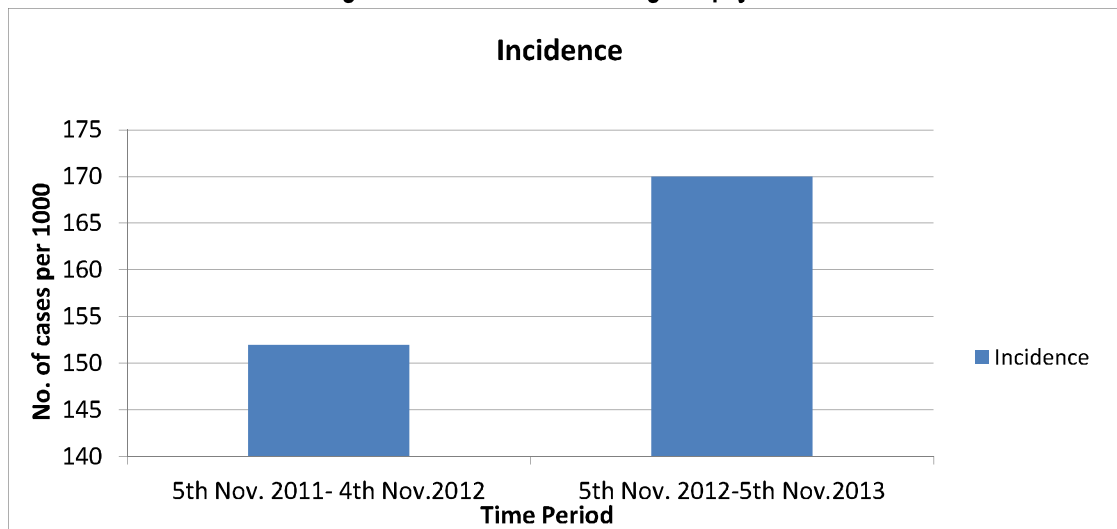


Fig. 2: Area wise distribution of cases

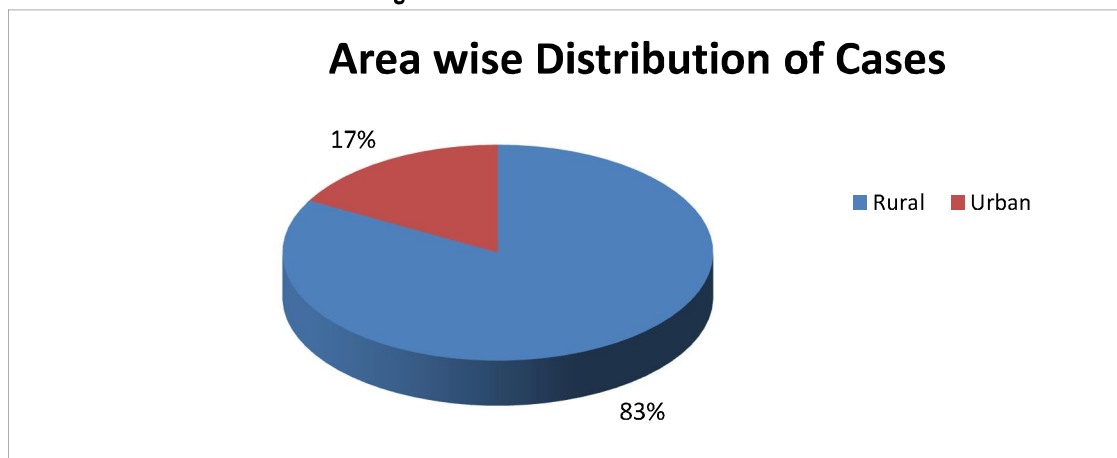
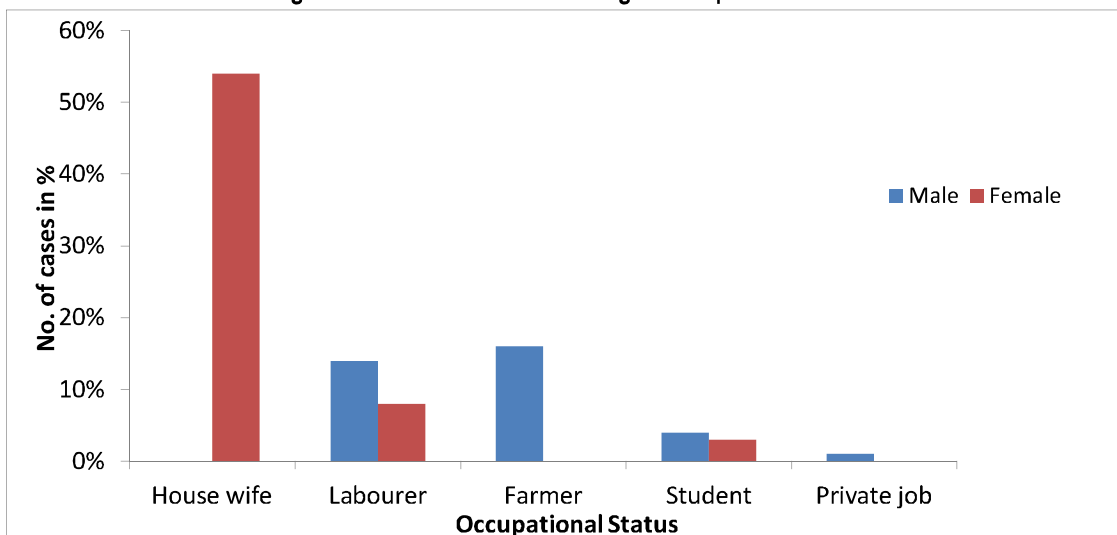


Fig. 3: Case distribution according to occupational status



Original Research Paper

Study of Students' Perceptions Regarding Open Book Test in Forensic Medicine

¹Pragnesh Parmar

Abstract:

Background: It is difficult for students to retain vast knowledge imparted during lecture and it is a challenge for medical education. Self-study and open book test, both are helpful for students as revision tools.

Materials and Methodology: A pre-test was conducted before the revision exercise, after obtaining informed written consent of 2nd MBBS students. Students were divided into two groups. The topic selected (i.e. Hanging) was divided into two portions of Part I and Part II. Group 1 students undertook open book test on Part I and self-study on Part II while Group 2 students reversed the order. The students were subjected to 1-2 sessions of open book test with short answer questions. A post-test was done with the same set of pre tested and validated MCQs after the revision exercise. The gain score of open book test was compared with that of self-study. To check the retention of the gain delayed post test was conducted after one week. Feedback from the students was taken on open book test and analyzed.

Results: A total of 100 students participated in the present study, of which 40 turned out to be medium achievers, while 60 turned out to be high achievers. Both medium achievers and high achievers obtained high score in open book test compared to self-study. Both medium and high achievers showed high gained score after 1 week on repeat open book test. Most of the students perceived that open book test increases self-directed learning process, very much an effective tool for revision, helps to retain knowledge for long time and is more beneficial compared to self-study.

Conclusion: The open book test is a superior revision exercise in comparison to self-study after the teaching modules in Forensic Medicine subject among 2nd MBBS students.

Key Words: Forensic Medicine, Open Book Test, Students' Perceptions, Exam Enhanced Learning.

Introduction:

It is difficult for students to retain vast knowledge imparted during lecture and it is a challenge for medical education. Students rarely have time to reinforce the content taught during lecture hours for long term retention.

As per cognitive psychological research, examination or test enhance the retention of knowledge and known as testing effect.¹⁻³ Hence, the aim of this study was to evaluate the effectiveness of 'Exam enhanced learning (EEL)' in the form of 'Open book test (OBT)' as a revision exercise in the subject of Forensic Medicine among 2nd MBBS students.

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Materials and Methodology:

A pre-test was conducted after the regular lecture classes of the topic of hanging in form of pretested and validated MCQs, but before the revision exercise on the same, after obtaining informed written consent of 2nd MBBS students. The students of 2nd MBBS were

divided into two groups after stratified randomization based on their previous internal assessment marks. The students were divided into Average and High achievers, only for the analysis of data, with 60% marks as the cut off scored in the previous internal assessment tests. The topic selected (i.e. Hanging) was divided into two portions of Part I and Part II. Group 1 students undertook open book test on Part I and self-study on Part II while Group 2 students reversed the order. The students were subjected to 1-2 sessions of open book test with short answer questions. A post-test was done with the same set of pre tested and validated MCQs after the revision exercise. The gain score of open book test was compared with that of self-study. To check the retention of the gain delayed post test was conducted after one week. Feedback from the students was taken on open book test via pretested and validated Likert Scale Type (1 to 7, 1 – Not at all true, 7 – Very true).

Results

A total of 100 students participated in the present study, of which 40 turned out to be medium achievers while 60 turned out to be high achievers. Comparison of gain score between self-study, open book test and repeat open book test was as per **Table – 1**. Both medium achievers and high achievers obtained high score in open book test compared to self-study. Both medium and high achievers showed high gained score after 1 week on repeat open book test.

Perceptions of students' towards open book test were as per **Table – 2**. Most of the students perceived that open book test increase self-directed learning process, very much effective tool for revision, help to retain knowledge for long time and more beneficial compared to self-study.

Discussion

Open-book test is thought to be able to enhance deeper learning among students.⁴ It is also believed that open-book test could have a powerful contribution to teaching and learning at higher taxonomical levels in any subject.⁵ Early studies on open-book test can be dated back to Stalnaker and Stalnaker's research in the

1930s.⁶ Following this research, both Tussing and Boniface focused on the arrangement of open-book test.^{7,8}

In the present study, the examination enhanced learning (EEL), in the form of open book test (OBT), has been found to be a superior form of revision exercise than self-study. The open book test was equally beneficial for both average and high achievers. There was retention of the gain from the exercise after one week among the high achievers; however there was a drop in the retention among medium achievers. The feedback obtained from the students was highly encouraging.

The open book test may be conducted during and or at the end of lectures to bring in the active learning process. Open book test, when conducted in the form of 2 to 3 questions during the lectures, could review the concepts and may keep the students active and aligned to the topic being taught.

We observed that during the examination, students usually spent about 2 to 3 minutes to read the questions. However, most of them already had their preferences materials or books identified beforehand. They spent another 5 to 10 minutes looking for relevant materials from the book to get an answer. This pattern is similar to another study done by Chan MY and Mui KW.⁹ Present study was also comparable with other study done for comparison of open book test and close book test at University examination.¹⁰ Open-book examinations could reduce the stress and anxiety of students. The proposition was firstly suggested in Feller's study.¹¹

Conclusion

The Open Book Test is a superior revision exercise in comparison to self-study after the teaching modules in Forensic Medicine subject among 2nd MBBS students.

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Table – 1: Comparison of gain score between self-study, open book test and repeat open book test.

Students	Median Score achieved		
	Self-study	Open book test	Repeat open book test
Medium achiever	1.5	2.5	3.0
High achiever	2.5	3.5	4.0
Total	2.0	3.0	3.5

Table – 2: Perceptions of students' towards open book test (Likert scale: 1 to 7, 1 – Not at all true, 7 – Very true)

Sr. No.	Perceptions of students	Median score
1	Open book test is a boring activity	3
2	Open book test increased my self-directed learning process	6
3	Open book test helps me to retain knowledge for long time	5
4	Open book test is more beneficial than self-study	4
5	Open book test is very much effective tool for revision	6

Review Research Paper

Chaperone Practice: Global vis-a-vis Indian Scenario

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Abstract:

Intimate examination is one area of medical practice where the gender of patient as well as the doctor has a significant influence on patient preferences and has been a subject of controversy for many years. Allegations are increasing day by day of unprofessional conduct while examining a female patient by the doctors, which ultimately creates an unpleasant situation in the hospital premises. Professional career of the doctor is also jeopardized and in some situations, morality is disturbed when the physician becomes victim of such situations. Moreover, faith of the patients upon their physicians; which is the backbone of doctor-patient relationship; is also being compromised following such events. Hence, to overcome such situations, guidelines have been incorporated by western countries to use a chaperone during intimate examination. Main aim of such chaperoning is to safeguard patients as well as doctors during embarrassing examination. Concept of using such impartial third person during intimate examination under some strict guidelines has not yet been implemented in India. Hence, it is utmost important to have some guidelines in relation to chaperoning a patient during intimate examination.

Key Words: Intimate Examination, Chaperone, Doctor-Patient Relationship

Introduction:

Trust and respect for a patient's autonomy is a major component of doctor-patient relationship. Trust is built on the basis of the concept that everything will be done for the welfare of the patient. Due to this, patients allow their physician to have access to their body during physical examination. Hence, it is the duty of each and every physician to examine the patient with respect, care and within the scope of professional barrier. Intimate examination is one area of medical practice where the gender of patient and the doctor has a significant influence on patient preferences and has been a subject of controversy for many years.^{1,2}

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Incidences of unprofessional conduct and sexual assault during intimate examination by doctors are increasing worldwide. In most of the situations, allegations are made by female patients against their male doctors. Moreover, incidences where the physician becomes the victim of false allegation are also common. Earlier, most of the incidences were not reported. But now a days, due to increase of awareness; reporting of such incidences is increasing in an exponential manner. In some situations, accompanying family members become hostile even if intimate examination was done in their presence. Hence, it has now become a matter of concern to get the patient examined in presence of a third uninterested person (a formal chaperone) during intimate examination; especially when the patient is of opposite gender to the physician.

The word 'Chaperone' was derived from a French word "chaperon", initially meaning a 'hood' and later; a type of 'hat'.³ The English people, in the 16th century used the word 'chaperone' to refer to an escort (an accompanying older woman), whose duty was to protect the reputation of an unmarried younger woman in public.³ But the practical implication of a chaperone by a doctor while examining a

female patient's private parts begun from early 17th century. During these days, male gynaecologists used to examine their female patients' pelvic region by palpation (inspection was not allowed) in presence of another female person.⁴ Since then, use of a third person (accompanying family person or nurse) has been incorporated during intimate examination.

The idea behind chaperoning a patient is like using a single arrow for two targets. They not only protect the patient but also doctor themselves, from false allegations of abuse. Most patients regard the offer of a chaperone as a sign of respect.⁵ Guidelines regarding use of a chaperone in intimate examination have been published by few countries only. In India, there is no such provision regarding intimate examination yet. Most of the physicians are practicing the traditional way by examining in presence of an accompanying person or a nurse (if available) with improper documentation. Hence, it is the high time to think about the matter seriously.

Definition of Chaperone:

In medical practice, there is no exact definition of a chaperone. A chaperone is an impartial person who acts as a witness for both patient and medical practitioner as a safeguard for both parties during a medical examination or procedure. They also act as a witness to continuing consent of the procedure. Family members or friend may be present during the examination or procedure, but they cannot act as a chaperone because they are not impartial.⁶

What is Intimate examination?

Intimate examination is likely to include examinations of breasts, genitalia and rectum, but could also include any examination where it is necessary to touch or even be close to the patient. Following things should be confirmed before proceeding intimate examination as per GMC guidelines:⁶

- To explain what is going to be done so that the patient has a clear idea of what to expect, including any pain or discomfort and let them ask question if they have any query.
- Patient's permission and consent should be taken and must be documented.
- A chaperone has to be offered.

- Privacy should be given to undress and dress; covering should be done as much as possible to maintain their dignity. It is not advisable to help the patient to remove clothing unless they have asked.
- If any procedure differs from what was told before, it should be explained and seek further patient's permission.
- Examination has to be stopped if the patient asks to do so.
- Irrelevant discussion and unnecessary personal comments should be avoided.
- Before carrying out an intimate examination on an anaesthetised patient, advanced consent; usually in writing must be taken.

Why a chaperone is needed:

A chaperone's main responsibility is to safeguard patients' interest, as well as to reassure and comfort them during embarrassing examinations. Other roles include supporting patients with undressing, interpreting, setting up equipment or creating a conducive environment during examination. Furthermore, they act as witness to the continuing consent for the examination and protect doctors from false allegations of abuse.^{6,7}

Who can be a chaperone:

Most of the patients prefer their family members to be the chaperone. As per General Medical Council (GMC), US guidelines, a Chaperone must be a health care professional with appropriate training.⁶ Those acting as chaperones need a valid DBS (Disclosure and Barring Service) check and receive appropriate training - according to "Care quality commission".⁸ Clinical staff who undertake a chaperone role, usually already have a Disclosure and Barring Service (DBS) check. If non-clinical staff acts as chaperones, they will normally require a valid DBR check. Members of staff who undertake a formal chaperone role must have been trained so that they develop the competencies required. Training should include knowledge of the term, chaperone; meaning and importance of 'intimate examination'; their role and responsibilities; rights of the patient; policy and mechanism for raising concerns.⁶

Global scenario:

Professional guidelines and clinical practice regarding the use of chaperones during intimate examinations vary substantially from one jurisdiction to other. In 1996, the United Kingdom's General Medical Council recommended offering chaperones during intimate examinations whenever possible.¹⁰ In spite of this, clinical practice of chaperoning a patient was very low and allegations were increasing. After that GMC has published guidelines, 'intimate examinations and chaperones 2013' which recommend all patients irrespective of gender be offered a chaperone during an intimate examination to protect patient as well as the physician.⁶ This recommendation has been supported by the medical defense union (MDU)⁹ and been incorporated within the guidelines for The Royal College of Obstetricians and Gynaecologists.¹⁰

In the United States, each state medical board has its own recommendation; hence there is no clear national standard as.^{11,12} Clinical guidelines in Canada also vary considerably from province to province. According to the guidelines of the College of Physicians and Surgeons of Ontario, both patient and physician have the right (except in emergency) to insist that a third party be present during intimate examinations, and in absence of which the examination can be postponed.¹³ In New Zealand, chaperones are used routinely, like in UK.¹⁴ Culture and religion has a potential influence on intimate examination in Saudi Arabia.¹⁵ In Australia, literature is unavailable regarding offering a chaperone while examination by general practitioners because only few studies have been conducted; that also in genitor-urinary settings.^{14,16,17} Medical Council of Hong Kong (Code of Professional Conduct) states that 'an intimate examination of a patient should be conducted in presence of a chaperone to the knowledge of the patient. 'Intimate examination' is not defined by it and there is no advice about the impact of gender.¹⁸ In most of the other countries, the use of chaperones remains largely unknown.

Guidelines recommended by General Medical Council (GMC) are:⁶

- When carrying out an intimate examination, patient should be offered

the option of having an impartial observer (a chaperone) present wherever possible irrespective of gender of the clinician.

- A chaperone should usually be a health professional and will: (a) be sensitive and respect the patient's dignity and confidentiality, (b) reassure the patient if they show signs of distress or discomfort, (c) be familiar with the procedures involved in a routine intimate examination, (d) stay for the whole examination and be able to see what the doctor is doing, if practical, (e) be prepared to raise concerns if they are concerned about the doctor's behaviour or actions.
- A relative or friend is not an impartial observer and so would not usually be a suitable chaperone, but doctor should comply with a reasonable request to have such a person present along with a chaperone.
- If either party (doctor or the patient) does not want the examination to go ahead without a chaperone present, or uncomfortable with the choice of chaperone, examination can be delayed to a later date provided patient's health is not affected.
- If doctor doesn't want to go ahead without a chaperone present but the patient has said no to having one, they should be explained clearly why it is important. Ultimately the patient's clinical needs must take precedence. Doctor may consider referring the patient to a colleague who would be willing to examine them without a chaperone, as long as a delay would not adversely affect the patient's health.
- Doctor should record any discussion about chaperone and the outcome in the patient's medical record. If a chaperone is present, every details including identity should be recorded. If the patient does not want a chaperone, it should be recorded that the offer was made and declined.

Different views regarding use of a Chaperone:

Studies regarding use of chaperone in intimate examination have been conducted globally by different authors from time to time. Different views were collected both from patients as well as physicians.

Views of patients:

Knowledge and attitude of patients regarding use of a chaperone during intimate examination was different from region to region.

Gender differences exist between patients with the preference for a chaperone. Men rarely wanted a chaperone during genital examinations irrespective of the examining clinician's gender,^{2,5} whereas, most of the female patients are in favour of using a chaperone when the examining doctor is a male one.² But, they are comfortable enough without a chaperone when examined by a female doctor. Some studies also demonstrated that young patients (female) are more likely than older one to opt for a chaperone during intimate examination.^{19,20} Most of the female patients believe that offering a chaperone should be done before consultation and they believe it to be a sign of respect.^{2,5,21}

Different determining factors for choosing a chaperone were found by different authors. Amongst them, gender of the examining doctor was the commonest cause. Exceptionally, in one study attitude of the doctor was found to be the leading cause followed by gender.⁵ In a study done by Sinha, et al, more than half of the patients undergoing breast examination wanted a chaperone regardless the sex of the examining doctor.²¹ Female patients also reported experiences where doctors had conducted a gynaecological examination in a "less than professional manner." Unprofessional behaviour involved over exposure of the woman's body; inappropriate comments, gestures, or facial expressions; and being examined in an unusual position.²² Sometimes, prevention of awkwardness rather than worry of professional misconduct were found to be the important deciding factor.²¹ Hence, it can be summarized that geographical & socio cultural variations plays an important factor towards opting a chaperone.

Most of the patients, especially teenagers, prefer to use their family members as a chaperone during examination. For women, a female nurse is generally the preferred choice.^{2,21} If given options, patients opted for a female nurse rather than a receptionist of a clinic in many occasions.⁵

Question of hampering doctor-patient relationship was raised following use of a chaperone during intimate examination. But most of the studies found that offering a chaperone doesn't mean that patients don't have faith on their physician and doctor-patient relationship is not hampered. Most patients were of the opinion that presence of a chaperone doesn't have any negative effect on doctor-patient relationship, patient confidentiality and doesn't cause embarrassment.²¹

Views of physicians:

Physician's concern about use of chaperone during intimate examination is not clear worldwide. Most of them are unaware of the chaperone policy. In some regions, the physicians are not even in favour of using it.²³ They believe that adopting it may hamper the doctor-patient relationship and confidentiality.²⁴ Amongst the physicians who are adopting it, the most important concern was their reputation (fear of allegation) rather than interest and right of the patient. Most of them keep the chaperone inside the room but outside the curtain just to maintain the formality.²⁵

Another important issue related to chaperoning a patient is lack of record. Physicians are offering chaperone during intimate examination, but they are not serious enough to keep detail records of it in patient's record sheet.^{1,26}

It is observed that chaperone policy is adopted only by male doctors while examining patient of opposite sex and female doctors are found to be inert irrespective of patient gender. A study done in England illustrated that only 37% physician are having a chaperone policy in their hospitals and those who are using it are mostly male, 2% being female.¹

In most of the times, physicians argued that chaperoning a female patient is not a problem in government hospitals and private nursing homes because of availability of female

nurse or any other female staff. Hence, they are adopting it in such set up. But problem arises in some private clinics especially in periphery and in home visits. Hence, they have to depend upon the available family members.

Indian perspective of Chaperone policy:

Till now, there are no such guidelines in India regarding intimate examination and use of a chaperone. Hence, physicians are using female attendant, which may be either a nurse or a family member. In primary settings, people have to depend upon the accompanying person and in some situations they are even examining without a third person. Hence, allegations of inappropriate examination are increasing day by day.

In spite of all these, neither MCI (Medical Council of India); the apex regulatory body of medical education and training, nor the IMA (Indian Medical Association) the largest association of the medical practitioners in India, have given any guidelines regarding intimate examination. Indian Medical Council (Professional conduct, Ethiquette and Ethics) Regulation, 2002, have not mentioned anything related to intimate examination. According to section 53 Cr PC, a female must be examined by a female registered medical practitioner or under her supervision. Hence, some guidelines are extremely important to tackle various situations which are seen following intimate examination.

Sometimes, issues regarding implementation of GMC guidelines in India have also been advised by some authors to uplift patients' right and interest as well as give confidence to the entire medical community. According to GMC guidelines, all patients irrespective of gender should be offered a chaperone. They are strict enough to offer a one which can be denied by a patient. But this denial has to be recorded properly. Even during use, every detail about the chaperone has to be recorded in the patient's record sheet. Hence, they have given equal emphasis on offering as well as record keeping which can easily help to track the chaperone (even they left job) at any time if some allegations are made. The main drawback of those guidelines is that they are difficult to follow in primary settings where

female nurse or any other female health personal may be unavailable round the clock or during home visit. In such situations, they solely have to depend upon the family members (although not impartial). Sometimes, they have to examine the patient without presence of a third person. Ideas for implementation of 'virtual chaperone' (like CCTV) during examination in primary settings in absence of a nurse are also put by some authors which itself is a controversy. Regarding training of a chaperone, nothing can be concluded from GMC guidelines. They have not mentioned properly the training curriculum and the appropriate authority to train them. If these drawbacks are corrected, it can easily be applied in Indian scenario in more rectified manner.

Conclusion:

It is the high time to save our patients as well as doctors from the nightmares of allegations which are increasing everyday in everywhere. Various guidelines implemented by different countries have to be analyzed to frame a rule which can adhere and fit to Indian scenario. Patients should feel safe while getting examined and at the same time doctors should be given a safety environment to practice their discipline. This will happen only if some new guidelines related to intimate examination can be implemented by the appropriate authority.

Conflict of Interest: None

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Review Research Paper

Bioterrorism – Are We Prepared?: A Current National Perspective

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Abstract:

Warfare by biological agents is an age old technique for mass calamity to an enemy civilization. Periodically, it has been flashing its presence in world map either by scattered sporadic incidences or wide spread impact. In the current scenario of our national diplomatic situation of unfriendly relationships with external & internal agencies, it is important that we review our status regarding this inhuman tool of terrorism or proxy-war. This article addresses the fundamental aspects of bioterrorism in current national perspective like recent national and international incidences, possible types of microbes and modes of transmission used for attacks, how to diagnose a bioterrorism attack, available defense resources in India for management, current legal provisions and suggestions for future plans.

Key Words: Bioterrorism, Biological weapons, Microbial forensics, Defense

Introduction:

As per United Nations, Geneva, 'Biological & toxin weapons' are defined as complex systems that disseminate disease-causing organisms or toxins to harm or kill humans, animals or plants.¹ WHO defines 'Biological agents' as those that depend for their effects on multiplication within the target organism, and are intended for use in war to cause disease or death in man, animals or plants.² As per the Centre for Disease Control, USA, a 'bioterrorism attack' is the deliberate release of viruses, bacteria, or other germs (agents) used to cause illness or death in people, animals, or plants.³

In the Indian system of thinking, war comprises Veer Rasa (heroism) and Rudra Rasa (anger and destructiveness), while terrorism consists of Bibhatsa Rasa (disgust & revulsion) and Bhayanaka Rasa (terrorism).⁴

The biological agents are not only comprised of human pathogens but also include micro-organisms or toxins that cause diseases of domestic animals and agricultural plants. A biological attack can cause widespread morbidity and mortality in humans directly by causing diseases or indirectly by deaths of domestic animals, diseases of animals, crop failure and ruin food stock that would result in food deprivation.⁴

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Background incidences:

Biological agents have been used as means of terrorism or non-conventional warfare since many centuries. Some of the most peculiar incidents are noted here.

- During World War I, the Germans attempted to ship horses and cattle inoculated with disease-producing bacteria, such as *Bacillus anthracis* and *Pseudomonas pseudomallei* to the United States and elsewhere. a German saboteur, who supposedly infected 4,500 mules with glanders, was arrested in 1917 in Mesopotamia.⁵
- In 1978, a Bulgarian exile named Georgi Markov was attacked in London, England,

with an 'umbrella gun' which discharged a tiny pellet containing a toxin 'Ricin'. He died several days later. After few days, another Bulgarian named Kostov was attacked by same technique.^{5,6}

- Transnational and transcontinental trade of animals is also a potential way to conduct biological attack that may lead to massive epizootics. Some historical examples are African horse sickness in India and Rift Valley fever in Egypt and Saudi Arabia.⁴
- During Rhodesian Bush War 1970, South Africa provided Anthrax and cholera micro-organisms to Rhodesian troops for use against guerrilla rebels.⁷
- In 1984, some extremist followers of Rajneesh in Oregon, U.S. spread salmonellosis by contaminating veg salads in 10 of the restaurants in community. A total 751 people were infected and several patients got hospitalized. Although no fatalities notified, even CDC and health authorities determined it as an ordinary outbreak initially. After one year, police investigation disclosed that it was manmade, when several persons from the cult group confessed the crime. They were shocked to know that the microbes were legally obtained from a commercial supplier and cultures were grown at their own facility.⁸⁻¹¹
- Few extremist from sect 'Aum Shinrikyo' tried many biological attacks in Tokyo and other areas of Japan during April 1990 to July 1995. It included four attacks using anthrax virus and six using botulinum toxin. They also tested some other micro-organisms like v. cholera, Ebola virus and Coxiella burnetii. They tried to spread botulinum toxin by driving a running car through streets and to spray anthrax spores from a truck around Japanese parliament and Imperial Palace. Although these biological attacks were failed to harm any people due to some or another technical non-expertise, they later used a chemical weapon- nerve gas Sarin in subways of Tokyo which killed 12 people and injured over 5000.^{6,8-12}
- In October 2001, a 63yr old male in Florida, USA, was diagnosed as having inhalational anthrax. Initially public health authority

announced that he probably contacted it during hunting. Later another two cases of inhalational anthrax from Florida and a fourth case of cutaneous anthrax from New York City were reported. Then further investigations revealed that they all got infected by anthrax containing postal mails. Meanwhile, the Senate Majority Leader in Washington DC also received such a letter-mail with anthrax and by the end of year total 17 confirmed and 5 suspected cases of anthrax were reported throughout country, with 5 deaths. All cases got infection via the same pattern, i.e. anthrax containing postal mails.^{9,11,13}

- In 2001, Deputy chief minister of Maharashtra, India received an envelope having anthrax culture. The pneumonic plague attack in 1994 at Surat, Gujarat is being suspected as an act of bioterrorism. The DRDO lab officials who analyzed the Yersinia pestis strains from the plague outbreak patients said that they were definitely different from preexisting established plague foci in India.^{14,15}

Meanwhile, few prank incidents are also notable here.

- West Bengal's Chief Minister Buddhadev Bhattacharya's office in Kolkata, received few envelopes with white powder and a note saying, "Sorry, you have just been attacked with anthrax. Thank you." and signed as "CIMI". Later, it was detected as nothing but talcum powder.
- As per a police official, Chandigarh Mayor Harjinder Kaur received a packet with some powdery material & a message, "You are going to die. This is anthrax - Bin Laden." Later it was revealed as just a prank by some unknown person.
- Motilal Naik who was judge in Hyderabad High Court, complained police about suspicious white powder in a magazine. A similar complaint was also registered by a Chennai citizen. Investigations revealed that it was chalk powder. It is not uncommon for the National Institute for Communicable Diseases (NICD), New Delhi, the nodal agency for testing for anthrax to receive

such suspicious samples from across the country frequently in a year.¹⁶

- In October 2010, a letter received from terrorist group Indian Mujahideen threatening to launch 'biological war' in Assam. Their demands were to free all jihadi leaders held at the Guwahati central jail, to stop operations against jihadi forces and stop all ongoing development projects in Assam. This was a case of blackmail.¹⁷

All of the above incidents indicate that the threat of bioterrorism is a fact and very possible in India.

Plausible Perpetrators or Technological Resources:

Many developed countries like United Kingdom, USA, Japan, Russia, Canada & Germany have actively conducted researches with various biological agents during and post-world war II era.^{5-9,18}

After Persian Gulf War 1991, Iraq government declared to United Nations Investigation Commissions that they had conducted research into offensive use of biological agents at research facilities of Salman Pak, Al Hakam and other cities.⁶

In May 2009, Eight countries - Algeria, China, Egypt, Iran, Israel, North Korea, Russia and Syria are believed to have biological weapons and many other countries including Pakistan are believed to have resources & capabilities to develop such biological agents.⁷

Now, the fact of matter is that all the data of research, technology and resources may not be safe anytime. Any of extremist or terrorist organizations or individual criminal may get access to them and some terrorist groups like Al-Quida also have disclosed interest for it.⁴ It is also possible that some country may provide such resources to them unofficially or secretly to encourage proxy war on enemy countries by bioterrorism attacks.

Classification of Biological Agents & Development Process:

CDC, USA has classified biological agents into category A, B and C according to the rate of transmission and morbidity-mortality rate.^{3,9} Category A has agents with high transmission and mortality rate. Category C

includes agents which are newer & emerging in medical science. And as discovery of newer agents and bioengineered organisms, the list of agents would never be conclusive.

Diagram 1 shows that the scientific process to develop biological agents differs from the medical use of micro-organisms only near its terminal phase.¹⁹ So, "if a scalpel can be used for a lifesaving surgery, it may also be used to cut a vital blood vessel by a person with immoral intentions."

Modes & Methods for transmission:

If large proportion of population in the same geographical area is infected, there is high possibility of use of biological agents having airway droplet or oral-faecal mode of transmission. If affected population is scattered discretely or sporadic cases, than biological agents with any modes could have been used i.e. airway, oral-fecal, contact, parenteral, sexual, animal-man.⁹

In rare occasions, instead of human pathogens, agricultural crop, food stock or domestic animals may also be targeted with agricultural and epizootic biological agents.⁴

Diagnosis of Biological Attack:

Following points suggest suspicion of a bioterrorism attack:¹¹

1. Epidemic which is highly uncommon in target population
2. Rapid transmission rate than natural course of disease
3. High rate of mortality & morbidity than expected
4. Common disease but resistant to standard drugs
5. Uncommon micro-organism strain
6. Point source outbreak
7. Multiple epidemics in relatively short duration or non-cyclical pattern
8. Downwind plum pattern of infection spread
9. Unexpected agricultural, epizootic or zoonotic diseases

Microbial Forensics is a new discipline dedicated to detection, collection and analysis of evidences from a bioterrorism attack and biological crimes.⁹ To link a biological crime to the culprit, microbial forensics can provide vital scientific evidence & expert opinion. E.g.

sequencing of amplified viral fragments from a dentist and infected patients proved the alleged transmission of HIV from a Florida dentist to his patients.¹⁴ In the infamous Aum Shinrinkyo case, multiple locus Variable Number Tandem Repeat(VNTR) analysis identified the *b.anthrax* strain as veterinary vaccine strain(Sterne 34f26) and linked to its source.²¹

Available Resources for Defense in India:

In India, National Centre for Disease Control(NCDC), New Delhi, Defense Research and Development Organization (DRDO) and National Disaster Management Authority (NDMA) are chief agencies for defense against chemical and biological warfare. DRDO also works to train doctors and police.^{14,16}

Delhi, being a prime target, has been divided into three zones with a major hospital with definite management plans in each - Indraprastha Apollo Hospital, Safdarjung hospital and AIIMS. They have rapid diagnostic methods available to detect diseases like plague, dengue, meningitis and typhoid within 24 hours. Kits to detect chemical threats in water and soil are also ready.¹⁶

As per 12th five year plan (2012-2017), Department of Health Research is developing 10 Regional laboratories (Grade1), 30 state level laboratories (Grade2) and 120 Medical college laboratories (Grade3) for timely identification of viruses and other agents causing morbidity significant at public health level and specifically agents causing epidemics and/or potential agents for bioterrorism. Amongst them grade 1, 2 and 3 indicates minimum biosafety levels of 3, 2 and 1 respectively.²¹ Under this scheme, total 39 laboratories are already upgraded and functioning across the country.²² India has three well-functioning institutions with BSL-4 facility. Biosafety level 4 laboratories are highest level microbiological research facilities, used for diagnostic work and research on pathogens which can cause fatal diseases with easy transmission. These include Marburgvirus, Ebolavirus, Lassavirus, Crimean Congo hemorrhagic fever, Hendravirus, Nipahvirus, Flaviviruses and Variolavirus.^{10,23} Apart from that, India have nine health science institutions working under DRDO on various aspects of microbiological research on diagnosis,

treatment, protection and preventive measures.^{24,25} Antibiotics, such as Ciprofloxacin, have been stock piled. Pharmaceutical firms like Ranbaxy are prepared to meet an increase on demand.¹⁶

National Disaster Management Authority (NDMA) has devised a draft plan and guidelines to counter any biological disaster, including manmade and natural outbreaks.³³ During the 2010 Commonwealth Games, National Disaster Response Force (NDRF) teams were deployed with prophylaxis for anthrax and nerve gas antidotes and were equipped with residual vapor ejectors, chemical agent monitors, water poisoning detector kits to tackle any biological/chemical incidents at New Delhi.¹⁷ NDMA has trained NDRF battalions to deal with chemical, biological, radiological and nuclear(CBRN) threats.²⁶ All the states and Union Territories of India also have their own state disaster management authorities.

Related Laws & Legal Provisions:

On 17 June 1925, the Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous or Other Gases and of Bacteriological Methods of Warfare, commonly called the Geneva Protocol of 1925, was signed by 108 nations, including the five permanent members of the United Nations Security Council.^{5,6}

Follow-on to it, the Biological Weapons Convention (BWC) 1972, was signed by 103 nations for prohibition of the development, production, and stockpiling of bacteriological (Biological) and toxin weapons and their destruction. As per this, it was made necessary to submit to the United Nations information on facilities where biological defense research is being conducted, scientific conferences that are held at specified facilities, exchanges of scientists or information and disease outbreaks. Suspected violations of BWC were to be reported to the UN Security Council, which would inspect the accused party and prescribe necessary steps. Still, it has no clear guidelines for inspections and disarmament. The definition of “defensive research” is yet to be made objectively clear.^{5,6,25}

IPC 269²⁷ deals with negligent act likely to spread infection of disease dangerous to life. IPC 270 deals with malignant act likely to spread

infection of disease dangerous to life. IPC 326 defines biological agents indirectly as dangerous weapons mentioning 'any poison or any substance deleterious to the human body to inhale, to swallow or to receive into blood or by means of any animal'.

Government of India had passed Terrorist and Disruptive Activities (Prevention) Act in 1987 and The Prevention of Terrorism Act (POTA) in 2002, in which all possible types of terrorism activities were well defined including biological and the punishments for same. Later, both acts were repealed in 1995 and 2004 respectively. Currently The Unlawful Activities (Prevention) Act, 1967 is in force with its amendments.^{10,28-31}

Though, USA has passed the bioterrorism Act, 2002,¹⁴ India is still finger-crossed to enforce a law on bioterrorism.²⁶

Suggestions to Strengthen the Defense Against Bioterrorism:

1. Awareness about suspicious clues for bioterrorism should be spread at community level authorities like doctors working at private or government hospitals of primary, secondary and tertiary levels, district police authorities, disaster management authorities at each districts, Heads of all government and private institutions of vital socio-economical importance.
2. Strong communication system with transport facility should be there between all resource agencies, institutions and medical establishments that have capacity to deal with such emergency to synchronize the management plan.
3. State wise and nation wise database should be prepared for all epidemic and endemic communicable diseases, their pathogens, causative virulent strains, mode of transmission, rapid diagnostic tests & modalities, standard treatment guidelines and methods to break the transmission-chain.
4. Database should be prepared about micro-organisms used in previous biological attacks and likely to be used for future biological attacks including agricultural and epizootic pathogens.
5. Efficient surveillance system for all types of communicable diseases should be there.
6. In case of deaths due to such suspicious biological attack, state wise one medical institute should be there having advanced autopsy facility according to CDC recommendations³³ or equivalent standards that can safely conduct autopsy and collect necessary tissue samples for forensic microbial analysis as well as research.
7. Before autopsy, PM conducting doctor must consult and co-ordinate with law enforcement agencies to decide if actual necessity is there for medicolegal autopsy and whether to perform 'complete autopsy' or 'Focused Forensic Autopsy' based on biosafety facility at autopsy centre & number of autopsy requiring cases.³³ NDMA should form proper guidelines for autopsy & related issues.
8. Upgradation of established nodal and regional BSL-3/4 level microbiological laboratories with microbial forensic technologies to detect molecular and genetic level evidences.
9. Stringent law should be formed and enforced to curb such newer ways of terrorism, i.e. Chemical, Biological, Radiological, Nuclear and Cyber. Common people should be made aware of offences and penalties so that emerging terrorism can be dealt with at very initial stage.
10. Stringent 24x7 security surveillance must be maintained at high level microbiological research facilities. Power & authorization can be allowed to regulatory bodies like Indian Council of Medical Research (ICMR) and National Accreditation Board for Laboratories (NABL) to vigilance the safety, security and staff working standards at these facilities regularly.
11. Research to develop newer vaccines, antibiotics or some novel treatment modalities like light-mediated technology¹³ against micro-organisms with high pathogenicity. Collaboration can be sought from CDC(USA) or WHO for the research and training.⁸

Conclusion – Are we prepared?

The answer to this question cannot be given in simple yes or no. Progress in genetic engineering and related fields do have their two faces and acting like a double edged sword. Mutation was earlier a natural phenomenon which now a days has become the artificial one in terms of developing newer strains of viruses. It has become easy now to develop modified strains of already known pathogens against which vaccines and antibiotics are yet to be developed.

But, this is also not to be concluded that we are not prepared. The answer basically constituted in terms of spectrum starting from primary policy making against suspected future bio-attacks to risk based sophisticated in-depth protocols development. In today's era of ever emerging terrorist groups, it's unwise for any nation to consider oneself fully prepared against bioterrorism and that is why endless continuous efforts have to be made to shift the defense mechanism against bio terrorism towards right in this spectrum.

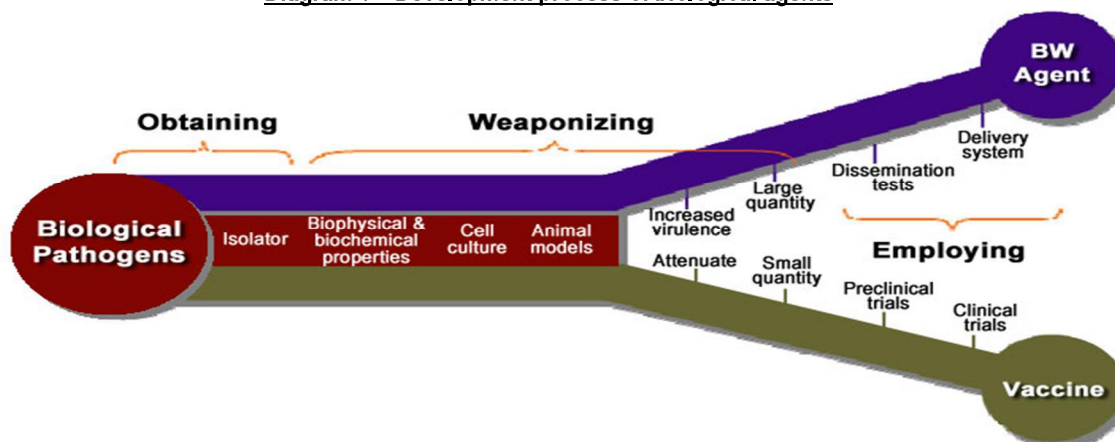
Conflict of Interest: None

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Diagram 1 – Development process of biological agents

Review Research Paper

Need for a National Code of Ethical and Scientific Autopsy Practice

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Abstract:

Autopsy practice has manifold benefits to mankind. It played an important role in the evolution of modern medicine as a Science. Pathological autopsy, as a tool, contributed a lot for improving the standards of medical care and thus for betterment of humanity. Medico legal autopsy plays an important role of aiding in the process of administration of justice. It is no exaggeration to say that entire modern medicine took birth in our mortuaries. It is undeniable that many benefits are sought only through autopsy practice. It is high time we should be manifestly honest, respectful and open towards the deceased and their families at all times in autopsy practice.¹

Attempts have been made by many Medico-Legal organizations cutting across national boundaries for harmonization of the performance of medico-legal autopsy. The guidelines put forward by European Council of legal medicine are one of the best of its kind.² This article attempts to emphasize on the need for a medico legal code for the whole country of India which deals with ethical and scientific standards for medico legal autopsy in the country.

Key Words: Medical legal code, Autopsy, Ethical Forensics, Performance Standards

Introduction:

Human life is the most precious asset on the planet, compared to anything else. Investigating into human death began as a quintessential quest for increasing the longevity of life and arrest its sudden end. Right to life is a sacrosanct right granted to the people of many sovereign countries either explicitly stated or implicitly existing in their respective statutes. In order to provide fair treatment to the dead and properly investigate the cause of the death the following legislations were adopted in many developed and developing countries. World health organization also envisioned a consensus document titled ethical practice in Laboratory medicine and forensic pathology.³

1. Harmonization of the performance of Medico Legal Autopsy-European Council of legal medicine, for all countries in the European Union.²

2. The National code of ethical autopsy practice, The Australian Health Ministers advisory Council, subcommittee on the autopsy practice.¹

3. Code of practice and performance standards for dealing with suspicious death - Royal College of pathologists United Kingdom. (Adopted in consistent with recommendation R (99) 3 of council of Europe on the harmonization of Medico legal autopsy rules adopted by the committee of ministers in February 1999.⁴

In our country, very few states have codification of scientific standards to be adhered to in autopsy practice. The Madras Medical Code is often claimed as one of the country's oldest medical code, which was published in two volumes dealing with all matters related to functioning of public hospitals including a chapter devoted to mortuary management.⁵ In the recent past, Maharashtra adopted a civil medical code⁶. Haryana published a Medico legal Manual in 2012.⁷ Recently Kerala came up with a Medico legal code⁸. This is the most successful

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attempt in this area. The authors acknowledge that no information is available to them with respect to Medico legal codes in other states. Readers are requested to bring forward to the notice of editor about any good practices existing in their states.

What is a Medico-Legal code?

A medico-legal code is a document which prescribes examination and certification standards to be followed in medico-legal cases. It contains performance standards on common minimum human and material infrastructure necessary for medico-legal work. Code contains a check list of procedures to be followed in each type of Medico Legal Case. E.g.: an exhumation, a rape victim examination, an anesthetic death, a maternal death etc & so on.

Ministry of Health and Family Welfare, Govt. of India, and several state governments have so far issued guidelines towards some medico legal services like in case of victims in sexual offenses.⁹ All these efforts were done in a piecemeal manner and a comprehensive consensus document towards harmonization of medical legal services is lacking to date.

The Punjab Medical Manual and its subsequent revisions were helpful in preparing Haryana Medico Legal manual ratified in 2012¹⁰. This manual has one of the best practices for age estimation. A Board of three members, namely, a dental surgeon, radiologist and third member (forensic expert/orthopedic surgeon/Physician) is to be constituted. General duty medical officer may be the third member in case if there is no forensic expert/orthopedic surgeon/physician available in the district. In case if examination of the female is required, then the fourth member shall be a lady officer.⁷ These practices are in no way diminishing the role of Forensic Specialist, but prescribing ways to be followed where he is not available. A code is needed to develop standard protocols of professional collaboration in various fields of medicine for maximum benefit of the clients. The Haryana Medico Legal manual which has legal sanction by the Statute, prescribes regular payment of T.A. & D.A rules as per existing Finance Rules.⁶ Some Points of Kerala Medico Legal Code⁸ worth noting are:

For the continued maintenance of quality of medico-legal work, a committee consisting of representatives of Government from the Health, Law and Home Departments, Director of Health Services, Director of Medical Education and senior most Medico-legal experts from Health Services and Medical Education Departments should be formed. Periodic revision of the Code should be undertaken by the committee, at least on a yearly basis.

Departmental training in medico-legal matters should be arranged regularly to medical officers and all staff of Health Services and Medical Education Departments and also to Officers of the Police Department.

The honorarium for conducting postmortem examination should be disbursed on a monthly basis. The clerk / typist who typewrite the postmortem certificate should prepare the monthly statement of this honorarium, to be disbursed to the eligible doctors / staff, indicating the number of cases attended to by each category of doctors / staff and the amount to be disbursed to each of them. The head of the institution, after proper verification, should sanction the same without any delay.

The good thing about the Kerala Code and the Haryana Manual is that they prescribe the way medico-legal work is to be carried out in Casualties and Forensic Medicine Departments, including: Identifying the following as Medico-legal Examinations & Certifications :- 1) Wound certification 2) examination and certification of drunkenness, 3) examination and certification of a male accused of sexual offence, including the examination of his potency, 4) examination and certification of a female victim of sexual assault, 5) examination and certification of a victim of unnatural sexual offences, 6) examination and certification of a female for signs of recent delivery, 7) examination and certification of a victim alleged to have been drugged, 8) certificate of physical examination of any person, by a Medical Officer/ Specialist, on the written requisition from a judicial or police officer, 9) certification of age, 10) postmortem examination,. 11) Any other medical examination of a person, conducted by a registered medical practitioner defined as

per clause (b) part 2 of section 53 Cr.P.C. for the purpose of identifying or excluding findings or collection of material objects which may aid in the administration of justice.

This particular clause of Kerala Medico Legal code clarifies the due diligence followed in drafting it and the drafter's commitment and responsibility towards science and society. It also emphasizes that blood and other waste products of postmortem examination, under any circumstances, should not be allowed to flow in to the common drainage. The postmortem table should have a drainage line directly from it and leading to a tank constructed in the similar manner as that of septic tank. A soak pit may be constructed to drain the effluent fluid from the tank. The size of the tank may be in accordance to the number of postmortem examinations conducted in the particular mortuary, in every year. The site of the tank should be behind the mortuary building. Only water used to clean the floor of the mortuary and its premises should be allowed to drain to the common drainage.⁸

One of the deficiencies of both the medico legal codes is that they fail to define: How to constitute a team of doctors for autopsy? When should a team of doctors be constituted? The codes also fail to positively assert the rights of medico legal practitioners explicitly. The Kerala Code has however made a good attempt in prescribing criteria for spot autopsy, availability of forensic medical services on holidays etc.

Why should we have a Medico-Legal code?

1. Code serves as a guidebook for every Registered Medical Practitioner to perform his legal obligations towards living and dead in spite of the fact that he's trained or not in medical legal work.

2. It leads to a uniform reporting system in the entire country which adds to the quality of work and helps judiciary in timely delivery of justice.

3. It will serve as a common minimum knowledge to empower citizens towards their rights with respect to medico legal services. Information contained in the code will fall within the ambit of mandatory disclosure clause of RTI Act 2005¹¹

4. It prescribes guidelines with respect to uniform and universal standards of evidence collection, storage, transport and submission to appropriate for further examination.

5. A code will give us a great sense of immunity to report with our scientific reasoning in the current pressures from police and political nexus. eg: police forcing doctors not to collect viscera for chemical analysis in influential cases of drunk and drive etc. (Recent case in Telangana State)¹²

6. The long standing demand of investigating all the operative table deaths and maternal deaths under 174 Cr PC can be addressed by formulating a code and getting it ratified by government. We personally felt the need for a Medico legal code when many mothers died in the state of Telangana in various government and private hospitals wherein the treating doctors were taken in to task as they failed to recognize the cause of death and no Autopsy was done in Maternal deaths.¹³

7. The code can clarify on details like jurisdiction of the autopsy center, prerequisites for a routine as well as spot autopsy, guidelines for maintaining Medico legal records, issue of reports etc. In short it will be common standard operating procedures manual for Forensic medicine departments in the entire country.

8. It, with prospective clauses, will ensure easy and effective dissemination of knowledge of new procedures and new guidelines to be followed by a simple amendment to it.

9. It prescribes a self regulating mechanism for autopsy surgeons to increase transparency in Medico legal work.

10. It shall prescribe a duty to keep well informed about the development in the field so as to remain competent to carry out Professional responsibilities.

11. It shall prescribe a duty to maintain confidentiality and refrain from releasing information to anyone other than investigating officer.

12. It shall prescribe a duty not to violate the constitutional rights of the alleged accused.

Ethical aspects of forensic pathology practice that are to be addressed by adopting a Medico Legal code -

In India, the autopsy surgeon is viewed with skepticism when he tries to engage to the next of kin of deceased in the whole process of arriving at a conclusion. Whereas, in many countries, even in the Coroner and Medical Examiner autopsies, the victim party will be involved in deliberations and discussions before arriving at the cause of death to the maximum extent possible. This creates an environment of allaying their anxieties, clearing their doubts, prevents airing of their genuine concerns to media and subsequent media trial & reduces the pervading trends of homicide psychosis. Engaging the victim party in the delivery of medico legal services is not colluding with them as is being perceived by many people in our profession based on legally unsubstantiated customary practices in the country. Whatever we do professionally is bound by a triad of truth, integrity and honesty.

Situations like the one below described below by Dr.T.D.Dogra can be avoided well in advance by involving the next of kin of deceased as a party to investigation:¹⁴ "At times, mostly the parents or close family member get obsessed to the idea commonly in situations of suicide that their loved one has been murdered instead of committing suicide. They may move from one investigating agency to another or from court to court, from one expert to other or asking for constitution of medical boards. They even try to influence the board members or investigating agencies to give an opinion in favour of homicide. If they do not get opinion of their liking, some of them hardly hesitate to make complaints against the investigating agencies or the experts who have given opinion. This is a way of expression to deny the reality or to prove that the deceased has not committed suicide because suicide brings a sense of guilt to the person and family even a social stigma. Sometimes, it may be a psychological cover for their own inadequacies or any kind of guilt complex in the relationship with the deceased. It is very hard to convenience these people of the real situation. Sometimes, there is feeling of revenge or settling the scores with the people against

whom they may have grudges and therefore may attempt to implicate them".

If we verify the protocols of death investigation in the office of Chief Medical Examiner, New York City, we understand that the next of kin of the deceased are a part of the team to investigate the cause of death who are consulted as well as briefed at various levels of investigation by the Medical Examiner. Though it sounds absurd in a police inquest and adversarial legal system of India, we should develop a mechanism for addressing this genuine grievance.¹⁵ In New York, a medical examiner can hold back the release of the dead body after autopsy till he makes himself satisfied of investigating it in all possible ways. A concept of investigative insurance of retaining a part of samples from the body with the autopsy surgeon is in practice in the west. This would help to work up the case afresh in case a need arises. The investigating officer wields power in Indian scenario. The current adversarial system in practice puts hold on the practice of involving either of the parties to guide the investigation.

Whom does the Forensic pathologist owe a duty, can sometimes be confusing question because the subject of pathologist's examination is dead. The issues for most other doctors are clearer because there is a living patient. However there is at least the argument to be made that the duty is owed to the deceased that the true cause and circumstance of death be revealed. If such a duty is doubted a stronger case can be made that the forensic pathologist has a duty to community at large because of the trust that the community has in the integrity of medical profession generally.³

It is now recognized that as with other areas of medicine, autopsy practice must be based on honest and open communication between health professionals and those they deal with. In both coronial and no coronial settings these issues started getting recognition.¹ A patient is explained about his disease, the treatment and the alternatives available for treatment and so on by the treating doctor. In a similar fashion the next of the kin of the deceased must be explained about the sequence of events which led to the death, the way we are trying to arrive at an end point, the investigations we are planning for. The concept of differential diagnosis of

death will gain importance in such a practice. In fact such an open communication will make us to rely more on science and less on dogma. Such a practice will trigger self-introspection among many autopsy surgeons who base their practice on forensic mythology.

Accreditation and associated compliance constraints are the most effective means of governance of best practice.¹ A model of registering all Forensic practitioners from various disciplines has already been suggested by Dr. V.V.Pillay through his "Forensic Development and Regulatory Authority bill 2011"¹⁶ which ultimately fell on deaf ears. Forensic laboratory investigations guidelines submitted by Dr. Misra and Dr. Damodaran in July 2010 titled "Perspective plan for Indian Forensics" remains un adopted till date.¹⁷ In the light of recent controversies over questioning the constitutional validity of existing practice of ordering postmortem examination vis a vis 174 Cr. PC¹⁸ and also the 206th Law Commission Report asking for a revival of a coronial system of inquest in India,¹⁹ we should rethink on establishing professional grief counseling centers in mortuaries properly informing and involving next of kin of deceased as important stake holders in autopsy practice as in the western world.

Some debatable issues are:

- Rights of the state to obtain organs for further investigations without the consent of next of kin. This is a controversial claim in the current legal system in India. (The authors don't endorse this in full proposition)¹⁸
- Rights of next of kin to agree/ deny removing organs for academic and research purposes. The existing state anatomy and pathology acts in India are to be amended on an urgent basis.

Some existing grey areas are

1. Rights of next of kin with regard to disposal options for retained tissues and organs. Should they be treated as anatomical waste or be sent for funeral?
 2. Rights of the next of kin to be advised about uses other than diagnosis to which retained organs and tissues can be put.
- The concept of right to life under article 21 of Indian constitution has been extended to fair treatment of dead so far.²⁰ It is desirable if the same is extended also as fair investigation of unnatural death. Moreover scope of Article 21 has been enormously expanded by the apex court, so as to include the right to know or right to have the correct information and this will also include right to know the correct cause of death.²⁰ This sets a bench mark for us to have a proper code which includes details about

human, material infrastructure as well as uniform and standard operating procedures for all medico legal purposes as not only an ethical but also a legal responsibility towards the dead.

The code will also prescribe time bound uniform reporting systems in the entire country as well as formulate guidelines towards disclosure of information to what extent, under the RTI Act. It will prescribe guidelines for digitalization and permanent archival system of medico legal records as per Electronic Health Record Standards of Government of India.²¹

What does the code of practice contain with respect to scientific standards?¹⁶

1. Adherence to this code of practice and performance standards will enliven the objective of an essential requirement in providing quality Forensic Services
2. It prescribes the duties and responsibilities of the Forensic Pathologist on matters of personal expertise, Professionalism, Integrity of evidence and ensuing fair presentation of evidence
3. It prescribes methods of scientific approach in crime scene processing, approach and standard practice of non departure to be adopted in autopsy of different type of unnatural deaths, standard practices of record keeping, drafting reports, photography and videography record maintenance, collection of trace evidence from body, methods and standards to be followed in investigations like postmortem histology and Thanato chemistry
4. Code prescribes guidelines for management of biomedical waste generated in mortuary as per biomedical waste management rules notified by government from time to time customized for our mortuary waste purposes
5. Prescribe proper reporting of cause of death as per ICD 10 classification wherever possible
6. Code prescribes Pathologist's availability for consultation, review of opinion and duties as a witness in court.

Conclusion:

The IAFM should constitute a team of experts from Forensic Medicine, Pathology, Forensic Science, eminent jurists and senior police personnel to prepare a draft for "National Code for Ethical and scientific autopsy Practice" and submit to the government for passing it as a bill in parliament of India. Properly investigating a maternal death or a case of medical negligence doesn't mean we are over enthusiastic towards pointing finger towards others. We are bound by the common

aphorism in Forensic Medicine, "In God only we trust and all others are suspects".

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Case Report

Self Inflicted Injuries Vis a vis Injuries Due to Assault: 2 Case Reports

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Abstract:

Background: Self injury, also called self-harm or self-mutilation is defined as any intentional injury to one's own body while self suffered wounds are those which are inflicted upon oneself with the help of another person. As a forensic expert, one should keep an open mind considering, in every case, the likelihood of a self-inflicted injury as a result of malicious intent.

Cases: We report two cases of self-inflicted injuries over neck, one claiming assault by a third person and the other a case of suicidal cut throat.

Conclusion: Meticulous examination of patient is necessary to differentiate between suicidal and homicidal injuries.

Key Words: Suicidal Cut Throat, Self-Inflicted Injuries, Assault, Alcohol.

Introduction:

Self-harm, as a means to avoid service in the Roman army, was described as early as the second century AD.¹ Self-inflicted injuries are those which are inflicted by a person on his own body himself and self-suffered are those which are inflicted upon oneself with the help of another person, usually for personal gains, like psychological, legal or material.

Another term associated with self-infliction is Para suicide, which is a self-harming behaviour believed to be life threatening, not with the purpose of causing one's own death but to express one's anguish to others, typically in the hope that those others will provide aid, comfort or rescue²

The modern day forensic expert plays an important role in identifying patterns of injuries and mechanisms/manner of death that can aid in understanding the circumstances leading to the injuries in question. Self-inflicted injuries have features which can be used to distinguish them from injuries inflicted by third parties. Visit to crime scene may also provide a useful insight in such cases.

Case 1:

On 2/7/2015 at 7:41 AM, a patient was brought to emergency of GMCH, Chandigarh with alleged history of attempted suicide at his home in Panchkula at about 6:30 AM. History given by his neighbours revealed that the patient had consumed alcohol and had a fight with his wife prior to the incident. A careful examination of the injuries revealed the presence of:

1. Two parallel, actively bleeding horizontal incised wounds measuring 5 cm x 2 cm and 5.5 cm x 2.5 cm respectively, both spindle shaped, superficial, involving only the skin subcutaneous tissues and muscles were present over the front of bend of left elbow; major vessels were spared. Multiple overlapping, parallel, superficially placed linear cuts (hesitation cuts) were present surrounding these incised wounds.[fig 1,2]
2. An actively bleeding horizontal incised wound measuring 16 cm x 6 cm, spindle shaped involving neck muscles, thyroid

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cartilage and trachea; major vessels were spared. Multiple overlapping, parallel, superficial incised wounds (hesitation cuts) were present surrounding this injury.[fig 3,4]

The patient was immediately intubated and shifted to ICU, from where he was discharged around 45 days later. The wounds being superficial, multiple, overlapping, interconnecting, involving only the assessable regions of body, with presence of hesitation cuts, along with history given by relatives, helped us to form an opinion of these injuries being self-inflicted.

Case 2:

A patient presented in the Emergency with alleged history of assault at a marriage function by his brother in law. On examination, smell of alcohol was present. The following injuries were noted:

1. Two overlapping incised wounds, skin deep measuring 3 cm x 0.5 cm over left side of neck; with active bleeding. [fig 5]
2. Three overlapping incised wounds, skin deep measuring 5.5 cm x 2 cm over left side of neck; with active bleeding. [fig 6,7]

Multiple linear old healed scars marks could be seen over the front of chest and both forearms of the patient.

The patient had consumed alcohol but was not under influence. He was visibly agitated and demanded police action against the accused. After a span of 45 minutes, the patient's mother arrived along with other relatives, who, on questioning, informed that the patient himself had inflicted the injuries upon his body and that there had been similar instances of self-harm in the past.

Superficial nature of the injuries, with discrepancies between the alleged history and injury found, in addition to the signs of similar old injuries on other body parts helped us conclude that the patient was feigning injury to falsely implicate someone.

Discussion:

Self-inflicted injuries are encountered on a routine basis in the emergency. Usually the patient has a hidden motive behind these injuries which may be-

1. Psychological (Attention seeking) (Insane, Schizophrenic etc.).
2. Manipulation of an older injury.

3. To implicate someone in a false case.
4. Self-infliction of injury as a means to escape punishment or duty.
5. Self-infliction of injury to claim compensation from insurance companies etc.^{3-7,13}

The inconsistencies between the damage on the clothing, pattern of injury and patients' own version of the incident are the primary pointers of injuries being self-inflicted.⁸ Hence, the details of the incident as narrated by the patient, may give a vital clue to the examiner; so examination of not only the patient but also his clothes becomes essential. In self-inflicted injuries, there are usually no signs of struggle or defence injuries. In fact, defence injuries may help us to distinguish victims and assailants.⁹ Symmetry can often be found in self-inflicted injuries. The injuries are usually localised to one part of the body, usually the accessible parts of the body and are not present in sensitive areas such as the eyelids, genitalia or nipples as found in both the patients in our case.

Suicidal cut-throat is uncommon and in such cases, the main issue is the differentiation between homicide and suicide. In suicidal cut throat by a right handed person, the incision is usually oblique, starting high on the left side of neck below the angle of jaw, to end at a lower level on the right side.¹⁰ Suicidal cut-throat wounds are placed at a higher level (above the thyroid cartilage), while homicidal wounds are present at a lower level (below the thyroid cartilage). Also, there will be absence of defence wounds in such cases. The injuries are usually superficial, multiple, parallel and often overlapping. 'Mirror image' lesions and "chessboard" pattern have also been described in self-inflicted injuries.^{11,12} In addition to these, previous psychiatric history of the patient and a visit to the scene of crime may also hold critical value in such cases. Studies on orientation of wounds have concluded that in homicides, wounds with a horizontal axis of entrance wound are less common while in suicides the wounds with horizontal axis are more common.¹³

Profiling such injuries reveals that most of these injuries are usually simple/superficial, involving mostly young males with upper limbs being the most

frequent targets.¹⁴ also, tentative cuts in close proximity were found to be the most useful indicator of self-inflicted injuries.¹⁵ Self-inflicted injuries by blunt force or thermal effects are less common. The presence of similar old injuries indicates previous suicide attempts.

Conclusion:

Undoubtedly, expertise in forensic medicine and psychiatry is needed to differentiate deliberate, goal-directed self-injury on the one hand, and overt or hidden self-destructive behaviour based on psychopathology on the other. The two categories overlap with no clear boundary, in between. However, it may be difficult to render a clear diagnosis in certain cases.

Every registered practitioner dealing with medico legal work should keep in mind to identify and note the anatomical site of the injury with its exact position on the body, description of the total number of injuries, the direction and the depth of the injuries and the presence or absence of hesitation cuts, corresponding cuts on clothes and medical and psychiatric history. The parameters discussed above are merely indicative and not absolute and they must be scrutinised according to the individual case.¹⁵

Nonetheless the investigating agencies should register cases, only after thorough investigation and after taking into consideration the medico legal report in detail.

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Fig 1



Fig 2



Fig 5



Fig 3



Fig 6



Fig 4



Fig 7



Case Report

Infidelity, Betrayal and Homicide – A Case Report

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Abstract:

Infidelity is a violation of a couple's assumed or stated contract regarding emotional and/or sexual exclusivity. Contrary to what most people assume, it is neither rare nor exclusively male behavior. It is one of the most challenging and damaging emotional events in life. It can be debilitating and feel like an *emotional murder*. We encountered a case of homicide in which the wife betrayed her husband and murdered him with the help of his friends due to her extramarital affairs with her husband's friends.

Police recovered a human skeleton from the bushes of hill. The bones were spread at different places along with the clothes. The skeleton was identified with the help of clothes by the father of deceased. After thorough investigation, the facts came out that his wife had extra marital affairs and she murdered him with the help of her friends. On postmortem examination, fracture of skull bone with infiltrations of blood was noticed. The cause of death in this case was opined as head injury which was ante-mortem in nature and sufficient to cause death in ordinary course of nature.

Key Words: Infidelity, Betrayal, Homicidal, Head injury, Ante-mortem.

Introduction:

Homicide is the most serious crime as old as civilization and reported as early as in the Bible.¹ Killing of an individual is the highest level of aggression found in all the cultures. Since ages, the very reason or motive for these killings has remained the same v.i.z. lust for money, women or land. To commit murder, two elements (*Mens-rea* which means preplanning or afore thought and *Actus reus* which means the actual execution) should work together to constitute the crime.²

Infidelity is a violation of a couple's assumed or stated contract regarding emotional and/or sexual exclusivity.³ Other scholars define infidelity as a violation according to the subjective feeling that one's partner has violated a set of rules or relationship norms. This violation results in feelings of sexual jealousy and rivalry.⁴ Infidelity, contrary to what most people assume, is neither rare nor exclusively male behavior. There is currently a debate in the field of evolutionary psychology whether an innate, evolved sex difference exists between men and women in response to an act of infidelity; this is often called a "sex difference".⁵ Those that posit a sex difference exists state that men are 60% more likely to be disturbed by an act of sexual infidelity (having one's partner engage in sexual relations with another), whereas women are 83% more likely to be disturbed by an act of emotional infidelity (having one's partner fall in love with another).⁶ It is one of the most challenging and damaging emotional events in life. The more you trust and feel safe with someone, the more powerful and painful it feels when it happens. It can be debilitating and feel like *emotional murder*.⁷

We encountered a case of homicide in which wife, who had no children, betrayed her

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husband and murdered him with the help of his friends due to her extramarital affairs with husband's friends.

Case report:

Police recovered a human skeleton from the bushes of a hill near Grugram, Haryana. The bones were spread at different places along with the clothes. The skeleton was identified with the help of clothes by the father of deceased, as a male person resident of an adjoining state, who was missing for last one month. As per the father's statement, the deceased was married six years ago and had moved back and worked as laborer for livelihood. As stated by the neighbor and relatives of the deceased, a month back, he went to a party along with his wife and friends, but he did not return. An FIR was lodged in the concerned police station. After thorough investigation by the police, the facts came out that his wife had extra marital affairs and she murdered him with the help of her friends. Four persons along with his wife were arrested and all of them confessed to the crime.

The bones were collected in a katta and brought to the nearest Civil Hospital. It was referred to our department by the Board of doctors with the comment "*Body is skeltonized and requires expert opinion*".

In police papers, police mentioned the apparent cause of death as "*Murdered by slitting the neck with a knife*".

When the bundle of bones was received by our department the findings of police papers along with postmortem findings were also noted. This disclosed many facts about the dead individual.

Autopsy findings:

The body was in a skeletonized state. The following recovered bones were arranged in anatomical position.

- Skull: Right orbit, right facial bones and upper part of maxilla were missing, without showing any blood infiltration at bony ends.
- Mandible, both clavicles and both scapula.
- Lower six cervical vertebrae, thoracic vertebrae, lumbar vertebrae, sacrum and coccyx. No injury was present over the available vertebra.

- Right and left humerus, right and left radius and ulna with some carpal bones attached with the help of tags of soft tissues.
- Right and left hip bones.
- Right and left femur, tibia and fibula and some tarsal bones attached with the help of tags of soft tissues. Tags of soft tissues were attached over the bones at places. Gnawing effects were present at places.

All the internal organs were missing.

The available bones were typically male in character.

Injuries:

- A fracture defect over the right frontal, partial and occipital region of skull measuring 27 × 7 cm with infiltration of blood into bony trabeculae of fractured segments of bone at places. A linear radiating fracture from anterior part of fractured frontal bone going from right to left over the frontal bone over which pericranial infiltration of blood was seen.
- The left temporal squamosal suture showed infiltration of blood at its posterior half. Blood infiltration was present over the other sutures at places.

Opinion

The cause of death in this case was opined as head injury which was ante-mortem in nature and sufficient to cause death in ordinary course of nature.

Discussion:

Head injuries are one of the most effective methods of homicide. The head is a vital organ and the most exposed part of body to receive injuries. A cranio-cerebral injury due to blunt trauma causes more homicidal deaths as compared with blunt trauma injury to other areas of the body. Investigation of a homicidal death can never be complete without a detailed postmortem examination. The detailed analysis and scientific interpretation of autopsy finding is imperative to reconstruct the crime scene. The recent rise in the trend of murder cases involving head injury is a serious concern to society.⁸

Women and men are now taking an equal-opportunity approach to extramarital hanky-panky. A report out from the Kinsey Institute at Indiana University found that, for

the first time in modern history, women are cheating at nearly the same rate as men.⁹ Another study, published in the National Opinion Research Center's 2013 General Social Survey¹⁰, found that while the percentage of men who admitted to infidelity was constant over the last two decades, the percentage of wives who reported having affairs rose almost 40 percent. Gary Spivak, founder of Fidelity Dating, a dating website designed to help users "find a loving non-cheater" — typically after being two-timed — says that last year membership on the site was largely female. Just one year later, it's an even 50-50 split.¹¹

In 2013, a study conducted by America's Journal of Marital and Family Therapy revealed that 41 per cent of marriages had one or both spouses admitting to either physical or emotional infidelity.¹² Last year, a survey by Ashley Madison threw up some startling statistics – 76 per cent of Indian women and 61 per cent of men don't even consider infidelity as a sin or immoral anymore. Responses were collected from 75,321 respondents – 80 per cent being married – across ten cities. 81 per cent of men and 68 per cent of women confessed that their affairs had a positive impact on their marriage. More than 80 per cent had had arranged marriages. The average age of those surveyed was 45 for men and 31 for women.¹³

Conclusion:

In this case a meticulous autopsy and careful history helped in determination of cause and manner of death. The autopsy revealed that the man was hit over his head by hard and blunt object by his wife's paramour with intention of homicide. This clearly reveals that this is a case of homicide involving more than one person.

Homicide due to extramarital relationship or infidelity is now taking an equal opportunity among women and men. This case report highlights less reported crime in that infidelity and the being of feeling children-less leads to inhuman and cruel crime.

Conflict of Interest: None.

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[marriage-women sexual...cheating.../5166.html](https://www.dailyo.in/lifestyle/indian-marriage-women-sexual...cheating.../5166.html). Accessed on: 3rd March 2017

Figure1. Human skeleton recovered, arranged in anatomical position



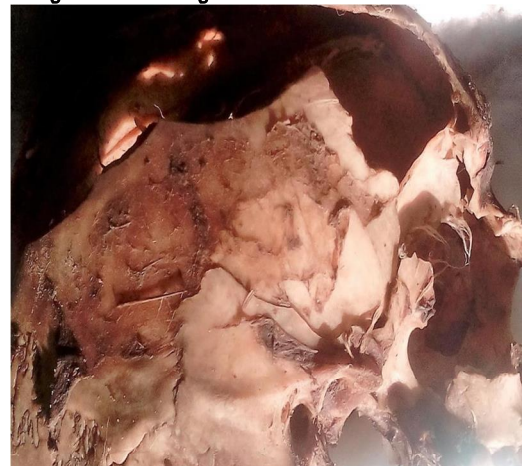
Figure: 2 & 3. Fracture defects of skull



Figure 4. Showing infiltration of blood over skull



Figure 5: Showing infiltration of blood over skull.



Case Report

A Case of Fatal Malignant Hyperthermia and Unavailability of Drug

¹Akhilesh K. Pathak, ²Sanjeev Sharma

Abstract:

Malignant hyperthermia is a rare condition in which the body temperature suddenly and unexpectedly increases due to severe reactions to some anesthetic drugs, which are commonly used to prevent pain during surgery and other invasive procedures. The patients who are susceptible to malignant hyperthermia are usually unaware about the problem and when it precipitates with the administration of any anesthetic agent, it can be life threatening. The drugs, which are used to treat this condition, are also not commonly available and hence the condition becomes worse. Such cases are commonly referred to as 'Death in the operation theatre' and allegations of medical negligence and consequent medico-legal autopsy are quite common due to the sudden and unexpected death of the patient. One such rare case was brought to us for autopsy examination in which the patient died in operation theatre due to malignant hyperthermia. The case is presented here to discuss the various issues related to the malignant hyperthermia and unavailability of its antidote in an emergency situation.

Key Words: Malignant hyperthermia, Autopsy, Operative deaths, Dantrolene sodium

Introduction:

Malignant hyperthermia is a rare condition, which is autosomal dominantly inherited, and occurs suddenly due to severe reactions to particular drugs, which are commonly used by anesthetics to prevent the pain during surgery or any invasive procedure. It commonly occurs within one hour of discontinuation of some anesthetic gases and the muscle relaxant that is used to temporally paralyze the patient during a surgical procedure, but rarely, delayed postoperative presentation may occur.¹

Instances of malignant hyperthermia occur in 1 in 5000-50,000 patients, in which people are given anesthetic gases, but the actual susceptibility to it is probably more frequent, because many people with an increased danger of it are never exposed to

drugs that generate a reaction.¹ In this condition, the body temperature suddenly and unexpectedly becomes high due to infusion of some drugs in people who are genetically susceptible and at risk. It commonly occurs due to the triggered response of the body to certain general anesthetic agents like desflurane, enflurane, isoflurane, methoxyflurane, halothane, ether and succinylchlorine, etc., which cause an uncontrolled increase in skeletal muscles, metabolism and impairment of thermo regulatory system of the body.²

The susceptibility of the individual to malignant hyperthermia may be unknown till these people are not exposed to the particular drugs. "In-Vitro Contracture Test" with halothane and caffeine, on muscle bundles obtained by open biopsy is the "gold standard" to establish the diagnosis of malignant hyperthermia in predisposed patients because of its high sensitivity and specificity.³⁻⁵ Majority of the authors have commented about the clinical implications of malignant hyperthermia but none of them have discussed the medicolegal issues related to it and hence the case is presented here to analyze the medicolegal issues and consequences of the unavailability of its antidote in health setup of developing countries like India.

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Case-History:

In 2013, a 28 year old male patient was admitted in a private hospital in Vadodara, Gujarat, with complaints of left lumbar pain radiating to the back. Routine investigation of blood, X-rays and ultrasound were advised. On USG, left kidney was found grossly enlarged (185X189 mm in size) and showing changes of hydronephrosis with marked dilatation (52 mm) of the left renal pelvis and small segment of proximal left ureter. Two renal calculi of size 7 mm and 5 mm in diameter, were found in left renal lower calyx with features of chronic ureteric obstruction. On further examination by intravenous pyelography, left sided pelvi-ureteric stricture was observed with confirmation of calculi in left renal lower pole. Pre-operative checkup was done and vitals were found to be within normal limits with no significant past and present history.

Pre-anesthetic clearance was obtained and under general anesthesia with Halothane, the surgery (pyelo-lithotomy with vertical flap pyeloplasty and stenting) was started. During surgery, muscle rigidity with tachycardia (radial pulse of 170/min) and hypotension (blood pressure 90/60 mm Hg) was observed. The body temperature was continuously increasing and reached 105° F. Efforts were made to bring down the body temperature by administering intravenous paracetamol and the cold saline infusion, but no significant response was seen and the patient went into sudden cardiac arrest from where he could not be revived. Intraoperative blood gas analysis showed increased CO₂ production and higher oxygen consumption, with acidosis. Blood reports showed raised Creatinine Kinase and hyperkalemia, with acidosis. Medico-legal autopsy was conducted next day morning due to alleged history of medical negligence. During autopsy, signs of pyelolithotomy were found on the left side, with stent in situ and, as per protocol, routine viscera were preserved for chemical analysis and histopathology examination. The reports of chemical analysis were found negative and histopathology examination reports showed changes of acute renal failure with edema of both the lungs. Classical findings of rising body temperature to 105° F with tachypnoea,

tachycardia, hypotension and muscle rigidity during surgery, with hyperkalemia, acidosis and increased Creatinine kinase in blood reports were suggestive of death due to malignant hyperthermia.

Discussion:

Malignant hyperthermia is a condition, which is very rare and occurs suddenly after administering the particular drugs for which patient is hyper reactive and leads to an uncontrolled increase in skeletal muscle metabolism and impaired thermo-regulatory system of the body. The muscle rigidity and increased muscle metabolism in the form of acidosis (due to excess carbon dioxide production) with increased body temperature (due to heat production and failure of thermoregulatory system) in the body was observed during surgery in the present case. The blood reports also showed hyperkalemia and increased Creatinine Kinase, which was suggesting malignant hyperthermia.

Hypothermia during anesthesia is one of the most common complication^{6,7} but cases of hyperthermia are uncommon and may happen once in the life of an anesthetist. Such a rare and uncommon emergency during anesthesia can be easily misdiagnosed and can be life threatening to the patient even in a minor surgery. The resulting 'death in operation theatre' commonly causes anxiety among the relatives and may lead to allegations of medical negligence against the treating surgeon and anesthetist. Almost same incidence happened in this particular case in which a healthy patient went for an elective surgery and died suddenly and unexpectedly. The autopsy findings in the present case showed signs of operative procedure with a negative chemical analysis report and non conclusive histopathology reports, but the history and clinical notes showing raised body temperature to 105°F with tachypnoea, tachycardia, hypotension and muscle rigidity during surgery with hyperkalemia, acidosis and increased Creatinine Kinase in blood reports are all suggestive of death due to malignant hyperthermia. Hemoperitoneum and hematoma in abdominal muscles were observed by Christiansen and Collins in a case of an autopsy of malignant hyperthermia.⁸

The present case is not only important from the perspective of alleged negligence, but also to rule out the possibility of susceptibility of the relatives of the deceased to such condition. Hence, all the persons who are genetically related to the deceased should be screened out for the susceptibility to malignant hyperthermia by in-vitro contracture test, because the same thing may happen to them also in the future, if they become exposed to anesthetic drugs during the surgery or any invasive procedure.⁹ Intravenous administration of Dantrolene sodium is the drug of choice for the treatment of malignant hyperthermia, along with supportive measures like cold sponging and correction of acidosis with treatment of organ dysfunction. The practical problem in the treatment of such rare diseases in developing countries like India is that the drugs, which are not demanded routinely by the practitioners (like injection Dantrolene sodium) are usually not available in most of the medical stores in the city, or when it is needed in an emergency situation, it becomes almost impossible to administer it within the golden period to save the life of the victim. It is advisable, that anesthetists should keep ready a set of such rare drugs in their bag so that in such emergencies, life of the patient can be saved. The reason of unavailability of drugs in operation theatre may also be argued to the repeated expiry of drugs due to their non use, because such rare diagnosis comes once in a career of the doctor or once in the career of 3-5 doctors, and keeping these rare drugs with them and repeated expiring of it is also not cost effective. The implementation of new formulations of Dantrolene has also been suggested by some authors,¹⁰ while the Gupta, et al¹¹ have observed that the quick clinical diagnosis, ongoing supportive treatment, discontinuation of all the anaesthetic agents and rigorous perioperative monitoring along with oral therapy of dantrolene may provide an answer to the crisis of malignant hyperthermia in the face of an unavailability of the IV dantrolene, which may be the case in many rural and developing health centers.

Conclusion:

Malignant hyperthermia is one of the rare condition, which comes once in a career of the doctor or once in the career of 3-5

doctors, but the knowledge to diagnose it and about its drug therapy can be life saving to a patient in an emergency and also important to avoid the legal complications further by the surgeon and the anesthetist.

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Case Report

A Case of Alleged Acid Attack, Diagnosed as Allergic Contact Dermatitis : Clinical Role of Forensic Medicine

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Abstract:

The incidence of acid attack in India is on the rise despite stringent laws. Such a case is given utmost importance by the law enforcement personnel. However, such a grave allegation must be established clinically by medical examination of the injuries before proceeding further. Here is a case of a middle aged lady who was brought to us with an alleged history of acid attack on her person. The on-duty doctors in the emergency who attended her first did not note the details of her injury and left the police in confusion. Hence, she was brought to the department of Forensic Medicine and Toxicology. Detailed history, thorough examination and previous documents helped us to clearly diagnose it as a case of allergic contact dermatitis to hair dye. Also the victim was found to be on psychiatric treatment. This case once again points out the importance of Clinical Forensic Medicine.

Key Words: Clinical Forensic Medicine, Acid Attack, Allergic Contact Dermatitis, Delusion of Persecution

Introduction:

Vitriolage or Acid Attacks have emerged as the contemporary form of violence which is generally targeted against women with the intention of deforming her face and body and even to kill her. According to a study, 174 cases of acid attacks were reported in India in 2000.¹ A study of Indian news reports determined that 72% of cases reported from January 2002 to October 2010 included female victims.² This has led to formation of stringent laws against such criminals. However, especially in the absence of eye witnesses, medical examination of the injury is essential to prove such allegation. Here comes the role of clinical Forensic Medicine. We present a rare case of what was initially alleged as acid attack and later diagnosed as 'allergic contact dermatitis'.

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Case Report: History-

A fifty years old lady was brought to the department of Forensic Medicine and Toxicology of a Medical College with alleged history of acid attack. According to her, three days back at around 10 pm, when she was resting in her bedroom, two masked persons entered her room and threw acid on her head and face from her right side and escaped. She subsequently attended the Surgery Emergency of the same medical college where she was diagnosed as a case of "superficial burn injury over scalp" and referred to Plastic Surgery OPD (**fig. 1a**). She was also given a ER attendance ticket by the EMO mentioning her history and diagnosis as "superficial burn injury over scalp and middle and right side of forehead" (**fig. 1b**). The following day she was brought to us for examination and opinion.

Examination findings:

On examination we found erythematous, raised lesions with irregular, demarcated margin and evidence of excoriation over

- Anterior half of scalp (**Fig. 2**)
- Right side of face up to angle of mandible in patches (**fig. 3a**)
- Left side of forehead extending 2 cm from hair line (**fig. 3b**)
- A 1cm x 0.5 cm patch lateral to lateral canthus of left eye

- e. Pinna and adjoining area of both sides (fig. 4)
- f. Nape of neck extending from posterior hair line to just below the prominence of 7th cervical vertebra, excepting the area covered by necklace (fig. 5)
- g. 1st palmar web-space of right side (fig. 6).

There was no evidence of any corrosion or ulceration, no eschar formation or sloughing of tissue. The pattern of the lesions showed no evidence of splashing or trickling. Findings were suggestive of severe allergic reaction to some offending agent.

The lady was complaining of pain and itching involving the lesions. On further questioning, she said that she had applied hair dye four days back. She also complained that some persons were after her life ever since she moved to her paternal house 25 years back after losing her husband. It was further learnt that she had been a victim of molestation as a child and had been under immense mental stress as a single mother. Documents produced by the police and her son showed previous episode of "Allergic Contact Dermatitis" to hair dye 6 months back (fig. 7a). We received a two months old Psychiatry OPD ticket of the lady which showed her to be on treatment for depression; also mentioning that she gave a history of someone trying to kill her (fig. 7b).

Discussion:

We will first have a look at the features of the injuries we found on the body of the victim. All the lesions were erythematous, raised, scaly with demarcated, irregular margins and excoriations at places. The victim complained of local pruritus involving the lesions. Contact dermatitis usually manifests as erythema and scaling with relatively well-demarcated, visible borders. The hands, face, and neck are usually involved, although any area can be affected. Allergic contact dermatitis from topical products (e.g., medicines, cosmetics, adhesive tape) often produces reactions with well-demarcated borders.³ Hair dye -in particular, the component p-phenylenediamine (PPD) - may trigger allergic contact dermatitis. Individuals allergic to hair dyes typically develop the most severe dermatitis on the ears and adjoining face rather than on the scalp.

In contrast, acids precipitate protein, producing a coagulation necrosis with a resultant eschar or scab.⁴ The resulting eschars are soft, moist and do readily slough out, as these agents devitalise the tissue and predispose them to infection.⁵ Thus, the features of the injuries, including the pattern of distribution, did not corroborate with the allegation. Together with the history of repeated reaction to hair-dye and application of hair dye recently, they established it to be a case of another episode of allergic contact dermatitis. On further probing, she was found to be on psychiatric treatment for depression. Her orientation and intelligence was normal, however, she was under a firm, false belief that some persons were after her life. Despite being repeatedly explained about the falsity, she could not be made to accept reality. She was diagnosed as a case of 'delusion of persecution'. This can be attributed to her history of a stressed childhood and single motherhood as mentioned above.

Here, we would like to point out that the doctors who first attended the alleged victim lacked expertise and orientation regarding examination of injuries. This could have misled the case. Assessing, documenting and interpreting injuries or scars which have been sustained as a result of trauma or violence is one of the key roles of any forensic physician or forensic pathologist.⁶ The purpose of assessment and documentation is to assist in establishing how the injury was caused- which may often be at issue in Courts of law. Thus, this case establishes the importance of clinical role of forensic medicine experts, which has been overlooked and ignored since long.

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Figure 1a: Surgery emergency ticket.

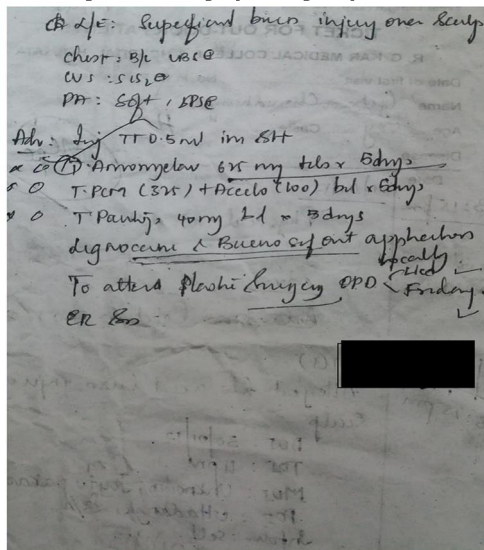


Figure 1b: ER attendance ticket.

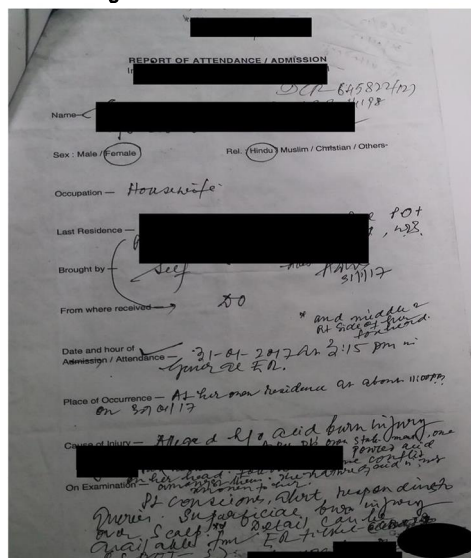


Figure 2: Lesion over scalp.



Figure 3a: Lesion involving right side of face.

Figure 3b: Lesion involving left side of face.



Figure 4: Lesion involving pinna.



Figure 5: Lesion involving nape of neck.



Figure 6a: Lesion involving first palmar web-space of right hand.



Figure 7a: Prescription mentioning past episode of allergic contact dermatitis.

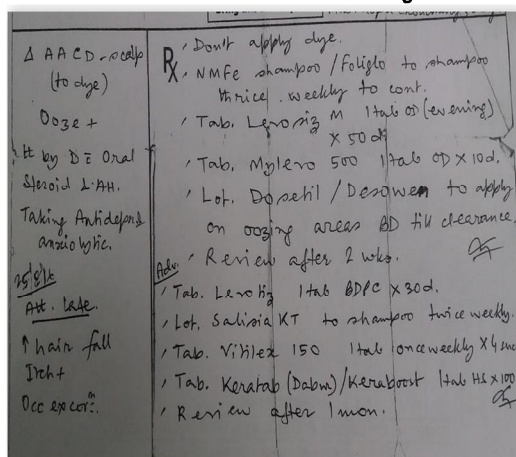
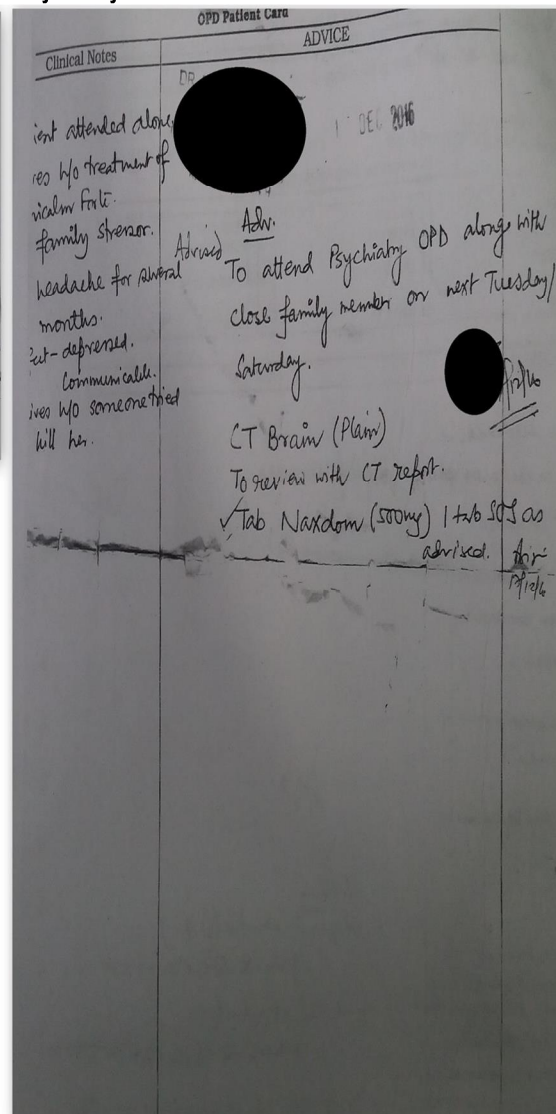


Figure 7b: Past Psychiatry OPD ticket.



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