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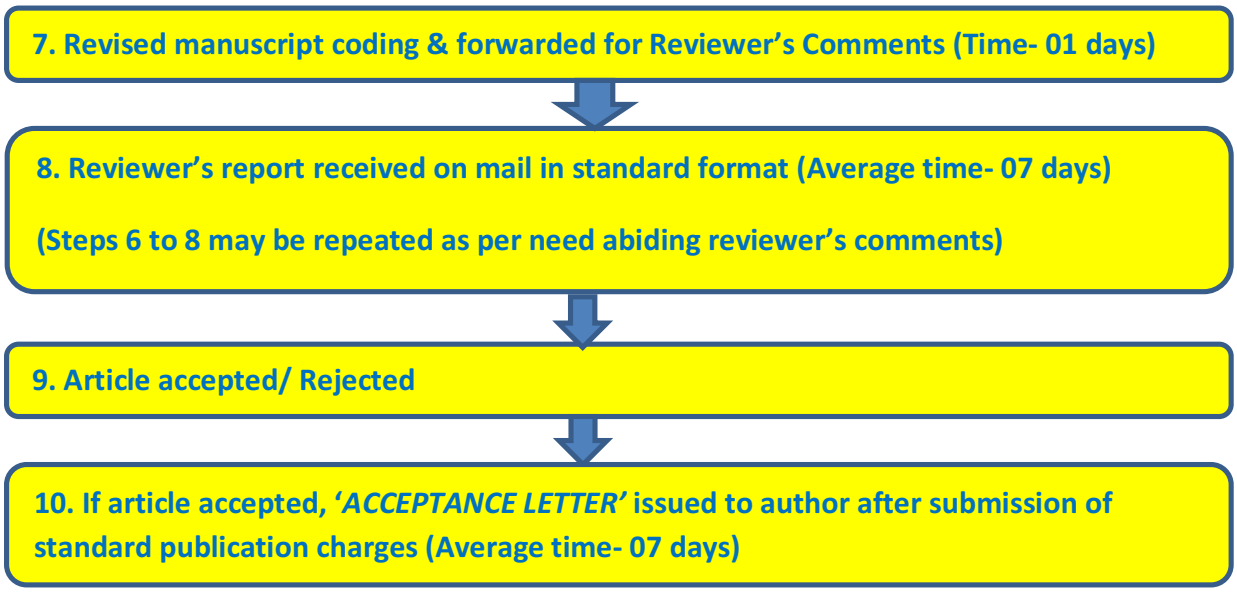

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Editorial

Avenues in Forensic Medicine

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1. Introduction

"Medicine is a science of uncertainty and an art of probability. Absolute diagnoses are unsafe and are made at expense of conscience."
- ***William Osler***.

Forensic Medicine is a medical speciality deals with application of medical and paramedical knowledge to aid in administration of justice. Sometimes it is called as Legal medicine. It broad term used to describe the group of medical specialists dealing with cases of injury, poisoning, sexual crimes, assaults, murder, suicide, accidents, and other forms of deaths related to sudden or unnatural causes. They provides their important information and expert opinion to legal authorities to solve legal problems and deals with the legal aspects of law.[1]

Forensic Medicine is a multi-disciplinary branch deals with various medicolegal services including ante-mortem and post-mortem services. It includes the practices of forensic pathology, forensic toxicology, clinical toxicology[2], clinical forensic medicine[3], forensic psychiatry, forensic radiology, forensic histopathology, forensic entomology, forensic dentistry, etc. At present the forensic medicine services are majorly divided in two main categories such as Clinical Forensic Medicine and Forensic Pathology based on patient's condition. In Clinical forensic medicine, the medicolegal services are provided to the living subjects, whereas Forensic pathology deals with post-mortem medicolegal services and related legal work.[4]

2. Scope of Forensic Medicine

Every medical institutions needs to have a department of Forensic Medicine and Toxicology abiding the norms of National Medical Commission. The faculty attached to the medical institution in this department is having dual responsibilities i.e. responsibilities as a teacher to teach undergraduate & postgraduate students and to execute the necessary medicolegal work of the department/ institution. Abiding the competency based medical education (CBME) undergraduate curriculum, Forensic Medicine and Toxicology subject is being taught in second and third phase of MBBS.[5]

Besides medical institution and tertiary care centres attached to such institutions, there are various Government secondary care institutions/ hospitals including Civil hospitals at district places and Rural healthcare centres/ Taluka-level hospitals providing medicolegal services. The antemortem and postmortem medicolegal services are provided by medical officers in such hospitals.

Also, there are many Multispeciality private healthcare institutions and trust hospitals providing medicolegal services. These services are being provided by Forensic experts, speciality experts or medical officers posted in that hospitals/ healthcare institutions.

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3. Avenues in Forensic Medicine

Considering the wide scope in Forensic Medicine towards executing academic, administrative, medicolegal work and research opportunities, the avenues are categorised under various levels as follows-

a. For students

i. CBME curriculum- Abiding CBME curriculum at present Forensic Medicine & Toxicology is being taught in phase II & phase III of MBBS.

ii. Antemortem Forensics – There is special emphasis given on clinical forensic medicine teaching with hands on experience in practical aspects. Undergraduates need to acquire necessary competence to handle the antemortem medicolegal cases.

iii. Postmortem Forensics – Undergraduate students need to gain appropriate knowledge, skills and competency in conducting a medicolegal autopsy.

iv. Responsibilities during internship- There is compulsory one week posting during internship to get enough hands on experience in practical medicolegal aspects in Forensic Medicine at hospital.

b. For Postgraduate students

i. Postgraduate curriculum- Those who takes admission for post-graduation in Forensic Medicine need to complete the training for three years abiding the NMC and concerned affiliated university guidelines. The postgraduate need to submit a dissertation at the end of course which provide great opportunities to him/her in research field.

ii. Rotary postings – The postgraduate need to complete certain period of rotatory postings in various other speciality departments including a district residency programme (DRP)[6]. It provide great opportunity to acquire interdisciplinary skills.

c. After Post-graduation in Forensic Medicine-

i. Work opportunities – Any postgraduate in Forensic medicine can join senior residency at medical institution abiding availability or join as Forensic expert/ officer/ consultant in various government or private hospitals as needed. After completing one year of senior residency, he/she can join as assistant professor in department of Forensic Medicine in any medical institutions abiding availability of vacancies and may further promoted to Associate professor, Professor, etc.

ii. Academic Opportunities- Postgraduate in Forensic Medicine can further opt for Super-speciality courses like DM Forensic Pathology, DM Forensic Radiology, DM Medical/ Forensic Toxicology. There are various foreign academic opportunities, certificate courses, fellowships or PhD programmes provided by many universities, too.

d. For faculty in Forensic Medicine -

i. Faculty can be further become research guide, PG Guide, PhD guide abiding standard norms of affiliated university.

ii. There are various foreign academic opportunities, certificate, diploma courses, fellowships or PhD programmes provided by many universities.

iii. Various courses related Medical Education Technology such as Basic Curse in Medical Education, Curriculum Implementation Support Programme (CISP), Good Clinical Practice (GCP), Biomedical Research Methodology Course,

iv. Advance Course in Medical Education (ACME), FAIMER (Foundation for Advancement of International Medical Education and Research).

v. Other Opportunities like Faculty development programme, Continued Medical Education (CME), webinars, Conferences of state & national level associations/ medicolegal societies. Career development opportunities, medicolegal expertise services.

vi. Faculty can be a member/ part of various Medicolegal Associations, Journals, Scientific forums.

vii. There are various administrative opportunities like Dean of medical institution, police surgeon, District/ state medicolegal advisor and at medical university position's as Controller of Examinations, Registrar, Pro-Vice- Chancellor or Vice Chancellor, etc.

viii. Research and Publications- At institute level various qualitative, quantitative or mixed research can be conducted. Further the result of such studies with conclusive remarks can be published and copyright or patent can be

registered for concerned intellectual property.

4. Forensic Medicine Services

Currently various different types of medicolegal services are provided at various medical institutions, Government and private hospitals and various centres of excellence for specialised services. These services are as follows-

i. Postmortem Examination of deceased at various Postmortem centres.
ii. Antemortem services under Clinical Forensic Medicine unit.
iii. Giving expert opinion in medicolegal matters to investigating authorities and court of law.
iv. Forensic Histopathological Laboratory Services.
v. Death Audit, Clinical Meet.
vi. Active part in various institutional and other committees like Institutional Ethics Committee, Committee on Adverse Event Following Immunisation, Committee on Prevention of Sexual Harassment at workplace, etc.
vii. Crime Scene investigation.
viii. Poison information centre.
ix. One stop help centres.
x. Cadaver Organ Retrieval Services.
xi. Tele- evidence (E-evidence).
xii. Medicolegal Consultancy- Legal Cell Consultant Firm.
xiii. Disaster Victim Management.
xiv. Dead body preservation- Cold storage services, Embalming, Transportation related certification, Taxidermy, etc.
xv. Humanitarian Forensics- Custodial deaths, Covid 19 Pandemic- dead body disposal, Disaster management, etc.
xvi. Advanced Histopathological Services.

5. Future scope of improvement in Medicolegal Services

Certain other services can be further started and improved at various institutions. These are as follows-

i. Forensic Radiology and Virtual autopsy.[7]
ii. Forensic Psychiatry.
iii. Forensic Anthropology and Forensic Odontology.
iv. Forensic Human Identification Laboratory.
v. Forensic Entomology.
vi. One window system for police and hospital medicolegal documentation services after death.
vii. Forensic Digitalization services.
viii. Mini-Forensic Laboratory attached to Clinical Forensic Medicine unit in Government tertiary care centres.
ix. DNA Laboratory.
x. Forensic Ballistics.
xi. Forensic Document examination services.
xii. Research on recent technological advancement in Forensics.
xiii. Three tier Forensic Services with a special central cadre under Ministry of Family and Health Welfare, Government of India.

There is a great scope in Forensic Medicine. There is need of progressive and innovative upgradations of all such special sectors or divisions of Forensic Medicine and medicolegal services.

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Original Research Article

Analysis of Injury Characteristics in Victims of Interpersonal Violence: Clinical Forensic Medicine Unit Perspective in a Tertiary Care Centre

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Interpersonal Violence, Covid-19, Lockdown, Domestic violence, Clinical Forensic Medicine.

Abstract

Introduction: World Health Organization (WHO) has classified violence under three headings, namely Self-directed, Interpersonal & Collective. Interpersonal violence (IPV) is defined as violence between individuals. **Material & methods:** In this retrospective observational record-based study, data was retrieved from the Trauma Registry of Clinical Forensic Medicine Unit (CFMU) of our institute over a period of 24 months from 01/01/2019 to 30/12/2020. This period of specifically chosen to find out the effect of Covid-19 pandemic-related restrictions on the incidence of IPV. **Results:** The maximum number of injured patients for both genders was in the age group of 21-40 years and 83(64.34%) out of 129 injured male patients were in this particular group. Out of a total of 31 female patients, 20 (64.51%) were in the age group of 21-40 years. **Conclusion:** There was no significant change in the number of male victims subjected to IPV with known assailants, as far as the lockdown is concerned. However, a reduction in the number of such female victims was noted.

1. Introduction

The intentional use of physical force or power, threatened or actual, against oneself, another person, or against a group or community, that either result in or have a high likelihood of resulting in injury, death, psychological harm, mal-development, or deprivation is defined as violence.[1]

World Health Organization (WHO) has classified violence under three headings, namely Self-directed, Interpersonal & Collective. Self-directed violence is defined as what people inflict upon themselves, such as suicidal behaviour and self-mutilation. Whereas, collective violence refers to instrumental violence inflicted by larger groups such as nation-states, militia groups and terrorist organizations to achieve political, economic or social objectives.[2] Interpersonal violence (IPV) is defined as violence between individuals.

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IPV is the violence that occurs between family members, intimate partners, friends, acquaintances and strangers, and includes child maltreatment, youth violence (including that associated with gangs), violence against women (for example, intimate partner violence and sexual violence) and elder abuse.[2] The emergency department (ED) is the first place to report such cases and WHO has thus recommended that the data should be collected from the ED in cases of IPV to study the morbidity or mortality.[3]

As per the National Crime Records Bureau India (2019) report, there has been a rise in cases of bodily hurt from 38.4% in 2017 to 40.7% in 2019. Whereas, in Chhattisgarh, a total of 18412 cases of bodily hurt were reported with a rate of 63.8 cases/lakh population. Out of those cases of bodily hurt, the victim was female in 1054 cases with a rate of 7.3/ lakh population.[4] Forensic medicine experts working in the Clinical Forensic Medicine Units (CFMU) in the hospital examines injured patients and prepare medicolegal records. Medicolegal documentation involves gross details of the type, size and shape of the injury, condition of the patient and injury severity helps in the determination of the nature of the injury as well as the weapon associated with it. Hence, the present retrospective study was planned to find out the pattern of injuries in the victims of IPV with an analysis of socio-demographic factors in victims as well as assailants.

2. Methodology:

In this retrospective observational record-based study, data was retrieved from the Trauma Registry of CFMU of our institute over a period of 24 months from 01/01/2019 to 31/12/2020. We included this specific period to find out the effect of Covid-19 pandemic-related restrictions on the incidence of IPV. The study period had two parts; Pre Covid-19 period in India from Jan 2019 to Feb 2020. A phase of Covid-19 related lockdown down period during 1st Covid-19 wave from March 2020 to Dec.2020.

A detailed description of injuries and other demographic data was collected from the case record file of each patient from the medical records department in pre-validated case record proforma. All the medicolegal cases of IPV were examined by the doctors in CFMU and written informed consent of the patient was accorded at the time of the examination. All the medico-legal case file of the patient is submitted to the medical record division of the institute as per standard protocol.

We screened a total of 216 patients of IPV irrespective of their gender brought for examination to the CFMU. Brought-dead cases of trauma, and patients of other traumatic injuries e.g., road traffic accidents, fall from height, and accidental and deliberate self-harm injuries were excluded. Non-consenting patients (children and adults) were also excluded.

3. Observations & Results:

A total of 216 cases of IPV were brought to our hospital during the 24 months-defined study period. Out of these 216 cases, medical records were either incomplete or not traceable in 56 (25.92 %) cases which brings our sample size to 160 cases of IPV. Amongst the 160 victims of IPV, 32 (20%) patients were hospitalized and received multidisciplinary treatment and no death was reported. The maximum number of patients were male 129 (81%), whereas female patients constituted only 31 cases. The maximum number of injured patients for both genders was in the age group of 21-40 years and 83(64.34%) out of 129 injured male patients were in this particular group. Out of a total of 31 female patients, 20(64.51%) were in the age group of 21-40 years. **(Table 1)**

Table 1: Age Group-Wise Distribution of Cases

Age Groups (Years)	Male	Female	Total
0-20	19	4	23
21- 40	83	20	103
41-60	20	7	27
>60	7	0	7
TOTAL	129	31	160

In the current study maximum incidents of IPV were encountered during the night hours. 68.75% (110) victims sustained injuries in outdoor attacks with the male preponderance of 94.5%. Whereas, females were the victims of indoor physical violence amounting to 52% of cases **(Table 2)**. In the present study 84(52.5%) victims were assaulted by perpetrators known to them and in 76 cases attackers were strangers.

Regarding substance abuse, a history of alcohol consumption at the time of the assault was found in 44 (56.81%) assailants known to the victim. Females were the commonest victim (35 cases) of violent abuse when the perpetrator was known and addicted to alcohol. The majority (51.87%) of the victims belonged to the low socio-economic strata.

Table 2: Demographic details of the cases.

S.No.	Criterion	No. of cases
1.	Time of Incidence • Day • Night	 58 102
2.	Place of Incidence • Outside the House • Indoor (inside the house)	 110 50 (M: 24, F:26)
3.	Type of Assailant • Known to the victim • Unknown to the victim (Stranger)	 84 76
4.	Socioeconomic status • Low income • Middle Income	 83 77
5.	Substance Abuse • Known Assailant (h/o consumption of Alcohol)	 44/84 (M: 25, F: 19)

***M- Male, F – Female**

Blunt force impact causing laceration was the commonest injury encountered amounting to 43.12%, followed by contusion at 31.87% and abrasion at 27.5% **(Table 3)**. The most commonly injured site was the head and neck, followed by the upper extremities and anterior aspect of the trunk **(Table 4)**. Of 34 injured patients,19 had incised wounds and in 15 cases stab wounds, indicative of the use of sharp pointed weapons **(Table 3)**. In the 19 cases, the assailant was known to the victim.

Table 3: Type of Injuries in various cases

Injury Type	Number of cases (N)
Abrasion	44 (27.5%)
Contusion	51 (31.87%)
Laceration	69 (43.12%)
Incised	19 (11.87 %)
Stab	15 (9.37 %)
Fracture	5 (3.12%)
Chop	1 (0.62%)

Table 4: Site of injury

Injured Site	Number of cases (N)
Face	27 (16.87%)
Upper Limb	23 (14.37%)
Anterior Trunk	12 (7.5%)
Posterior Trunk	4 (2.5%)
Lower Limb	7 (4.37%)

We studied the incidence of IPV during the Covid-19 pandemic as the study period falls within the pandemic-related lockdowns announced by the Union and State government to contain the spread of the virus at different intervals. During this period people suffered the loss of income, personal grief due to the loss of their dear ones along with mental agony due to strict restrictions. Hence, we categorised the cases into two groups. Group 1: Pre-Covid 19 before the announcement of the first national lockdown, Group 2: Actual period of lockdown as the COVID-19 Lock down period. A total of 97 cases (Males 74, females 23) of IPV have presented in the institute before the lockdown and 63 cases (males 55, females 8) during the lockdown phase. Whereas, male patients constituted the maximum number of injured IPV cases irrespective of lockdown. However, there was an actual fall in cases of IPV against the woman during the period of lockdown (n=8) **(Table 5)**.

Table 5: Type of assailants involved in IPV on female

Group	(N)	Type of assailant		
		Known to Victim		Unknown to the victim
		Husband	Other Family member	
Pre Covid-19 Period	23	12	9	02
Covid 19 Lock down Period	08	4	4	00
Total	31	16	13	02

Among the total females who sustained injuries due to IPV (31 patients), intimate partner violence (16 cases) followed by physical abuse by other family members (13 cases) was common **(table 5)**. There was a slightly increased use of sharp/ pointed objects as a weapon for causing physical injury during the lockdown period in 18 (25.39%) out of 97 cases as compared to pre lockdown period 16 (18.5%) out of 63 cases.

4. Discussion:

We excluded 56 cases out of 216 cases of IPV due to incomplete documentation or missing records. Miscoding leading to incomplete data in cases of IPV is not infrequent.[5] Hence, the proper policy framework is a must in documentation and record keeping in medicolegal cases. In our study, 81% of patients were male as compared to females (19 %). Concurrent findings were noted by Wright J et al. and Hazra et al.[3] Maximum number of injured patients for both genders was in the age group of 21 to 40 years (64.34% of male and 64.51 % of female patients). Comparable findings were noted in previous studies.[3,6,7] Gul H et al.[8] in their study noted that mean+/- S.D. the age of women who were physically abused was 38.7+/- 9 years. Sharma R et al.[9] found a significant correlation between the violence-related behaviour in adolescents and male gender, lower age,

number of close friends, copying role models who smoke or drink and those who reside in resettlement colonies, slums and villages. We found that the majority (51.87%) of the victims belonged to the low socio-economic strata.

We noted the maximum incidence of IPV during night hours similar to the findings of the previous studies by Tingne et al.[7] and Hazra et al.[3] Our, 68.75% of victims sustained injuries in outdoor attacks with a male preponderance of 94.5%. Whereas, females were the victims of indoor physical violence amounting to 52% of total cases. Consistent with the findings noted by Tingne et al.[7] 52.5 % of patients were assaulted by known perpetrators; similar to the earlier studies.[3,7] Males are breadwinners for the family and are mostly engaged in outdoor activities in this part of the world, hence most vulnerable to interpersonal conflicts as documented in the previously reported study by Sharma R et al.[9]

We found that 51.61% (16) female patients were victims of intimate partner (husband) violence and in 13 cases other family members were the perpetrator. Surprisingly only in 2 cases assailants were not known to the victim. Hofner et al.[10] described that 60 % of their female patients were victims of IPV in indoor settings. Baena MD et al. noted that 42.7% of women were assaulted by a partner,41.1 % by an unknown person and by both in 16.2 % of cases.[11] However, Gul H et al.[8] found intimate partner physical violence only in 19 % of their cases. Females are more likely to be attacked by a single person known to them at home.[5]

During the Covid-19 lockdown period, there was an actual fall in the incidence of IPV against females from 23.71% before the lockdown to 12.6% after the enforcement of strict lockdown. However, the pattern of intimate partner violence remains unchanged. Alcoholism at the time of the assault was found in 44 (56.81%) assailants known to the victim and females were the commonest victim (35 cases) of violent physical and verbal abuse after indulging in alcohol. The integrative review by Carvalho AP et al.[13] included 19 studies and showed that alcohol consumption is the predictor of physical violence in the perpetrator and for the adolescent victim of the violence. Lim KHA et al.[12] found that majority of the victims of IPV presented to the emergency department had a history of alcohol intake. Blunt force or impact injuries (lacerations at 43.12%, contusion at 31.87% and abrasion at 27.5%) were the commonest in the patients of IPV in the current study. In most of the cases, a combination of injuries was noted. The most commonly injured site was the head and neck. Of 34 injured patients,19 had incised wounds and in 15 cases stab wounds, indicative of the use of sharp pointed weapons.

Concurrent findings were noted by Hazra et al.[3] showing laceration to be the most commonly noted injury. Subba et al.[6] and Tingne et al.[7]showing the head and neck to be the most commonly affected area. Whereas, Lim KHA et al.[12] found that single-punch head injuries were commonest amongst the non-indigenous male victims of IPV. We did not have a single case of IPV using firearms, this is contrary to the finding of Hsu HT el. they found increased use of firearms by adolescents in physical violence.[14] We noticed a relative fall in incidence reporting of IPV from 97 cases to 63 cases before the implementation of the lockdown and after the state-announced strict Covid-19 lockdown period, respectively. Interestingly violence by the known perpetrators using domestic objects like kitchen knives, screwdrivers, forks, scissors etc. had increased to 25.39% during the lockdown phase from 18.5% before the lockdown. Levandowski ML et al.[15] reported a 54 % drop in reporting of cases of violence against children and adolescents in the year 2020 during the Covid-19 Pandemic. They concluded that the under-reporting may be due to social distancing.

We disagree with the authors about the possibility of under-reporting of IPV during the lockdown in the Indian context. Because most of the victims of IPV were physically injured in outdoor violence. India was one of the countries in the world which had strictly implemented a Covid-19 lockdown along with social distancing norms. There has been a severe psychological impact on the masses due to the mortality and morbidity caused by COVID 19 disease.[16]

Hence, the actual fall in cases of IPV during the lockdown period might be due to the restricted and lesser mobility of people outside their homes and legally binding social distancing norms, which led to lesser exposure to situations of IPV.

5. Conclusions:

Male young adults, addicted to alcohol, and engaged in outdoor work are the most commonly involved in IPV. Females are victims of intimate partner violence by husbands and physical abuse by

other family members at home and they fear seeking any help due to social stigma and apprehension of further violence. We found that there was an actual fall in the incidence of IPV during the Covid-19 pandemic lockdowns.

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Original Research Article

Estimation of Stature from Bigonial Breadth in Population of Western Maharashtra

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Key words
Stature estimation, Anthropometry, Bigonial diameter, Regression analysis.

Abstract

Introduction: Establishing personal identity is the top priority in crime scene investigation mainly when body is mutilated, decomposed and in persons who are found missing. When it comes to the accuracy and dependability of the estimate, regression analysis is the most reliable way**.** It is increasingly acknowledged that there is a direct correlation between a person's height and other body parts such as the head, trunk, and upper and lower limb lengths; bigonial breadth also like other areas of the body has a clear biological relationship with stature. **Material & Methods:** The present study is a cross sectional study conducted in Forensic Medicine department with 278 medical students included as the study population. Bigonial diameter and stature were measured. **Results:** In our study it was observed that mean height, bigonial diameter were higher in males than in females. Correlation between bigonial width of the mandible and height among men was shown to be statistically significant ($p< 0.05$). Among women, bigonial width presented a weak statistically significant correlation with height. We also established regression equation for both sexes. **Conclusion**: Bigonial diameter can be used for estimation of stature with less accuracy rate when cephalo-facial remains are brought for forensic examination.

1. Introduction

Establishing identity is essential in civil and criminal cases for the living, recently deceased persons, decomposed bodies, mutilated remains, and persons who are found missing.[1]

When intact bodies are being inspected, estimating stature is not difficult. When forensic pathologists are working with dismembered human body parts as in natural or man-made mass casualties like earthquakes, tsunamis, cyclones, floods, aviation accidents, terrorist activities, fire accidents, homicide, however, the task becomes considerably more difficult.[2]

When it comes to the accuracy and dependability of the estimate, regression analysis is the most reliable way**.** It is increasingly acknowledged that there is a direct correlation between a person's height and other body parts such as the head, trunk, and upper and lower limb

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lengths, bigonial breadth, like other areas of the body, has a clear biological relationship with stature.[3,4]

Anatomists, anthropologists, and forensic medicine professionals have always been fascinated by determining a person's height from measurements of various body parts. It has been presumed that each race requires its own finding for stature estimation because of climatic, ethnic, and dietary variations.[5] Hence, results of studies done in one population cannot be applicable to other populations entirely. Considering this fact, the present study was undertaken and the aim of the study is to derive regression formulae to predict the height of an individual using bigonal breadth and to study gender differences between stature and bigonal breadth.

2. Material and Methods

This cross-sectional study was conducted after obtaining permission from the institutional ethics committee. Written informed consent was obtained before collecting the measurements. The study was done among a total of 278 MBBS undergraduates (144 males and 134 females) between the age 20-25 years. All adults who are healthy and without any pathological fractures, developmental disturbances of the mandible, inflammation of the face, traumatic injuries, and surgery were included in the study and those with previous history or clinical signs of orthodontic or orthognathic therapy, head trauma or surgery and Individuals suffering from chronic illness, endocrine disorders, deformities of foot, lower limbs (Knock-Knee), and vertebra column (Scoliosis, Kyphosis) were excluded from this study. The instrument used for the study was digital vernier calliper for measurements of bigonial diameter and stadiometer for measurement of stature. After suitably explaining the subjects about the study, its procedure and after obtaining informed written consent, the subjects were asked to stand straight on a stadiometer and then their stature was measured from vertex to floor with the head in the Frankfurt horizontal plane.

Bigonial diameter - The maximum breadth of the lower jaw, between two gonion points (gonion is the most posterior, inferior and laterally situated point on the angles of the mandible) on the angle of mandible was taken with the help of digital vernier caliper.

All measurements were taken in centimeters. To minimize subjective errors all measurements were taken three times and then the mean was taken. After collection of data these were evaluated and analyzed with SPSS software 20. Data was subjected to descriptive statistics (mean, standard deviation) and then Karl Pearson correlation test was used for finding the significance of correlation between the stature and bigonial diameter in both males and females. A linear regression equation was developed for calculation of stature using bigonial diameter for males and females.

3. Results

278 subjects participated in this study, out of which 144 were males and 134 were females. The age of the study participants ranged from 18-23 years. The mean age for males was 19.82 years whereas for females it was 19.21 years. The mean stature for males and females was found to be 170.90 ± 6.97 cm and 157.28 ± 6.00 cm respectively. The mean values of bigonial diameter for males and females was found to be 11.3 cm ± 0.84 cm and 10.90 ± 0.96 cm respectively. It was observed that the mean height, bigonial diameter were higher in males than in females **(Table 1)**. Correlation between height and the bigonial diameter was found out by calculating correlation coefficient.

Table 1: Descriptive statistics in total subjects

Parameter	Sex	Mean	SD	Range
				Minimum-Maximum
Bigonial diameter	Males	113.71	8.47	138.13 - 168.89
	Females	109.06	9.66	142.2 - 165.62

The Pearson correlation test showed that there is a significant correlation between male bigonial diameter (p value 0.02) and stature, however in females there is no significant statistical correlation between female bigonial diameter and stature (p value >0.05) **(Table 2)**.

Table 2: Pearson Correlation Coefficients Between Stature and Bigonial diameter in Males and Females

Measurements	Sex	r*	p- value
Bigonial diameter	Males	0.191279	0.02
	Females	0.049744	0.57

*r: Pearson correlation coefficient

After finding a positive correlation between the bigonial diameter and stature, regression analysis was done for the estimation of stature in both males & females. To calculate regression equations the values of constants “a” and “b” (regression coefficient of the dependent variable and independent variable respectively) were calculated. Then, the stature was calculated. **Table 3** shows standard error of estimate.

Table 3: Regression Equations for Estimation of Stature from Bigonial diameter in Males and Females

Regression Equation		Standard Error of Estimate (SEE)	
Males	Females	Males	Females
Height= 153.50+0.15(BD)	Height = 153.90+0.03(BD)	7.78	5.92

Table 4: Studies showing comparison of mean values and p values of Bigonial diameter of present study with the mean and p values of previous studies

Sr. No.	Authors	Study population	Mean Bigonial diameter		P value	
			Male	Female	Male	Female
1	Present study	Maharashtra	11.37	10.90	0.02	0.57
2	Kumar& Gopichand[14]	Haryanvi Bania Population	11.45	10.33	0.0009	0.016
3	Shah et al[6]	Gujarati Population	10.38	8.79	< 0.05	< 0.05
4	Agnihotri et al[13]	Indian-Mauritian	10.55	9.90	0.85	0.17
5	Sahni et al[12]	Northwest Indian Population	10.64	10.26	0.20	0.29
6	Krishan and Kumar[15]	North Indian Kolis	8.34	-	<0.001	-
7	Krishan[10]	North Indian gujjars	9.73	-	<0.001	-
8	Yadav et al[16]	Uttar Pradesh	9.91	9.04	< 0.05	-
9	Varghese et al[17]	South India	11.62	9.89	<0.0001	<0.0001

4. Discussion

Determination of the biological profile of a victim or suspect in forensics and crime scene investigation is a top priority. Estimation of stature from measurements of long bones, foot length, and hand length has been tried by many researchers. Since everyone's growth is influenced by many factors as mentioned above producing differences in skeletal proportions, it is important to know such differences in different regions and races. Further, when only few body parts are available, an estimate of height then must be made based on relationship of body parts with the stature. In this respect, stature is one of the parameters with great importance in creating the biological profile. The estimation of stature from skull bones alone can be a challenging task. Inadequate body height data along with cephalo-facial measurements is one of the hurdles faced in computing the stature estimation formula. Bigonial diameter can be utilized for the approximation of stature when facial remains are brought for medicolegal examination.

In our study, the means for all the variables used were shown to be higher among males than among females. Similar results were obtained by Shah et al[6] and by Patil and Mody[7] in a lateral cephalometric study on adults in central India. In our study correlation between the bigonial width of the mandible and height among men was shown to be statistically significant ($p< 0.05$). Among women, the bigonial width presented a weak statistically significant correlation with height, similar to the values found by Shah et al.[6] A comparison of mean values and p values of Bigonial diameter of present study with the mean and p values of previous studies is shown in **Table 4.**

In study conducted by Aragao et al[8] on Brazil population, it was observed that mean bigonial diameter showed statistical significance in males but in females there was no statistical significance as seen in our present study. In a study on Sudanese Arab students, Ahmed and Taha[9] reported that the highest correlation coefficients between cephalofacial measurements and height was related to the bigonial width and in another study conducted by Krishan[10] on a sample of 996 adults Gujjars in northern India indicate that all the variables used presented positive correlations with height, with correlation coefficients ranging from 0.455 to 0.781, but in our study there was a correlation between height and bigonial diameter in males and in females there was no correlation.

In a Turkish population, Pelin et al[11] sought to evaluate the correlation coefficients between cephalofacial anthropometric variables and height, according to different types of head and different

types of face. They found that these variables were not good predictors for estimating height. Sahni et al[12] also found low correlation coefficients between facial variables and height as observed in our study in females. Agnihotri et al.[13] observed that in the Indo-Mauritian population the cephalo-facial dimensions are not good predictors for estimating stature. Subsequent studies conducted by Kumar and Gopichand[14] on 800 male & female Haryanvi Bania Population, Krishan and Kumar[15] on North Indian Kolis, Yadav et al[16] on North Indian population, Vargehese et al[17], Kulkarni et al[18] and on South Indian population, Ilayperuma[19] on Sri Lankan population, Akther[20] and Zakia A et al[21] on Bangladesh population, Ewunonu and Anibeze[22] on South-Eastern Nigerian population, Jibonkumar et al[23] on Manipur population, Mansur D[24] on Nepal population indicate that there is positive correlation between stature and bigonial diameter. But Ekezie et al[25] mentioned that the Bigonial diameter did not show any positive correlation with stature in Igbos (South Eastern Nigerians).

5. Limitations

This study has been conducted on medical students of western Maharashtra. Hence, the studies in rest of the country and on diverse ethnic group are needed to verify whether the bigonial diameter can be used for estimation of stature elsewhere.

6. Conclusion

Bigonial diameter in our study is significantly associated with height in males however Pearson correlation coefficient (r) of 0.19 shows that only 3% variation in heights can be explained with variation of bigonial diameter. Hence bigonial diameter cannot be independently used for prediction of height. We also established the regression equation for both sexes. Therefore, it can be concluded that, like other parts of the human body, bigonial diameter can also be used for estimation of stature with less accuracy rate when cephalo-facial remains are brought for forensic examination. While applying linear regression formulae, one should keep in mind that these are population specific; these cannot be used on other populations of the world.

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Original Research Article

Dermatoglyphics of Medical Students of a Tertiary Teaching Hospital in Srikakulam District, Andhra Pradesh.

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Dermatoglyphics,
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Abstract

Introduction: A study to explore the association between fingerprint patterns, gender, and blood group types was carried out among medical students of GMC, Srikakulam, Andhra Pradesh with an objective to explore various fingerprint patterns, analyse and classify fingerprint patterns on individual digits, study the association between fingerprint pattern and gender, and determine any predominance of a particular pattern among different blood group types. **Material & Methods:** A total of 1320 fingerprints from 132 subjects were collected using stamp pad, printers' ink, and other tools. The collected data, including gender, blood group type, and fingerprints of all ten fingers, were analysed using statistical software. **Results:** Loops were the most common fingerprint pattern, followed by whorls, arches, and composite patterns. Ulnar loops were more prevalent in both males and females. The frequency of whorls was higher in females, contrary to previous studies. The association between fingerprint patterns and blood group types revealed varying distributions among different blood groups. The study also found a significant association between the right-hand ring fingerprint and gender as well as blood group type. **Conclusion:** Gender and blood group type may complement fingerprint patterns for identification purposes. The significant associations found in this study were limited to the right ring finger, and further research on a larger sample size is required to confirm the findings for other fingers.

1. Introduction

Dr Edmond Locard famously known as the "Sherlock Holmes of France" is well-known for his Locard's Principle of Exchange.[1] He stated that "every contact leaves a trace." Fingerprinting techniques were developed based on this principle. Dermatoglyphics is the study of fingerprint pattern

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of fingers, palm, and soles. The term was first coined by Harold Cummins in 1926. Fingerprint is an impression of the epidermal ridges of the bulb of finger.[1]

Fingerprint remains ubiquitous throughout life and forms the most reliable criteria of identification. The pattern makes their appearance as early as 10 weeks of intrauterine life. Various patterns like loop, Arch, Whorl and Composite were recognized worldwide and are in practical use. Literature shows, Loop as the most common pattern among all four (60-70%) and Composite is the least common type (1-2%). Whorls form 25-30% and Arches constitute 6-7%. Though the average distribution of different fingerprint patterns is known worldwide, published literature on the distribution of fingerprint patterns on individual digits are very few[2,3] and no such study was ever conducted in Srikakulam district of Andhra Pradesh.

Fingerprints have long been used as a reliable means of identification, due to their uniqueness and stability throughout a person's lifetime. Recent studies have suggested that there may be potential correlations between certain fingerprint patterns and individual characteristics such as gender and blood type.

The potential correlations between fingerprint patterns and individual characteristics such as gender and blood type are important to explore in order to improve the accuracy and effectiveness of fingerprint identification in forensic investigations. Several studies have investigated the association between fingerprint patterns and gender and blood group type, with some suggesting that certain patterns are more prevalent in males or females and certain blood group types. However, other studies have reported conflicting results, and these findings have not been consistently replicated in other studies indicating a need for further research to better understand the relationship.

A better understanding of these relationships could have important practical applications, such as helping to identify potential suspects or narrowing down the pool of potential suspects in criminal investigations. An attempt was made in this study to explore and understand these associations.

2. Objectives:

i. To explore various fingerprint patterns among final year part I MBBS students of GMC, Srikakulam.
ii. To analyse and classify fingerprint pattern on individual digits
iii. To study the association between fingerprint pattern and gender of an individual.
iv. To determine any predominance of a particular pattern among different blood group types.

3. Methodology

Study design: Cross-sectional study

Population & Setting: Final year part I MBBS students of GMC, Srikakulam, Andhra Pradesh.

Study period: May 2023.

Inclusive criteria: final year part I MBBS students of GMC, Srikakulam

Exclusion criteria: Students suffering with any medical or surgical conditions affecting the fingerprint, students with any scars on finger bulbs which will hamper the collection and analysing the fingerprint and students not willing to consent for the study are excluded from the study.

Sample size: 1320 finger prints of 132 subjects.

Study Tools: Stamp pad, Printers ink (Black), Torch. Magnifying lens, Data collection sheets, Data analysing software (SPSS 16).

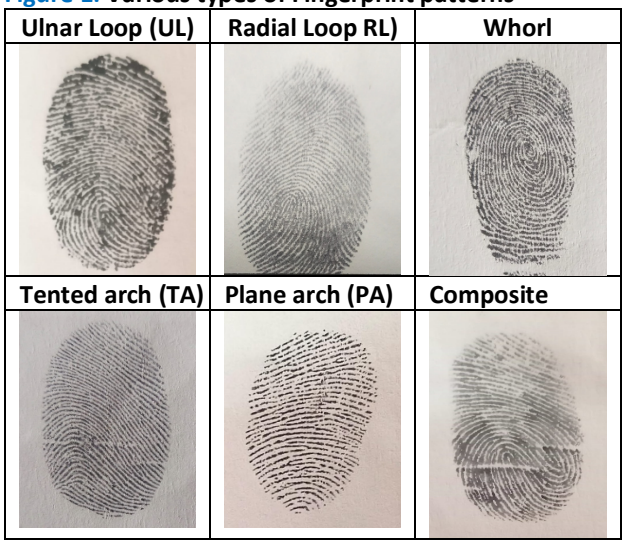
Method of data collection*:* Institutional ethics committee of GMC & GGH, Srikakulam, approval was obtained (Approval Certificate no: IEC23/GMC&GGH/SKLM/170523/40). Written informed consent is obtained before collecting the fingerprint from individual study participants. All the researchers involved in the study were trained in the dept of FMT, GMC, Srikakulam in collecting, analysing, and classifying the fingerprints. The researchers were trained by collecting and reviewing fingerprints of random samples in the department. Data collection sheets are designed to collect the gender, blood group type and finger print of all ten fingers. Everyone is assigned a unique code for future reference. The study participants were instructed to clean the bulb of finger with soap and water to remove any dirt particles. The bulb of finger is allowed to dry before application of ink. Ink is spread on the bulb evenly and the study participant were instructed to press the finger gently on data collection sheet. The researcher would ensure the appropriateness of the fingerprint. All prints which are smudged or inappropriate were repeated. Similar procedure was followed for all ten fingers of each individual. A total of 1320 fingerprints were collected within the study period. All fingerprint patterns were classified as per study definitions described below. To

minimize the inter-observer and intra-observer bias, certain patterns were randomly classified by all researchers with the help of unique code assigned.

Data Analysis: The collected data entered into Microsoft excel sheet and analysed with statistical software SPSS 16. Appropriate statistical tests were performed to achieve the study objectives.

Study Definitions: Sir Francis Galton classified different fingerprint patterns. Fingerprint patterns were classified into four types based on the presence of a core and delta. A core is a ridge that curves back on itself, while a delta (or triradius) is formed by the convergence of ridges from three directions. An arch pattern is characterized by the absence of both core and delta. A loop pattern is defined by the presence of one core and one delta. A whorl pattern has no core and two deltas. Composite patterns are a combination of two or more of these types. [4]

Figure 1: Various types of Fingerprint patterns



All prints will be analysed by all the researchers and classified as follows **(Figure 1)** -

a. Loops are the most common fingerprint pattern, accounting for approximately 67% of all fingerprints. They are characterized by ridges that enter from one side, curve around, and exit from the same side, with a single core and delta. Loops are further divided into two types: radial loops (RL) where ridges enter and exit from the radial side, and ulnar loops (UL) where ridges enter and exit from the ulnar side.
b. Whorls are the second most common fingerprint pattern, comprising approximately 25% of all fingerprints. Whorls are characterized by ridges that make a complete 360° circuit around the centre of the print, with two deltas.
c. Arches are the least common fingerprint pattern, accounting for only 7% of all fingerprints. They do not have a core or delta and are further divided into two types: plain arches (PA) where ridges enter from one side, rise to a slight bump, and exit out from the opposite side, and tented arches (TA) which are similar to plain arches but have ridges that stand at an angle of 45° or more.
d. Composite fingerprints make up only 1% of all fingerprints and are a mixture of two or more of the above fingerprint types in a single print.

Gender and blood group type of the study participants are also collected on a data sheet along with the fingerprints. The data were analysed for distributions of fingerprint patterns and correlations if any among various study variables.

4. Results

Sixty five percent of study participants are females and remaining 35% are males. Among 132 study participants 60 (45.5%) were O+ve blood group followed by 33(25%) of B+ve blood group. Thirty students (22.7%) were of A+ve blood group. AB+ve & O-ve blood group constituted 3%. A-ve blood group participants were 1(0.8%). No study participants belonged to B-ve and AB-ve blood groups **(Table 1 & 2)**.

Table 1: Distribution of gender

Gender	Frequency	Percentage
Female	85	64.4%
Male	47	35.6 %

Table 2: Distribution of Blood group types

Sex	A		B		AB		O		Total
	Rh+	Rh-	Rh+	Rh-	Rh+	Rh-	Rh+	Rh-	
M	10	0	15	0	1	0	19	2	47
F	20	1	18	0	3	0	41	2	85
T	30	1	33	0	4	0	60	4	132

M- Male, F- Female, T- Total.

Table 3: Distribution of patterns

Pattern	Frequency	Percentage
Loops	810	61.363 %
Whorls	397	30.075%
Arches	98	7.424%
Composite	15	1.136%
Total	1320	100 %

Table 3 shows maximum (61.36%) number of fingers print patterns are loops followed by whorls (30.07%), arches (7.42%) and composite (1.13%). Ulnar Loops are most seen in both males and females (17.87% and 39.92% respectively). Composite being the least with 0.76% in males and 0.37% in females **(Table 3 & 4)**.

Ulnar Loop has shown highest frequency in all the blood group types. Highest percentage of Ulnar Loops are present in O+ve (27%) followed by 13.5% in B+ve, 13.4% in A+ve.

Table 4: Patterns distribution among males and females

Sex	Loops		Arch		Whorl	Composite	Total
	UL	RL	PA	TA			
Male	236(17.87%)	19(1.43%)	9(0.68%)	12(0.90%)	184 (13.93%)	10 (0.75%)	470
Female	527(39.92%)	28(2.12%)	41(3.10%)	36(2.80%)	213 (16.13%)	5(0.37%)	850
Total	763	47	50	48	397	15	1320

Table 5: Patterns distribution among blood group types

Blood Group	Loops		Arch		Whorl	Composite	Total
	UL	RL	PA	TA			
A+	177 (13.40%)	18 (1.36%)	14 (1.06%)	14 (1.06%)	73 (5.53%)	3 (0.22%)	299
A-	7 (0.53%)	2 (0.15%)	0	0	01 (0.07%)	0	10
B+	178 (13.48%)	13 (0.98%)	17 (1.28%)	8 (0.60%)	108 (8.18%)	6 (0.45%)	330
B-	0	0	0	0	0	0	0
AB+	33 (2.5%)	1 (0.07%)	1 (0.07%)	0	5 (0.37%)	0	40
AB-	0	0	0	0	0	0	0
O+	355 (26.89%)	11 (0.83%)	15 (1.13%)	23 (1.74%)	191(14.46%)	6(0.45%)	601
O-	15 (1.13%)	1 (0.07%)	3 (0.22%)	4 (0.30%)	17 (1.28%)	0	40

Table 6: Association between fingerprint and gender and Blood groups

Association between fingerprint and gender				Association between fingerprint and blood groups		
	Value	df	p value	Value	df	p value
Pearson Chi Square	16.86	4	0.002	1.438E2	20	0.000
Likelihood ratio	18.56	4	0.001	22.92	20	0.293
Linear –by –linear Association	14.32	1	0.000	0.006	1	0.940
Phi	0.35		0.002	1.044		0.000
Crammer's v	0.35		0.002	0.52		0.000

The second most frequently seen pattern is whorls in all the blood groups. Among Arches Tented Arches are with higher frequencies in O+ve and A+ve blood groups; Plane Arches are with higher frequencies in, B+ve, O+ve & A+ve and least in O-ve & AB+ve blood groups. Arches were not observed in A-ve blood group. Composites are the least with 1.1% frequency. **(Table 5)**. **Tables 6** show a statistically significant association between right hand ring fingerprint and gender and blood group type. (p=0.002 & 0.000 respectively).

5. Discussion

The results of our study are in accordance with the studies done by Chandra Sekhar V *et al* 2020[5], Iju Shrestha *et al* 2019[6], and followed the general pattern with loop being the predominant type followed by whorl and arch patterns. Ulnar loop pattern is more common compared to radial loop pattern in our study similar to the studies done by Iju Shrestha *et al* 2019.[6] Frequency of loops were higher in both males and females similar to the study done by Chandra Sekhar V *et al* 2020.[5] The similarity of the results of our study with the study conducted in Visakhapatnam by Chandra Sekhar V *et al* 2020 assumes its importance due to their geographical location with, both centres being located within 100 km from each and similarities between study population. Many studies found higher frequency of whorls in males compared to females, however our study revealed higher frequency of whorls in females.[6]

Ulnar Loops were highest in O+ve and Radial loops were highest in A+ve group. Both the loop patterns were least distributed in A-ve blood group type. Highest frequency of PA found in A+ve group and TA were found in highest numbers in O+ve group. AB+ve and O-ve had lesser numbers of PA and TA respectively. Highest frequency of whorl pattern seen in O+ve group and least in A-ve group. Similar results were found by Manikandan S *et al* 2019.[7] When analysed for association between print pattern and gender and blood group type, the right-hand ring fingerprint showed a highly significant association with gender (p=0.002) and blood group type (p=0.000) in our study. Similar attempt by some researchers found that gender and blood group types

were associated with a particular pattern but these studies did not explore the statistical correlation.[7]

Fingerprint ridge density (FPRD) was used to study the gender specificity. Fingerprint ridge density refers to the number of ridges (raised lines) present in a specific area of a fingerprint. Some researchers found a strong association between gender and print pattern with the help of FPRD, and concluded that fingerprints could accurately predict the sex of an individual.[8] Significant association was observed between print pattern and gender in this study (p=0.002).

Our study revealed as strong association between fingerprint of right-hand ring finger and blood groups (p=0.000). This finding should be considered as a casual association, as currently there is no scientific evidence to support a direct association between fingerprints and blood groups. While fingerprints are unique to each individual and can be used for identification purposes, they are not directly related to an individual's blood type. There have been some studies that have looked at the relationship between fingerprints and blood types in terms of their potential use in forensic investigations and found that individuals with higher ridge densities tended to have a higher frequency of certain blood types, but the relationship was not statistically significant.[9-15]

It is important to note that while these studies suggest a potential relationship between fingerprints and blood types, more research is needed to confirm these findings and to determine the practical applications of such relationships in forensic investigations.

6. Conclusion

The findings of this study suggests that the gender and blood group type could complement fingerprint patterns of an individual for identification. The significant association between gender, blood group type and fingerprint pattern found in this study was limited to one finger (Right ring finger), however, further research on a larger sample would increase the odds of finding association in remaining fingers and confirm the findings of this study.

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Original Research Article

The Profile of Fetal and Infant Mortality in South-western Maharashtra Population: A Preliminary Study.

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Key words
Neonatal mortality, Meconium aspiration, Amniotic fluid aspiration, Congenital anomalies, Pneumonia.

Abstract

Background: Fetus is the unborn offspring that develops from an animal embryo. Infant mortality rate is the probability of a child born in a specific year or period dying before reaching the age of one year. Fetal mortality remains a significant and understudied problem that accounts for 50% of perinatal death. High infant mortality rates are generally indicative of unmet human health needs in sanitation, medical care, nutrition, and education. The present study was undertaken to understand the cause of fetal and infant deaths in terms of age, sex, area of residence, pathological conditions and injuries contributing to death. **Material & Methods:** The present cross-sectional retrospective study was carried out on 34 deceased fetus and infants brought for postmortem examination to Government Medical College and Hospital from January 2018 to December 2019. **Results:** In the present study female cases (55.88%) were more than males (44.12%). 12 cases (35.29%) were fetuses 11 cases (32.35%) were neonates of age group from birth to 28 days and 11 cases (32.35%) were infants of age group 29 days to 1 year age. 19 cases (55.88%) belong to the rural area and 11 cases (32.35%) belong to the urban area. The most predominant cause of death was fetal death (35.29%) followed by pneumonia (29.41%) meconium aspioration (11.77%) congenital anomalies (8.82%) and amniotic fluid aspiration (8.82 %). **Conclusion:** The most predominant cause of death in the present study was pneumonia followed by fetal death. The female deaths were more common than male deaths.

1. Introduction

Fetus is the unborn offspring that develops from an animal embryo.The term infant is applied to very young children from birth to one year of age. The Infant mortality rate is the probability of a child born in a specific year or period dying before reaching the age of one year.[1] Foetal mortality remains significant and understudied problem, that accounts for 50% of perinatal death.[2,3] It is an important indicator of the overall physical health of the community. Preserving the lives of newborns has been a long-standing issue in public health, social policy and humanitarian endeavours.

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High infant mortality rates are generally indicative of unmet human health needs in sanitation, medical care, nutrition, and education. The infant mortality rate is an age-specific ratio used by epidemiologists, demographers, physicians, and social scientists to better understand the extent and causes of infant deaths.[4] Globally, about 15,000 children die every day. Child mortality rates have declined in all the parts of world, but still it is not on track of reaching the sustainable development goals for child mortality. In countries like Iceland, Japan, Monaco etc. with best health facilities, child mortality rates are ten times lower than the global average suggests that most of these child deaths are preventable.[5]

Monaco, Iceland and Japan are among the top three countries with the lowest infant mortality rates with around 2 infant deaths per 1,000. Additionally, the countries with the highest density of physicians also generally report low infant mortality.[6] As far as india is concerned, in 2018, one in 28 infants died in rural areas and one in every 43 infants died in urban areas with national average of 1 in 31 infants. In rural areas, the infant mortality rate was lowest in Chandigarh (4 cases) and Nagaland (5 cases) and highest in Madhya Pradesh (52 cases) and Uttar Pradesh (46 cases). In urban areas, the infant mortality rate was highest in Mizoram (2 cases) and Nagaland (3 cases) and highest in Madhya Pradesh (36 cases) and Uttar Pradesh (35 cases).[7] The infant mortality rate in Maharashtra fell gradually from 48 deaths per 1000 live births in 1999 to 19 deaths per 1000 live births in 2018.[8]

One of the most important purposes of infant and foetal autopsy is to find out the cause of death, which may provide the valuable information about various aspects of infant and fetal death. But in developing countries like India, it is very difficult to gather the actual data because most of the deaths including infant death goes unnoticed and not medically certified. The present study was undertaken to understand the cause of foetal and infant deaths in terms of age, sex, area of residence, pathological conditions and injuries.

2. Material and methods:

The present cross-sectional study was carried out on a total 34 deceased foetus and infants brought for postmortem examination to Government Medical College and Hospital from January 2018 to December 2019. These cases were either brought dead cases or admitted cases of this or outside hospital. The brought dead cases includes neonates and aborted fetus found near railway station, roadside, in secluded places with intention to conceal the birth. The fetus and infants were studied after postmortem examination in terms of age, sex, area of residence, pathological conditions , and injuries to ascertain the cause of death and to highlight the factors associated death. Wherever available the histopathological examination reports were studied to ascertain the definite cause of death. The consent for study was not taken from relatives as it is retrospective study and data is anonymised.

3. Results:

Among the cases examined, 15 cases (44.12%) were male and 19 cases (55.88%) were female **(Table 1)**.

Table 1: Showing distribution of cases as per gender of infants.

Sex	No of cases	Percentage
Male	15	44.12
Female	19	55.88
Total	34	100

Tables 2: Showing distribution of cases as per age of infants.

Age	No of cases	Percentage
Fetal Death (Before birth)	12	35.29
0-28 days (Neonate)	11	32.35
29 days – 1 year (Infant)	11	32.35
Total	34	100

Table 3: Showing distribution of cases as per area of residence.

Residence	No of cases	Percentage
Rural	19	55.88
Urban	11	32.35
Not known	4	11.77
Total	34	100

12 cases (35.29%) were fetuses 11 cases (32.35%) were neonates of age group from birth to 28 days and 11 cases (32.35%) were infants of age group 29 days to 1 year age. In one fetus proper age could not be determined due to dismembered body parts brought for autopsy examination **(Table 2)**. Among the study individuals 11 cases (32.35%) belongs to the urban area, 19 cases (55.88%) belongs to the rural area and in 4 cases (11.77%) area of residence were not known as they were found roadside or near the railway station or secluded places **(Tables 3)**. The most predominant cause of death was fetal deaths (35.29%) followed by pneumonia (29.41%) meconium

aspioration (11.77%) congenital anomalies (8.82%) and amniotic fluid aspiration (8.82 %) **(Table 4)**.

Table 4: Showing distribution of cases as per cause of death in infants.

Sr. No.	Cause of death	Male (%)	Female (%)	Total	Percentage
1	Fetal death	4 (11.76)	8 (23.52)	12	35.29
2	Pneumonia	6 (17.64)	4 (11.76)	10	29.41
3	Meconium aspirations	1 (2.94)	3 (8.82)	4	11.77
4	Congenital anamolies	1 (2.94)	2 (5.88)	3	8.82
5	Amniotic fluid aspiration	1 (2.94)	2 (5.88)	3	8.82
6	Strangulation	1 (2.94)	0	1	2.94
7	Intestinal obstruction	1 (2.94)	0	1	2.94
Total		15	19	34	100

4. Discussion:

Reducing the infant mortality rate less than 30 per 1000 live births by the year 2010 was declared as the major goal of "Health for All policy-2000." [9] Each of the major causes of neonatal deaths can be prevented or treated with known, highly effective and widely practicable interventions such as improvements in prenatal care, intrapartum care and postnatal care. Concern has been raised that neonatal death rates in India are not falling at expected pace. Almost half of India's neonatal deaths are caused by birth asphyxia & birth trauma, sepsis, pneumonia and tetanus etc. that can be avoided by prenatal, intrapartum and postnatal care.[10] Environmental and social barriers prevent the access to basic medical facilities and thus contribute to an increasing infant mortality rate. Among all the neonatal death occurring in developing countries, 86% occurs due to infections, premature births, complications during delivery, and perinatal asphyxia and birth injuries.[11]

In the present study, it was observed that the female infant and fetal deaths were more than males. Maximum number of the cases belong to the rural area. The fetal deaths were slightly more than the neonatal and infant death. The most predominant cause of death was fetal deaths followed by pneumonia, meconium aspiration congenital anomalies and amniotic fluid aspiration. The infections and diseases of infants may be treated if diagnosed in early period. Amniotic fluid aspiration and meconium aspiration can be treated properly if diagnosed in early period. The discarded fetus at the roadside, near railway stations and in the garbage may be due to poverty, born out of illegal relationships, born out of rape and the inability of parents to rear the children. One case was of strangulation with doubt that the child did not belong to him and maybe born out of illegal relations of his wife with someone else. Death at the time of delivery may be due to complications of pregnancy, placental abnormalities , Birth defects, Infection, and umbilical cord defects. The majority of causes of infant death were preventable and treatable. Hence, we can say that, improving the timing and quality of antenatal care is essential for early detection, anticipating high-risk newborns, and timely interventions. Furthermore, early initiation of feeding and better referral linkage to tertiary health facilities could lead to a reduction in neonatal death in this setting.

In the present study, histopathological examination in case of death due to pneumonia was vascular engorgement and intra-alveolar oedema, neutrophilic infiltration, marked cellular exudate of neutrophils, extravasation of erythrocytes, desquamated epithelial cells, fibrin within the alveoli was seen and patchy consolidation areas. These changes were seen on histopathological examination according to stage of pneumonia. In case of aspiration of meconium bronchus and bronchial tree was shows meconium and the histopathological examination shows signs of aspiration pneumonitis and neutrophilic infiltration. In intestinal obstruction cases haemorrhagic areas were observed, neutrophilic infiltration were observed, necrosis and gangrenes were observed on histopathological findings. In fetal deaths, histopathological examination shows microscopic findings of acute respiratory distress syndrome with collapse of lungs.

Also, Rather than pointing at the medical causes, the socioeconomic factors like income, access to health services and immunization programs are important determinants to assess the status of health of children. Many studies emphasize, how socio-economic and demographic factors impact the infant mortality such as, medical care of the mother during the antenatal period, care at birth, preventive and curative care in the postnatal period. Maternal factors, such as, age at marriage, age at first birth, parity and birth intervals, and household and community-level factors such as, drainage, sanitation could significantly reduce infant mortality rates.[12]

India has witnessed a significant improvement in neonatal health after the

introduction of NRHM. Apart from the JSY, the country has launched several new initiatives to improve neonatal care. Notwithstanding this newfound focus on neonatal health, the annual rate of reduction in NMR and ENMR still lags behind IMR and under-five mortality rate. There is an interplay of different demographic, educational, socioeconomic, biological and care-seeking factors, which are responsible for the disparities and the high burden of neonatal mortality. The country has to increase the coverage of key interventions and also improve the quality of care in health facilities on an urgent basis.[13]

5. Conclusion

To conclude, the most predominant cause of death in the present study was pneumonia followed by fetal death and the female deaths were more than male deaths. In the rural area there may be a lack of accessibility to health care facilities, lack of access to health leads to late diagnosis and late intervention and delay in treatment causing most of the deaths. The majority of causes of infant death were preventable and treatable. Improving the timing and quality of antenatal care is essential for early detection, anticipating high-risk newborns, and timely interventions. Also, early initiation of feeding and better referral linkage to tertiary health facilities could lead to a reduction in neonatal deaths.

Ethical Clearance: IEC approval is taken from the Institutional Ethical committee.

Contributor ship of Author: All authors equally contributed.

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Original Research Article

Study of Cerebrospinal Fluid Electrolyte Concentration in Medico-Legal Cases

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Abstract

Introduction: Post-mortem changes in the cerebrospinal fluid occur rapidly and are quite erratic. And among the electrolyte's potassium and sodium ion concentration gives a more precise value of time since death. The ratio of sodium and potassium ions is a better parameter for predicting time since death compared to postmortem interval estimation from sodium or potassium values alone. Hence, we studied the correlation between CSF potassium and sodium ion changes with time since death. **Material and Methods:** The present study was carried out in the department of forensic medicine of a tertiary care government hospital from June 2018 to December 2021. This study has been extended to directly compare the accuracy of determining death intervals from biochemical parameters of cerebrospinal fluid. In 124 medico-legal cases with a known time of death, cerebrospinal fluid was taken from ventricles and analysed for sodium and potassium. **Results:** A strong correlation between time since death and the ratio of sodium to potassium is observed. The time since death was regressed by the ratio of sodium to potassium. **Conclusion:** The changes in electrolytes (sodium, potassium) in CSF after death do not show any significant relation with the age, sex, various causes of death of the individual. The TSD and value of CSF potassium and sodium level show particular relationship in estimating time since death.

1. Introduction

While investigating a crime, it is essential for the investigating officer to have adequate knowledge about the place of death, cause of death, "Time since death" (TSD) etc. In criminal cases, the Post-Mortem Interval (PMI) serves as an important clue for the investigating officer to probe and helps them eliminate the innocent.[1] The importance of PMI is to aid in the identification of an accused, and in cases of violent death, it limits the number of suspects and helps to validate or

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reject an alibi and verify witnesses' statements. In civil cases also, the time of death plays a vital role in deciding about the legal heirship, inheritance, or succession of the property. To fix time since death based on Post-mortem changes alone has been a constant challenge to medico-legal workers in many situations. The time of death becomes very important in certain situations. And this question is raised to the most of Forensic experts by the Investigating Police Officers, which is answered sometimes with touch of accuracy. Though it is not possible to fix the exact time of death by autopsy finding alone, yet some close and reasonable approximation should always be aimed at.[1,2] Many biochemical changes begin to take place in the body immediately or shortly after death and progress in fairly orderly way until the body disintegrates. These changes occur in various body fluids[3, 4] including vitreous humour of eye and CSF.[5,6,7,8]

The present study was undertaken to investigate whether post-mortem analysis of CSF electrolytes is useful for the estimation of PMI and, if yes, what parameters are better correlated with PMI.

2. Material and Method:

The present study was carried out in the department of forensic medicine of a tertiary care government hospital from June 2018 to December 2021. Prior permission from the Institutional Ethics Committee of the college was obtained. The ethics committee approval number is: EC/PG/372/OCT/2018 date: 19/10/2018. The material for study is cerebrospinal fluid (C.S.F). Those cases with a known time of death and PMI of less than 24 hours were enrolled in the study. During the study period, all medico-legal autopsy cases and all the information about the deceased like name, age, sex, date and time of death, date and time of collection of C.S.F, cause of death, mode of death, temperature, and sodium and potassium concentrations, were fully recorded in specially designed proforma. A total 124 cases were included in the study during the stipulated study period.

Inclusion criteria:

1. Time of death should be known.
2. Sample collection within 24 hours of death.
3. Cases having clear C.S.F. were taken.

Exclusion criteria:

1. Any case of head injury, brain pathology, bleeding diathesis, vertebral column and spinal cord injury.
2. More than 24 hours of time of death
3. Cases of burns
4. Cases of extensive soft tissues injuries
5. Age <15 years and >80 years
6. All those cases where the time of death was unknown
7. The cases in which the extracted sample is turbid/ cloudy/yellow.

Methods of Collection of CSF:

The cranial cavity was opened and the vault will be removed to expose the dura and brain. Dura is gently cut from the vault region of the brain; both cerebral hemispheres are separated apart from the midline by left hand to expose the corpus callosum; a 10ml plastic disposable syringe with a wide bore cannula (18 gauge) is inserted on the posterior and dependant parts of corpus callosum for 1.5cm depth; the needle is directed posterior downwards and slightly laterally in each hemisphere and cerebrospinal fluid is withdrawn.[9]

The samples were taken immediately to the central laboratory, department of biochemistry for analysis. The collected samples were immediately centrifuged at a rate of 3000 rpm for a period of 3 minutes. The supernatant solution was collected in a sterile tube and analysed for sodium and potassium ions by using the ion-selective electrode method.

The individual analysis findings were entered in the master chart, and analysis was done. The statistical analyses for the data were carried out using the software statistical package for social sciences (SPSS 15). The analyses were done first on the control group with a known time of death and the correlation between C.S.F, sodium and potassium and PMI. A formula for PMI based on sodium and potassium levels was established.

3. Observations and Results:

In the present study, 124 cases are within the stipulated study period. In the present study out of 124 cases, the minimum and maximum values of the post-mortem interval noted were 2.35 hours and 22.00 hours respectively. The post-mortem interval is taken from the time of death declaration in hospital records. The post-mortem interval (PMI) was divided into four groups as shown in the **Table no. 1**.

The sample collections were divided into four groups as per the PMI/ time since death (TSD). 26.61% of cases belonged to 0 -6 hours of TSD, 56.45% of cases belonged to 6 to 12 hours, 13.71% of

cases belonged to 12 -18 hours and 3.23% of cases belonged to 18 -24 hours.

Table 1: Showing the distribution of cases as per Postmortem interval (PMI).

Groups	PMI (Hours)	No. of Cases	%
1	0 to 6	33	26.61
2	6 to 12	70	56.45
3	12 to 18	17	13.71
4	18 to24	4	3.23
Total		124	100

Table 2: Summary statistics.

Parameters	Min	Max	Mean	SD
Potassium	21	48	30.28	5.29
Sodium	96	147	114.99	14.982
Time since death	2.55	22	8.38	3.78

Table 3: Comparison between TSD, potassium and sodium

Time since death (hours)	Potassium		Sodium	
	Mean	SD	Mean	SD
0-6	27.16	4.07	122.50	11.077
6-12	30.60	4.08	114.56	10.30
12-18	35.38	7.09	104.62	8.64
18-24	36.38	7.34	108.80	8.79
P- value	<0.001		<0.001	

The minimum (Min) potassium of the dead body is 21q/L, and the maximum (Max) potassium is 48q/L, with an average potassium was 30.28 q/L and standard deviation (SD) of 5.29q/L. The minimum sodium of the dead body is 96q/L and the maximum sodium is 147q/L with an average sodium was 114.99 q/L and standard deviation of 14.982q/L **(Table 2)**. The potassium and sodium levels were compared with the time since death. The potassium level was increasing with the increase in time since death. At the sixth-hour postmortem interval after death, it ranges from 21-38meq/L with a mean 27.16meq/L, SD of 4.07 meq/L. At the twelfth hour postmortem interval after death, it ranges from 23.20-40meq/L with a mean 30.60 meq/L, of SD 4.08meq/L. At the eighteenth-hour postmortem interval after death, it ranges from 26-48.10 meq/L with a mean 35.38 meq/L, of SD 7.09 meq/L. At the 24-hour postmortem interval after death it ranges from 27-47meq/L with a mean of 36.38 meq /L, of SD 7.34meq/L. The sodium level was decreasing with the increase of time since death. At the sixth hour postmortem interval after death, it ranges from 97-147meq/L with a mean 122.50meq/L, of SD 11.08meq/L. At twelfth hour postmortem interval after death, it ranges from 100-145meq/L with a mean 114.56meq/L, of SD 10.30meq/L. At eighteenth hour postmortem interval after death, it ranges from 98-122meq/L with a mean 104.62meq/L, of SD 8.64meq/L. At 24th hour postmortem interval after death it ranges from 96-120meq/L with a mean 108.80meq/L, of SD 8.79meq/L **(Table 3)**.

Regression: The strong correlation between time since death, potassium and sodium is observed. The time since death was regressed on potassium and sodium levels **(Graph no. 1)**.

Graph no. 1: Relation between potassium, sodium and TSD.

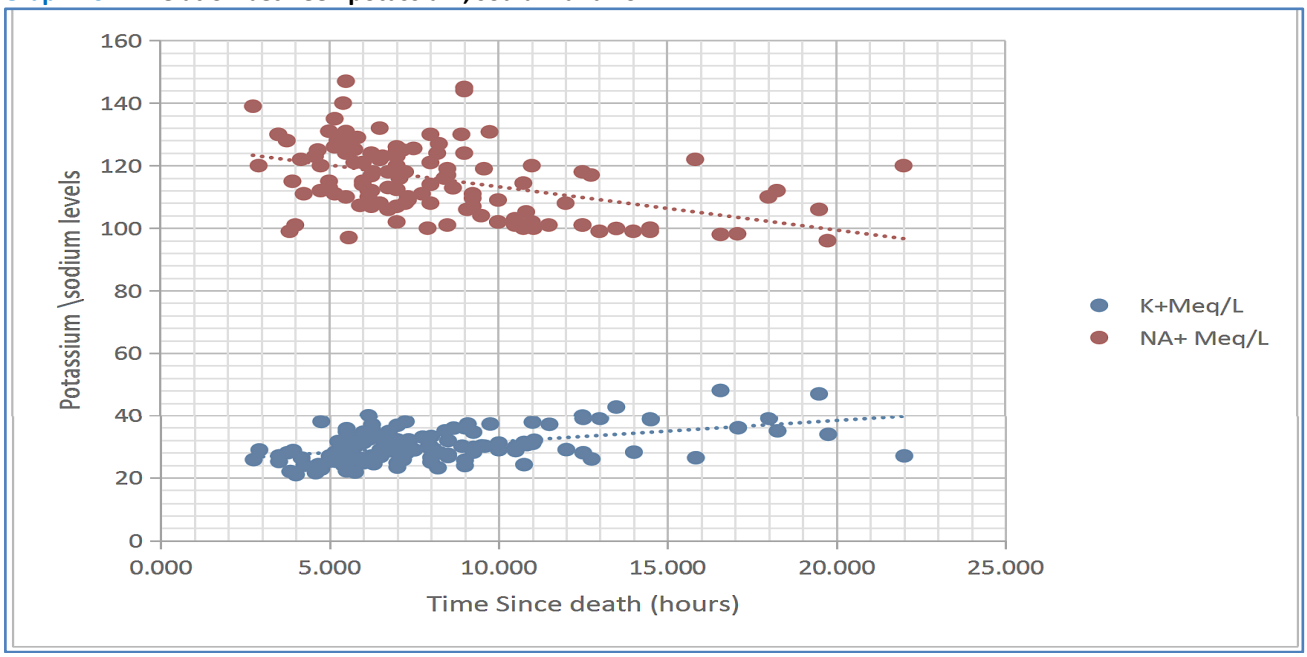

Table 4: Model Summary with Dependent variable: Time since death, Independent variables: Potassium and Sodium.

Model	R	R square	Adjusted R Square	Std. Error of the Estimate (SEE)
1	0.571	0.327	0.315	3.09760
2	0.527a	0.278	0.272	3.19417

a. Predictors: (Constant), ratio

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate (SEE)
2	0.527a	0.278	0.272	3.19417

Table 5: Coefficients

Model	Un standardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	17.329	1.359		12.747	0.000
Ratio	-2.305	0.336	-0.527	-6.854	0.000

a. Dependent Variable: TSD.

Table..

The impact of potassium and sodium was significant on TSD in hours, with a beta value of 0.266, p-value <0.001 and beta value -0.104, p-value <0.001 respectively **(Table no. 4 & 5).**

Regression of TSD with Na/K:

A strong correlation between time since death and the ratio of sodium to potassium is observed. The time since death was regressed by the ratio of sodium to potassium. The regression equation can be written as,

***TSD** = 17.329-2.305 × (Sodium/Potassium)*

The linear formulae to estimate PMI were derived by the following equation: y = axe + b, where y is electrolyte concentration, x is PMI in hours (dependent variable), a is the slope, and b is the intercept of the regression line.

The regression equation can be written as,

TSD = 12.245+ 0.266 × Potassium - 0.104 × sodium

As such, we have tried to document the correlation between potassium and sodium ion concentrations in CSF and time since death at this centre. There is a significant correlation between changes in levels of both ions and time since death.

4. Discussion:

The hospital-based prospective study was conducted on cases coming for medico-legal autopsy at the Department of Forensic Medicine and Toxicology. Post-mortem biochemistry is an important but seldom-practiced tool in death investigations. Mason, Klyne & Lennox (1951), Naumann H. N. (1958), B.V.Subramanyam et al observe the post-mortem rise of CSF potassium. Their observations are consistent with our findings.[10,11,12] V. Rama conducted a study on 100 samples of CSF and observed an increase in the level of potassium ions in CSF with time since death, except during 12 to 18 hours of time since death. His observations are inconsistent with our findings.[13] Yadav J et al. revealed a significant correlation between sodium and potassium ions in CSF up to 25 hours of time of death, with an average per hour rise of 1.21 meq/h for potassium and a fall of 1.115 meq/l for sodium ions. A useful relationship between sodium and potassium ion ratios and postmortem intervals was also elicited. These observations are inconsistent with our findings.[03,14,15]

Sanjay Choudhary et al. conducted a study of potassium levels in CSF and observed that there is a consistent increase in potassium levels with time since death. These observations are inconsistent with our findings.[16] Bardale R.V. et al. (2004) observed that potassium increases with increasing post-mortem intervals and that the rise is linear.[17] The sodium in the CSF decreases with increasing post-mortem intervals, and the decrease is not linear.[18] These observations are inconsistent with our findings. Chintalwar et al. estimated the time since death from potassium ion concentration levels in CSF, CSF was aspirated from lateral ventricles after opening the skull and dura, and concentration of potassium ion was estimated over dimension expand plus auto-analyzer. In their study they found the potassium concentration r*0.944(p<0.001), the least square regression equation derived is found to be y*1.705x+18.83, where y= potassium ion concentration (in-dependant variable) and x=time since death (dependant variable). Post-mortem changes of CSF electrolyte are based mainly on the hypoxic damage of the choroid plexus. Potassium ion concentration is useful to estimate time since death;

the amount of potassium increases at a constant rate in relation to the temperature of the body during the first 20 hours. The concentration of sodium, calcium, and magnesium has no obvious relationship to time since death.[19] In our study, the time since death and the value of CSF sodium level show a particular relationship in estimating the time since death.

Bhanwar L. J., O.P. Saini et al. (2019) study 100 medico-legal autopsies to estimate time since death irrespective of age and cause of death in RTA, poisoning, hanging, drowning, and burn cases, except the head injury, vertebral column, and spinal cord injury cases, and in cases where the time of death was known. A significant inverse fair correlation existed between the time since death and K^+ level ($r=0.82$, $p<0.001$).[20] these observations are consistent with our findings. Soon after death, the volume of CSF averages 150 cc in amount, but it gradually disappears within 24-48 hours. Potassium moves into the cerebrospinal fluid progressively[21], and the rate of this diffusion is greater between the eighth and twenty-four hours after death.

Kumari Mamta et al conducted a study on 81 cases, and concluded that the time since death can be estimated by using changes in the biochemical markers in CSF. The potassium showed moderate correlation with time since death, and sodium showed weak correlation with time since death.[22] Kumari Mamta et al. conducted a study on 81 cases and concluded that the potassium showed a moderate correlation with time since death, and the sodium showed a weak correlation with time since death.[22]

The present study revealed a postmortem increase in potassium and a decrease in sodium ion concentration similar to that reported by earlier researchers in various body fluids, including CSF. The ratio of sodium and potassium ions is a better parameter for predicting time since death compared to PMI estimation from sodium or potassium values alone. Hence, we have tried to establish the correlation between CSF potassium and sodium ion changes with time since death.

5. Conclusions:

These are the conclusion from my study:

a. The changes in electrolytes (sodium, potassium) in CSF after death do not show any significant relation with the age of the individual.
b. The changes in electrolytes (sodium, potassium) in CSF after death do not show any significant relation with the sex (male, female) of the individual.
c. The changes in electrolytes (sodium, potassium) in CSF after death do not show any significant relation with the various causes of death.
d. The TSD and value of CSF potassium level show particular relationship in estimating time since death.
e. The TSD and value of CSF sodium level show particular relationship in estimating time since death.

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Original Research Article

A Cross-Sectional Study on Profile of Survivors of Sexual Assault at Agartala City.

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Abstract

Purpose: The menace of sexual assault has spanned over the globe. No country is immune to it. This study was conducted to assess the profiles of survivors of sexual assault at Agartala, since there were no other studies on the same population. **Methods:** This was a cross-sectional study spanning 2 years from and done at 3 tertiary hospitals in Agartala, Tripura. Survivors who visited these hospitals and had given written consents (n=167) were accepted as study participants. For incidence, population of Agartala was considered. Modified Kuppuswamy scale was used for socio-economic status. Chi square test was applied to find relations between categorical variables and P value lesser than 0.05 was considered statistically significant. **Results:** Female survivors constituted 98.5% and majority were between 11-20 years. Profession-wise unemployed, homemaker or students constituted 39%. Religion-wise Hindus constituted 68.65%. Marital status-wise unmarried survivors constituted 86.56%. Most of them were either illiterate or finished just primary schooling. Majority belonged to lower socioeconomic status and from urban areas. Count of cases in regards to age, religion, community, socio-economic status was compared to the residence of the survivors and it was found out that P> 0.05. **Conclusion:** Sexual assault is an omnipresent occurrence and is not related to the survivor's age, religion, community or, socio-economic status.

1. Introduction

Sexual assault is one of condemned crimes. Inconsistent definitions, different rates of reportage, recording, prosecution and conviction produce differences in statistics which are either unreliable or fallacious.[1] A report by United Nations compiling data from 65 countries, revealed 250,000 or more cases of attempted rape or rape were registered by police per year.[2] In 2019, 87 rape cases occurred daily in India.[3]

Previously no study was conducted to assess the profile of survivors at Agartala, the capital city of Tripura; hence this study was first of its kind to measure the extent of sexual assault prevailing in Tripura.

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2. Materials and methods:

This was a cross sectional study, done at the only 3 government tertiary hospitals at Agartala for 2 years commencing August 2014. Alleged Sexual Assault cases examined at these hospitals were considered as suitable participants. The study was explained to them in their vernacular language and written informed consent was taken from them when major or from parents when minor. Identifying data were kept confidential. Survivors or their guardians who did not give consent for participation, were excluded from the study. Proforma of Ministry of Health and Family Welfare for examination of Survivor of Sexual Violence was used to record data.[4]

Variables:

The variables noted are Gender, Age in years (0-10, 11-20, 21-30, 31-40, 41-50), Religion (Hindu, Muslim, Christian, Buddhist), Community (Bengali, Tribals, Others), Residence (urban, semi-urban), Marital status (Unmarried, Married, Socially separated, Divorced, Widow), Educational Status (Illiterate/Primary school, High school/Intermediate, Graduate/Postgraduate, Professional course/honors), Occupation (Legislators/Senior officials/Managers, Professionals, Technicians/Associate Professionals, Clerks, Service workers/Shops/Market sales workers, Skilled Agricultural and Fishery workers, Craft and related Trade Workers, Plant and machine operators and Plumbers, Unskilled workers, Unemployed). Modified Kuppuswamy scale of 2014 was used and their socio-economic status was calculated (Upper, Upper Middle, Middle/ Lower Middle, Upper Lower, Lower).[5]

Statistical Analysis:

Data were entered into SPSS 21(IBM Corp., Armonk, NY, USA), expressed in frequency and percentage.[6] According to Municipal Census 2015, population of Agartala city was 5,22,600 and the incidence was calculated accordingly.[7] Relation of count of cases with socio-economic and demographic profile of survivors was done Chi square test was conducted and P value analyzed. P value of <0.05 was considered statistically significant.

Ethics: Institutional Ethical Committee of Agartala Government Medical College has granted permission for this study.

3. Results:

About 67 survivors of sexual assault reported during the study period, out of which only one was male. Incidence of Sexual Assault was 0.128. Profile of survivors is depicted in **Table 1**.

Table no 1: Profile of survivors of sexual assault.

Variable	Groups	Number	%
Age	0-11	10	14.9
	11-20	27	40.09
	21-30	25	37.31
	31-40	4	5.97
	41-50	1	1.49
Religion	Hindu	46	68.65
	Muslim	8	11.94
	Christian	12	17.91
	Buddhist	1	1.49
Community	Bengali	51	76.11
	Tribal	15	22.38
	Others	1	1.49
Marital status	Unmarried	58	86.56
	Married	6	8.95
	Socially separated	2	2.98
	Divorced	1	1.49
	Widow	1	1.49
Educational status	Illiterate or till primary school	43	64.17
	High school/Intermediate	22	32.83
	Graduate/Postgraduate	1	1.49
	Professional course or honours	1	1.49
Occupation	Legislators, Senior officials, Managers	0	0
	Professionals	1	1.49
	Technicians , Associate Professionals	0	0
	Clerks	0	0
	Service workers, Shops, Market sales workers	2	2.98
	Skilled Agricultural and Fishery workers	0	0
	Craft and related Trade Workers	1	1.49
	Plant and machine operators and Plumbers	0	0
	Unskilled workers	23	38.42
	Unemployed	39	58.2
Residential area	Urban	55	82.08
	Semi-urban	12	17.92
Socio-economic status	Middle/ Lower Middle	3	4.47
	Upper Lower	15	22.38
	Lower	49	73.13

Majority were between 11-20 years. Hindus were 68.65%. About 86.6% survivors were unmarried or below age of legal marriage. About 64.2% were illiterate or studied till primary school. Survivors from urban areas constituted 82.08%. About 73.1% belonged to lower socioeconomic status. **Table 2** is a comparative table between the residence of the survivors and the count of cases based on their age, religion, community and socio-economic status. P value in each was found to be more than 0.05.

4. Discussion:

Mukherjee et al stated that actual statistics of sexual assault is not portrayed.[8] In present study, 98.5% were females, similar to Fimate et al and Sarkar et al.[9,10]

Table no 2: Comparative table between the residence of the survivors and the count of cases based on their age, religion, community and socio-economic status.

			Residence of the survivor		Chi- square value	P- value
			Urban	Semi-Urban		
Age	0-10	Count	8	2	0.375	0.984
		% within age group	80.0%	20.0%		
	11-20	Count	21	6		
		% within age group	77.8%	22.2%		
	21-30	Count	19	6		
		% within age group	76.0%	24.0%		
	31-40	Count	3	1		
		% within age group	75.0%	25.0%		
	41-50	Count	1	0		
		% within age group	100.0%	0%		
Religion	Hindu	Count	39	8	3.355	0.34
		% within religion	83.0%	17.0%		
	Muslim	Count	5	3		
		% within religion	62.5%	37.5%		
	Christian	Count	7	4		
		% within religion	63.6%	36.4%		
	Buddhist	Count	1	0		
		% within religion	100.0%	0%		
Community	Tribal	Count	10	5	1.55	0.46
		% within Community	66.7%	33.3%		
	Bengali	Count	41	10		
		% within Community	80.4%	19.6%		
	others	Count	1	0		
		% within Community	100.0%	0%		
Socio-economic class	Lower middle Upper lower class	Count	2	1	3.214	0.20
		% within Class	66.67%	33.33%		
	Lower class Lower middle	Count	10	6		
		% within Class	62.5%	37.5%		
	Upper lower class	Count	40	8		
		% within Class	83.33	16.66%		

Majority were between 11-20 years alike RAINN and Sharma and colleagues.[11,12] Majority were Hindus which resemble findings of Fimate et al and Bhowmik et al.[9,13] In the state of Tripura, communities that reside are Tribals (about 19 recognized tribes), Bengalis and others. In the present study, survivors were mostly Bengalis (76.11%). This might be attributed to the fact that tribal communities in Northeastern part of India are more matriarchal in nature. Majority were unmarried, which is in accordant to S.C. Sarkar, Tamuli et al & Sukul et al.[14,15,16] Mostly were illiterate or studied till primary school, alike S. C. Sarkar, Bandyopadhay, Sukul et al, Tamuli et al.[14,15,16,17] About 58.2 % were unemployed. About 73.13% belonged to lower socio-economic status, similar to S.C. Sarkar and studies from South East Asia.[14,18] Statistics indicated that there was a 336% increase in child rape cases from 2001 to 2011 in India.[19]

Study population was from Agartala city, which is a capital city and hence were from urban area (82.08%). However, when the count of cases from urban and semi urban area were compared to age, religion, community and socio-economic status, it was found out that P value was not

significant, which can be inferred that Sexual assault is an ubiquitous phenomenon and is not dependent on the survivor's age, religion, community and socio-economic status.

5. Limitations:

Apart from tertiary hospitals, some primary health centers are there around Agartala where some survivors might have reported and were missed in the study.

6. Conclusions:

Sexual assault is prevalent throughout and isn't related to the survivor's age, religion, community or, socio-economic standing. Awareness about laws of the land, modification in deep rooted cultural practices can only curb this evil. Many a times, due to poor knowledge regarding the clauses of sexual assault and consenting age for sexual intercourse, many girls get victimized. Hence, sex education should be included as part of curriculum in school.

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Original Research Article

Epidemiological Study of Poisoning During Autopsy in Solapur Region

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Abstract

Background: Poison is a substance that causes damage or injury to the body and endangers one's life due to its exposure by means of ingestion, inhalation or contact. Pattern of poisoning in a region depends on variety of factors, such as availability of the poisons, occupation etc. **Aims:** This retrospective study was carried out to know epidemiological aspect of poisoning. **Material and methods**: This study was carried out in Dept of forensic medicine & Toxicology, Dr. V. M. Government Medical college, Solapur, from January 2016 to April 2017.This study is based on the autopsy record of cases of poisoning which had been brought for medicolegal autopsy examination in department. **Results**: During this period, total 2554 medicolegal autopsies were conducted out of which 219 cases were that of poisoning, consisting of 8.57% of total autopsies. Maximum i.e. 161 cases were male (73.51%).The age group most common age affected was 21-30 years (27.85%). The farmer were 62(28.31%) cases. The cases of suicide in present study were 145 (66.21%) . Poisoning due to insecticide group of poison were 125 (57.7%). **Conclusion**: There is increase in frequency of insecticidal poisoning including younger age group & male sex.

1. Introduction

Poison is a substance that causes damage or injury to the body and endangers one's life due to its exposure by means of ingestion, inhalation or contact (Thomas et al., 2004).[1] With the development in the industrial and agricultural field and in medical sciences, much number of poisons has become available, which on exposure may produce severe toxicity. [2]

High doses of analgesics, tranquillizers, and antidepressants are the commonly used agents for intentional poisoning in industrialized countries[3] and agriculture pesticides are used in Asian region for self-poisoning particularly in rural areas with a fatality range of 10-20%.[4]

Pattern of poisoning in a region depends on variety of factors, such as availability of the poisons, socio-economic status of the population, religious and cultural influences and availability of drugs.[5] Rapid industrialization, introduction of newer range of drugs for treatment and massive use of pesticides in agriculture has increased the incidence of poisoning. In advanced countries, it has been observed that poisoning deaths are mainly due to cleansing agents, detergents,

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paracetamol, carbon monoxide and other cosmetic products (Gargi et al., 2008).[6] In India, as agriculture is the main occupation, insecticides and other agrochemical fertilizers are used to a greater extent and the poisoning with such products are more common (Aaron et al., 2004).[7]

2. Material and method

This retrospective study was carried out in the Department of Forensic Medicine and Toxicology, Dr V. M. Government Medical College Solapur, a Western Maharashtra region from January 2016 to April 2017. This study is based on the record of autopsy of poisoning cases that had been brought for medico-legal autopsy in the department. The detailed pertaining to age, gender, area of residence, marital status, occupation, type of poison consumed, time interval between poisoning and admission, length of stay in the hospital taken from post mortem memorandum and investigating agencies documents submitted for requesting autopsy such as Police panchanama and treatment record. The data was entered on predesigned data sheet to maintained uniformity, tabulated and then statistically analyzed.

3. Observations and results

The present observational study conducted in dept. of Forensic Medicine & Toxicology, Dr. V. M. Government Medical College, Solapur from 1st January 2016 to 30th April 2017.

Incidence

During this period, total 2554 medicolegal autopsies were conducted out of which 219 cases were that of poisoning, consisting of 8.57% of total autopsies.

Age and Gender

In present study, out of 219 cases 161 were male (73.51%) & 58 cases were female (26.48%) while considering the age group most common age affected was 21-30 years (27.85%) followed by 41-50 years (20.09%) & 31-40 years (19.63%) **(Table 01)**.

Table 1: Age and gender wise distribution of cases.

Age	Male	Female	Total	%
1-10	2	3	5	2.28
11-20	10	10	20	9.13
21-30	38	23	61	27.85
31-40	31	12	43	19.63
41-50	39	5	44	20.09
51-60	24	1	25	11.41
Above 60	17	4	21	9.58
Total	161	58	219	100

Marital Status

In this study, out of 219 cases 185 cases were married (84.41%) & 34 cases were unmarried (15.52%) in married population out of 143 cases were male & 42 were female **(Table 02)**.

Table 2: Distribution of cases according to marital status.

Sex	Married		Unmarried	
	No. Of cases	%	No. Of cases	%
Male(n=161)	143	88.81	18	11.18
Female(n=58)	42	78.41	16	27.58
Total	185		34	

Table 3: Distribution of cases according to region.

Region	No. Of cases	%
Urban	67	30.60
Rural	152	69.40
Total	219	100

Table 4: Distribution of cases according to manner of death.

Manner	Male	Female	Total	%
Suicide	105	40	145	66.21
Accident	56	18	74	33.78
Homicide	00	00	00	00
	161	58	21	100

Table 5: Distribution of cases according to occupation.

Occupation	Cases	%
Labourer	48	21.91
Farmers	62	28.31
Housewife	37	16.89
Student	31	14.15
Bidi worker	9	4.10
Service holders	6	2.73
Unemployed	26	11.87
Total	219	100

Table 6: Distribution of cases according to type of poison

Type of poison	Cases	%
Insecticide	125	57.7
Snake bite	32	14.61
Keroscene	03	1.36
Alcohol	15	6.84
Corrosive	04	1.82
Asphyxiant gases	03	1.36
Auramine o (morchap)	20	9.13
Unknown poison	17	7.76
Total	219	100

Region wise distribution

In present study 152 cases were from rural area (69.40%) & 67 cases were from urban area (30.60%) **(Table 03)**.

Manner of Death

The cases of suicide in present study were 145 (66.21%) & cases of accidental were 74 (33.78%). There was no single case of homicide **(Table 04)**.

Occupation

In present study, the farmer were 62 cases (28.31%), 48 cases were that of laborer (21.91%), house wife were 37 (16.89%) & student were 31 (14.15%) The Bidi worker consist of 9 cases (4.10%) service holder were 6 (2.77%) 26 (11.87%0 cases were that of unemployed person **(Table 05)**.

Type of poison

In this study, poisoning due to pesticide group of poison were 125 cases (57.7%), cases due to snake bite consists of 32(14.61%), the poisoning due to kerosene were 03 (1.36%), alcohol were 15 (6.84%), corrosive were 04 (1.82%), Asphyxiates were 03 (1.36%). There were 20 cases (9.13%) that of Auromin -0- phosphate poisoning (cow dung) and 17 case (7.76%) were that of unknown poisoning **(Table 06)**.

Survival period

The survival period i.e. time period between consumption of poison and death of 135 cases (61.64%) were less than 24 hours & 20 cases (9.13%) were 24 to 48 hours. In 38 cases (17.35%) the survival period was 3 to 5 days. & in 17 cases (7.76%) it was 6-10 days. In present study 04 cases (1.82%) survived for 11 to 20 days & 05 cases (2.28%) were for 21-30 days **(Table 07)**.

Table 7: Distribution of cases according to survival period

Duration of survival after poisoning	Cases	%
Less than 24	135	61.64
24-48 hours	20	9.13
3-5 days	38	17.35
6-10 days	17	7.76
11-20 days	04	1.82
21-30 days	05	2.28
Total	219	100

4. Discussion

Incidence of Poisoning

The incidence of poisoning in the present study was 8.57%.These result were consistent with the result of study by Aggarwal et at (10.57%)[8],Dalal et al (15.39%)[9], A.K.Kapoor et al (11.70%)[10],Gupta & Waghela (15.98%)[11],Dattarwal S.k(23.42%)[12]Gargi J et al(16%)[6],Rajani Bhagora et al(13%)[13],Shailesh Jhaveri et al (11.5%)[14],D Harish (24%)[15],Navinkumar Varma (16.28%).[16]

The popular notion that poisoning causes minimal suffering prior to death & that it is less grave a sin than causing death by violence has helped in rapid rise in incidence of poisoning cases (Sharma B.R et al)[17]

Age and Sex

The incidence of poisoning was higher in male (161 i.e. 73.51%) as compared to female (58 i.e. 26.48%).This study coincides with the study of Gupta B.D[11] where male (62.1%),female(37.9%), The study by Rajani Bhagora[13] male(57.58%) female (42.42%), Reddy.K.S.N[5] male (65.65%) female (35.35%),Vinay Shetty[18] male(51.1%) female(49.99%), Zine K.U et al[19] `male(68.25%) female(31.77%), Dalal J.S et al[9] male(63.19%) female(36.81%), Dattarwal S.K et al[12] male(68.62%) & female(31.37%),Navin kumar Varma [16] male(65.03%) female(34.97).It could be explained by the fact that In India traditionally the male are doing outdoor works & they are exposed to stress & strain of day to day life, occupational hazards & easy availability of poisonous substance are also imp factor for male predominancy (S.B. Patil)[20] added families responsibilities, social customs limited resource etc. in males in rural population are some important factors for outnumbering male than female (Harish et al)[15]

The present study showed that the most common age group affected was 21-30 years. These observation were coincides to the observation of study conducted by B.D.Gupta and P.C.Vaghela[11] shows most common age group 21-30 years(43.1%),Rajini Bhagora,[13] 21-30 years(28.49%), D.Harish[15] 21-25 years (29.49%),Shailesh Jhaveri[14] 20-30 years (35.9%), Navinkumar varma[16] 21-30 years(30.06%).

The younger age group was physically socially & mentally active. The younger age group is most susceptible to the lure of riches the modern society yardstick of success frustrations causes by inability to cope with the highly competitive, indifferent & materialistic society have resulted in increasing in younger generation (D. Harish)[15] The problems in family studies marriage life settlement & employment are responsible for stress & inclination towards the suicide. The person of this age group as are active & they are also exposed to accidental exposure to the poisonous substance while they are working in that environment.

Marital Status

In this study, out of 219 cases 185 cases were married (84.41%) & 34 cases were unmarried (15.52%), similar pattern of result was noted by S.B. Patil et al.[20]In which married population is 79.92%. This might be due to additional mental stress and exposure in married as compared to unmarried.

Region wise distribution

In present study, 69.40% were from rural & 30.60% from urban area, this coincides with study by B.D.Gupta and P.C.Vaghale[11] cases of poisoning in rural area is 68.88% and urban area is 37.12% Navin Kumar Varma[16] rural cases are 58.05% and urban area 40.55%.Rajani Bhagore et al[13] rural cases are 57.58% and urban area 42.43%,Dalal J.S et al[9] rural cases are 74.84% and urban cases are 23.92%,Dhattarwal S.K et al[12] rural cases are 71.03% and urban cases are 28.97%. In India most of the population belongs to rural area & agriculture is the main profession. The pest control is the most common problem faced by the farmers in agriculture. In Order to eradicate the weeds & pests farmer procure and keep pesticide at their houses because of easy availability of pesticide people are tend to use them for intentional poisonous substance. Illiteracy, less education & less availability of immediate treatment in rural area are the reasons for maximum incidence in the rural area (Rajni Bhagora).[13]

But study by Sanjeev Choudhary et.al.[22] showed 64.90% cases were from urban area they stated that due to globalization & Urbanization the people are migrating from other descript & other state which causes in population of city, the urban people have lot of business failure & social problems so these factors are contributing main role to commit suicide.

Manner of Death

In present study, 66.21% cases were suicidal and 33.78% were accidental & 00 % homicidal. The most common manner was suicidal. This coincides with study of B.D. Gupta(68.2%)[11],Navin kumar Varma(72.02%)[16], Chaudhary (92.78%)[21] The various stress factor coming from social family, Financial problem were responsible for this act. In adolescents age group stress factors like family arguments, love failures, failures in studies & mental conflicts are responsible for poisoning cases (MC Clure GM) [3] In cases of females mainly in married females' dowry, cruelty by in- laws family quarrels maladjustments in married life low level of education. Infidelity, unemployment, dependence of woman on husband etc. are important predisposing factor for suicide by poisoning (D. Harish)[15]

Occupation wise distribution

The incidence of poisoning is more in farmers and housewives. Similar results were noted by B. Maharani and vijayakumari[22] as these groups are more vulnerable groups and easily exposed to the poisoning agents. Poverty, inadequate income to run the family, monsoon failure was responsible for higher incidence of poisoning among laborers and farmers (Vinay et al. 2008).[19]

This may due to factors like dowry, cruelty by the in-laws, family quarrels, maladjustment in married life and dependence of women on husband are responsible for the higher incidence of poisoning among house wives. As agriculture is major profession in the rural part of India farmers stock the pesticides to eradicate the weeds and pests. Due to easy availability of the pesticides, they are commonly used by the individuals to end their life in stressful situations.[7]

Type of poison

Insecticides are most common elusive agent in present study i.e. 57.7 % cases. This coincides with Study of B.D. Gupta & Waghela[11] revealed that 53.79% cases were that insecticide poisoning also with study by S.B. Patil et.al. [20] which showed that out of 744 cases 406 cases of insecticide poisoning i.e. 54.56% but D. harish et.al.[21] in their study showed that Aluminium Phosphide poisoning consist of 50.52%. which does not coincide. The reasons being agriculture-based economics, poverty unsafe practices, illiteracy, ignorance and lack of protective clothing and easy availability of highly toxic pesticides and among pesticides. Organophosphates form the largest bulk of poisoning in India.

As in this study, 20 cases of auramine-o diarylmethane dye i.e in local language it is called as "MORECHAP". It is used as a synthetic yellow cow dung powder. It was used to clean living premises in south india, in this region, most of the peoples are south indians, so auramine poisoning is used for suicide[23].

Survival period

In present study, most of cases survived for duration less than 24 hours. The study by Gupta & Waghela [11] reveals that spot deaths were more, which does not coincide. The reason behind it were lack of awareness to go for treatment, lack of proper treatment, distance between hospital & scene of incidence.

5. Conclusion & Recommendation

The present study helps to interpret the epidemiology of poison used. In this study, there is increase in frequency of insecticidal poisoning in rural population including younger age group & male sex.

Strict implementation of insecticide act & education to handled mainly farmer & laborer in agriculture industries who are involved in handling of pesticide about the life-threatening effect of compounds & taking precaution while handling & giving primary management in case of accidental poisoning will be helpful.

Ethical Clearance: IEC approval is taken from the Institutional Ethical committee.

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Original Research Article

Morphometric Analysis of Orbital Parameters for Sex Determination.

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Abstract

Introduction: Identification of a person from bone is most common and critical problem faced by Forensic experts and Anthropologist. Different craniometric parameters have been employed to accurately and reliably determine the sex of a person in forensic medicine. Orbital measurements are one of the craniofacial parameters that could be used in sexual estimation in terms of anthropological studies. The aim of this study was to evaluate orbital parameters as reliable tool in sex determination. **Material and Methods**: It is a cross sectional study which was conducted in the Department, 46 skulls were used and Orbital parameters dimensions (OH and OB) was measured using vernier callipers. Orbital Index was calculated by the formula. **Results**: Orbital Breadth was significantly higher in male skulls compared to female skulls. Orbital index was higher in female skulls compared to male skulls. {(OH 31.83 vs 31.28) (OB 37.36 vs 35.63) (OI 85.27 vs 87.92)}. **Conclusion**: Orbital height, Orbital breadth and Orbital index showed significant differences in male skulls compared to female skulls. Hence metric analysis of the orbital parameters are useful for sex determination.

1. Introduction

Identification of a person from bone is most common and critical problem faced by Forensic experts and Anthropologist. The morphometry of skull was most often used for the estimation of age, stature and ethnicity. It plays an important role in the forensic investigation and anthropological examinations of unidentified persons.[1,2] Sex of an individual can be identified accurately in 90% of the cases using pelvis alone, 80% of cases using skull alone and in 98% cases using pelvis and skull together.[3] Mostly the craniofacial skeletal structures are injured or damaged after air accidents, mass disasters, fire, explosion, or injuries resulting from violence making it difficult to determine the gender and the identification of the individual.[4]

The orbit is a part of the body structure that is convenient to measure. There is noteworthy sexual dimorphism from the Orbits within the skull, with male having characteristically squarer and relatively smaller orbits, while female orbits are rounder and comparatively larger.[5-7]

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Diverse craniometric parameters have been utilized to precisely ascertain the sex of a person in forensic medicine. Orbital measurements are one of the craniofacial parameters that could be used in sexual estimation in terms of anthropological studies (Weaver et al., 2010; Rossi et al., 2012).[8,9]

The present study was carried out for sex determination from dimensions of orbit in South Indian region by morphometric analysis which would be of great value to the forensic and anthropological investigators.

2. Materials and methods

The study includes 46 intact adult skulls (27 male and 19 female) present in the Department of Forensic Medicine. The skull was differentiated into male and female on the basis of certain classic anatomic characteristics. Morphometry of Orbital length (OH) & Orbital breadth (OB) was measured using vernier caliper (Forbes) to an accuracy of 0.5mm. The technique involved repetition of the measurements twice and average results were considered.

Measurement of orbital parameters

Orbit breadth (OB) - the distance in millimetres between the dacryon and ectochion was measured as the orbital breadth. Orbit height (OH) - the direct distance in millimetres between the superior and inferior orbital margins perpendicular to the orbital breadth (Ectochion - the intersection of the most anterior surface of the lateral border of the orbit and a line bisecting the orbit along its long axis. Dacryon - the point on the medial border of the orbit at which the frontal, lachrymal and maxilla bones intersect) **(Fig. 1)**.

Fig 1: Measurement of dimensions of Orbital parameters.

Orbital index is calculated as Orbital height / Orbital breadth x 100.

The skull samples between 18 to 60 years were included in the study. The skull samples which were damaged or deformed was not included in the study. Statistical analysis was done in SPPS software version 21 using t-test, and a value of $p<0.05$ was considered significant.

3. Results

Out of 46 intact adult skulls, there were 27 male and 19 female skulls. Left orbital height (LOH), left orbital breadth (LOB), right orbital height (ROH) and right orbital breadth (ROB), are higher in males compared to females {(LOH 31.82 vs 31.44) (LOB 37.33 vs 35.53) (ROH 31.84 vs 31.11) (ROB 37.38 vs 35.74)} **(Table 1)**.

Table 1: Orbital height & Orbital breadth (left and right) of males & female skulls.

Sex	Parameter	Mean	SD
Male	LOH	31.82	1.91
	LOB	37.33	1.37
	ROH	31.84	1.90
	ROB	37.38	1.36
Female	LOH	31.44	1.60
	LOB	35.53	1.56
	ROH	31.11	1.62
	ROB	35.74	1.65

Table 2: Comparison of orbital height, orbital breadth and orbital index between male and female skulls.

Parameter	Gender	Mean	SD	P value
Orbital Height	Male	31.83	1.89	0.214
	Female	31.28	1.60	
Orbital Breadth	Male	37.36	1.35	0.097
	Female	35.63	1.59	
OI	Male	85.27	5.18	0.244
	Female	87.92	5.52	

Orbital height of male skulls was higher compared to orbital height of female skulls. Orbital Breadth was significantly higher in male skulls compared to female skulls. Orbital index was higher in female skulls compared to male skulls. {(OH 31.83 vs 31.28) (OB 37.36 vs 35.63) (OI 85.27 vs 87.92)}, but p value was not significant **(Table 2)**.

4. Discussion

Orbital parameters can play an important role in case of sex determination. The results of the present study were compared with other studies.

Ghosh et al[10], study conducted in Calcutta and Jain D et al[11], study conducted in Delhi, observed that right orbital breadth, left orbital breadth, right orbital height and left orbital height was more in males compared to female skulls (42.87 vs 42.00, 42.87 vs 40.66, 36.77 vs 36.00, 37.12 vs 36.33) (42.2

vs 40.4, 41.8 vs 39.8, 33.1 vs 32.7, 33.1 vs 32.7) respectively.

In the current study we also observed similar results but the mean values were on the lower side (37.38 vs 35.74, 37.33 vs 35.53, 31.84 vs 31.11, 31.82 vs 31.44). But study by Sarkar N and Mukhopadhyay PP [12], conducted in west Bengal observed right orbital breadth and left orbital breadth was more in males compared to female skulls but right orbital height and left orbital height was more in females compared to male skulls (39.86 vs 39.00, 39.93 vs 39.17, 34.96 vs 35.63, 35.22 vs 35.86) **(Table 3)**.

Table 3: Comparison of orbital height & orbital breadth with other studies.

Author/Ethnicity	Gender	Orbital height	Orbital breadth
Jain K et al., Nagpur [13]	Male	32.1 ± 0.28	38.7 ± 0.25
	Female	32.0 ± 0.31	35.5 ± 0.33
Mekala D., Tamil nadu [14]	Male	36.2 ± 0.23	42.9 ± 0.27
	Female	34.5 ± 0.2	40.5 ± 0.24
Present Study	Male	31.83 ± 1.89	37.36 ± 1.35
	Female	31.28 ± 1.60	35.63 ± 1.59

The comparison of the morphometric analysis obtained in this study with the results of other studies had the following results: the orbital height of the male skulls in the present study (31.83±1.89) was lower than Jain K et al [13] (32.1 ± 0.28) and Mekala D [14] (36.2 ± 0.23).

Similarly in female skulls orbital height (31.28±1.60) was lower than Jain K et al [13] (32.0 ± 0.31) and Mekala D [14] (34.5 ± 0.2). Regarding the orbital breadth in the current study of male skulls (37.36± 1.35) was lower than Jain K et al [13] (38.7 ± 0.25) and Mekala D [14] (42.9 ± 0.27). Similarly in female skulls orbital breadth (35.63 ± 1.59) was similar in Jain K et al [13] (35.5 ± 0.33) and but lower than Mekala D [14] (40.5 ± 0.24). Orbital index calculated from the present study showed (85.27 ± 5.18) in males and (87.92 ± 5.52) in females. Similar results were also found in study by Mekala D et al [14] (84.62 ± 8.21, 85.46 ± 5.93) and Jain D et al [11] {(right side 78.60 ± 4.53, 80.99 ± 4.85) (left side 79.44 ± 4.62, 82.40 ± 4.67)}.

Though statistical significance was not obtained in our study, but the results demonstrated that significant differences in orbital parameters (OH, OB and OI) in male and female skulls. Hence in unknown skulls, metric analysis of the orbital parameters is useful for sex determination. The values obtained will be helpful for this part of South Karnataka region (South Indian).

5. Conclusion

In unknown skulls, orbital parameters can be used during forensic and anthropological investigation for determining sex.

Ethical Clearance: IEC approval is taken from the Institutional Ethical committee.

Contributor ship of Author: All authors equally contributed.

Conflict of interest: None to declare.

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Original Research Article

Identifying Areas for Development of the Law of Practicing Healthcare Professionals in Saudi Arabia: A Medicolegal Committee-Based Survey Study

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Abstract

Introduction: Malpractice lawsuits are considered a significant problem globally. In Saudi Arabia, the number of lawsuits increased by 242% since 2001. The Law of Practicing Healthcare Professions (LPHP) was introduced by the Ministry of Health (MOH) in 2005. The LPHP has some deficiencies in some regulations. These deficiencies are left for interpretation by the judge and the medicolegal committee. An example of such deficiencies is off-label prescriptions regulation. **Methods:** This is a cross-sectional study. A self-designed questionnaire was sent by email to all medicolegal panels' physician members. The first part of the survey focused on demographics. The second part focused on members' observation, opinions, and recommendations concerning LPHP and off-label medications prescription. Most of the respondents agree that implementing LPHP knowledge assessment in training and licensing will decrease the number of litigations. **Results:** 62 members out of 109 responded to the survey (56.8%). Most of the respondents agree that some physicians are liable only because they lack knowledge of the rules. 58% of the respondents (58.1%) agree that physicians should disclose if the medication is used as off-label. 38.8% of medicolegal panels' members believe that physicians should be held liable for any adverse event due to off-label medication use. **Conclusion:** It is clear from the responses that LPHP requires further elaboration. This will most likely improve healthcare for both the patient and the physician. Further objective research in the field of medicolegal litigation in Saudi Arabia is warranted.

1. Introduction

Malpractice lawsuits are considered a significant problem globally. In Saudi Arabia, the number of lawsuits increased by 242% since 2001.[1] Despite that over 50% of medical malpractice law-

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suits rule in favor of physicians, healthcare professionals lose substantial time, money, and utilize personal resources to resolve such litigations. In the United States, the estimated annual cost of malpractice litigations is 2%–3% of healthcare spending, which is around 60 billion USD.[2] The American Medical Association states that one-third of physicians will be sued, at least once in their career.[3] Thus, every physician is at risk of a lawsuit. The risk and cost of litigations in Saudi Arabia have not been established.

Many publications can be found on preventing litigations with a focus on multiple aspects including patient care, diagnosis, referral, communication, documentation, physician's skills, and other aspects.[2,4-6] Keeping in mind that improving patients' safety should always be a priority when considering methods to reduce liability.[7] But some of the medicolegal issues do not impact patient safety and are related to the laws of the country of practice. For example, posting a clinical photo on social media could be allowed with a patient's consent in the USA but not in Saudi Arabia. Adherence to the laws of the country or state where physicians are practicing and providing the standard clinical practice could potentially reduce healthcare personnel liability.[8,9]

The Law of Practicing Healthcare Professions (**LPHP**) was introduced by the Ministry of Health (MOH) in 2005. LPHP regulates multiple aspects including licensing healthcare professionals, medicolegal committees, the process of litigation, and obligations toward healthcare facilities and patients.[10] Currently, healthcare providers are not required to review or know LPHP to get licensed to practice in Saudi Arabia. Not knowing the law could have an impact on the liability of physicians. This impact could be higher than anticipated because the majority of physicians in Saudi Arabia are foreigners.[11]

The LPHP has some deficiencies in some regulations. These deficiencies are left for interpretation by the judge and the medicolegal committee. This may lead to variability in decisions between different medicolegal committees. An example of such deficiencies is off-label prescriptions regulation. Off-label drug use is defined as administering medications for indications or using a dosage or dosage form, that has not been approved. Off-label use occurs in all specialties. However, it may be more common in areas of medicine in which the patient population is less likely to be included in clinical trials (e.g., pediatric, pregnant, or psychiatric patients).[12] Off-label medication use was reported to be up to 30% of the patients.[13, 14] If off-label prescribing was prohibited, various new therapies and evidence would not be presented and accessible for physicians worldwide.[12]

We aim to assess the observations and recommendations of the medicolegal committees' members concerning the impact of mandating LPHP training as a requirement to be licensed to practice in Saudi Arabia. The second aim is to assess the presence of any variability in interpreting the law by medicolegal committees' members, regarding off-label medication use, as an example of LPHP deficiencies.

2. Materials and methods

Study Design

This was a cross-sectional quantitative study during September 2020. A list of the members of the medicolegal committees in Saudi Arabia was obtained from the MOH. Each medicolegal committee, also known as a medical-sharia panel, consists of a judge and 3 physicians. The purpose of the panel is to trial malpractice lawsuits on weekly basis. An electronic survey was sent by email to all physicians who are members of these committees.

Survey Content

The electronic survey was constructed using Google Forms (Google Form, Mountain View, CA, USA). The survey questions were formulated by a member of the medicolegal committee and then revised by two other members to ensure content validity. The survey included two sections: demographic data and a self-designed questionnaire. The demographic data included age, number of years serving in the medicolegal panel, number of cases reviewed per year, and specialty (medical, surgical, or dentistry). The second section collected data regarding members' observation, opinions, and recommendations concerning LPHP and off-label medications prescription. Table 1 lists all items of the questionnaire.

Statistical Analysis

Statistical analysis was performed using SPSS version 23 (IBM Corp. Released 2015. Version 23.0. Armonk, NY: IBM Corp). All demographic frequencies were calculated and the responses to all questionnaire items were analyzed. We compared the responses of medical and surgical respondents; dentists were excluded due to the low number of

respondents. Because the data for some variables did not have a normal distribution and the assumption of variance homogeneity was violated for some of the variables, both independent samples *t*-tests and Mann-Whitney *U* tests were computed. We used Kolmogorov-Smirnov and Shapiro-Wilk to assess the normality of responses to certain survey items. A Chi-square test for independence was performed to test the associations between specialty and specific responses to the questionnaire. Correlation analyses were performed to compare responses based on demographics (age, years of experience, and the number of cases reviewed per year). We also tested for relationships between questionnaire items and demographics. Spearman's *rho* coefficients were calculated due to the non-normality of the data. A p-value of less than 0.05 was determined to be significant.

Ethical Considerations

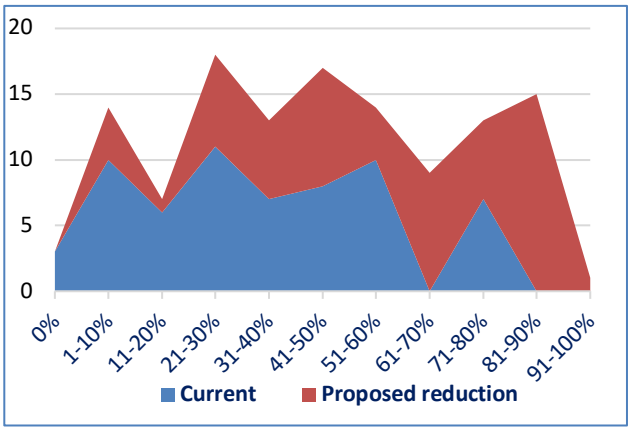
Approval from the MOH was obtained on the 6th of July 2020. No number was allocated for this project's ethical review. Electronic consent was obtained from each respondent before beginning the survey.

3. Results

Demographic data

Out of 109 medicolegal members, 62 responded to the survey (response rate = 56.8%). The mean age of respondents was 49.8 years (*SD* = 8.60); the mean number of years serving in the panel was 12.3 years (*SD* = 10.96); over 75% of the respondents had reviewed over 50 cases per year; and the respondents specialized in surgery were (62.9%), other medical specialties (29%), and dentistry (8.1%).

Figure 1: Current observed status and the proposed reduction in medical litigations after the implementation of LPHP. Y-axis represents the number of responses.



LPHP Implementation

Most of the respondents (67.7%) agree with the statement, "some physicians are liable only because they lack knowledge of the rules and not because of error in planning or executing treatment". Based on the respondents' observations, the average percentage of litigations due to lack of knowledge of the rules is 38.5% **(Figure 1)**.

Most respondents either agree (24.2%) or strongly agree (53.2%) with the statement "Implementing the Law of Practicing Healthcare Professions in training and licensing will reduce physician liability". An average of 61% reduction is expected to occur in litigations after implementation **(Figure 1)**. 67.7% believe that LPHP knowledge assessment should be implemented in both residency training and licensing. Responses to the questionnaire are presented in **Table 1a & 1b**.

Table 1a: Responses to questionnaire items

Question	Responses:	n (%)
If a malpractice lawsuit was trialed by multiple medical-sharea panels, it will have the same verdict every time.	Strongly Agree Agree Neutral Disagree Strongly Disagree	10 (16.1%) 16 (25.8%) 20 (32.3%) 11 (17.7) 5 (8.1%)
Some physicians are liable ONLY because they lack the knowledge of the rules and NOT because of errors in planning or executing the treatment.	True False	42 (67.7%) 20 (32.3%)
How much percentage of the cases you examine fall in the previous category?	0% 1-10% 11-20% 21-30% 31-40% 41-50% 51-60% 61-70% 71-80% 81-90% 91-100%	3 (4.8%) 10 (16.1%) 6 (9.7%) 11 (17.7%) 7 (11.3%) 8 (12.9%) 10 (16.1%) 0 (0%) 7 (11.3%) 0 (0%) 0 (0%)
Implementing the "Law of Practicing Healthcare Professions" in training and licensing will reduce physician liability.	Strongly Agree Agree Neutral Disagree Strongly Disagree	33 (53.2%) 15 (24.2%) 8 (12.9%) 2 (3.2%) 4 (6.5%)
How much reduction of physician liability do you anticipate if this type of training is implemented?	0% 1-10% 11-20% 21-30% 31-40% 41-50% 51-60% 61-70% 71-80% 81-90% 91-100%	0 (0%) 4 (6.5%) 1 (1.6%) 7 (11.3%) 6 (9.7%) 9 (14.5%) 4 (6.5%) 9 (14.5%) 6 (9.7%) 15 (24.2%) 1 (1.6%)
Where do you believe the implementation of the "Law of Practicing Healthcare	Licensing Residency training Both	3 (4.8%) 17 (27.4%) 42 (67.7%)

Professions" will be most useful?		
The physician should be held liable for any adverse event due to off-label medication use.	Strongly Agree Agree Neutral Disagree Strongly Disagree	12 (19.4%) 12 (19.4%) 10 (16.1%) 6 (9.7%) 22 (35.5%)
The physician should disclose if the medication is used as off-label.	Strongly Agree Agree Neutral Disagree Strongly Disagree	22 (35.5%) 14 (22.6%) 11 (17.7%) 6 (9.7%) 9 (14.5%)
The "Law of Practicing Healthcare Professions" needs further elaboration on off-label prescriptions.	Strongly Agree Agree Neutral Disagree Strongly Disagree	32 (51.6%) 13 (21%) 10 (16.1%) 1 (1.6%) 6 (9.7%)

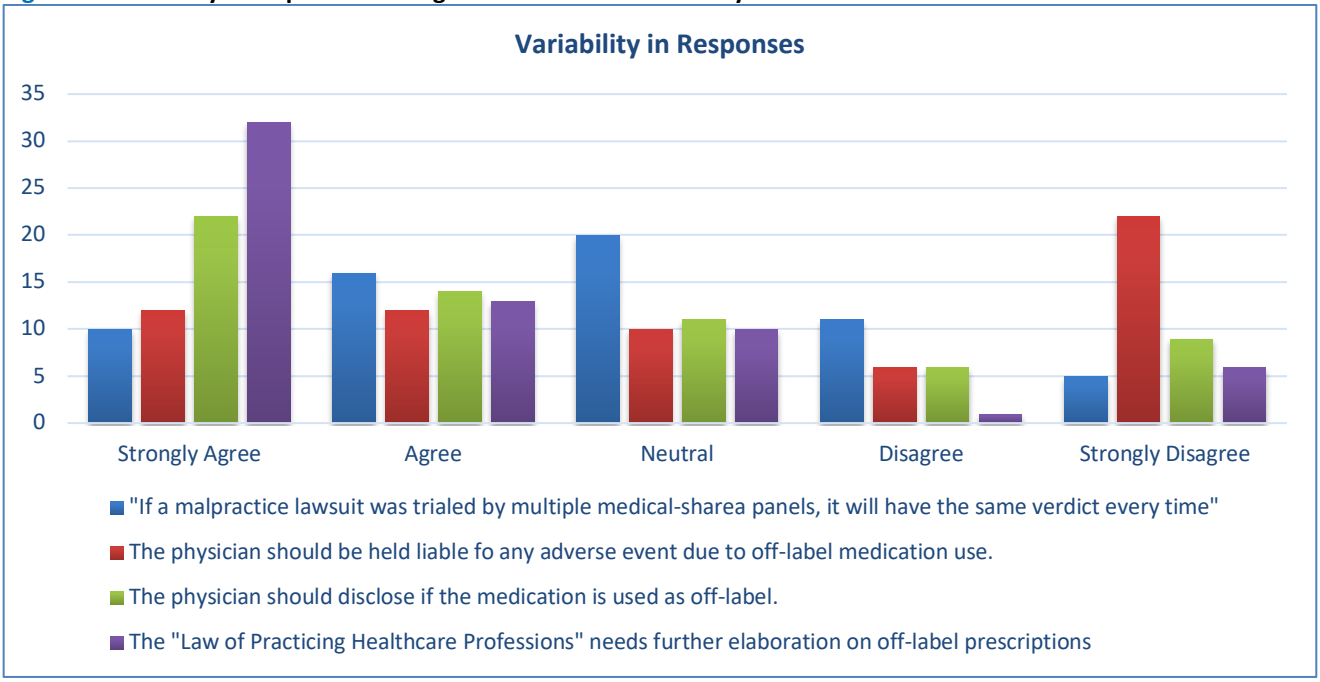
Off-Label Medication Use

Most of the respondents (58.1%) agree that physicians should disclose if the medication is used as off-label. 38.8% of medicolegal panels' members believe that physicians should be held liable for any adverse event due to off-label medication use. 72.6% agree that LPHP requires further elaboration on off-label prescriptions. As for the suggested laws, 58.1% recommended that physicians should disclose the off-label prescriptions, 48.4% recommended that physicians are only held liable if an approved alternative is available with equal efficacy, and 33.9%

Table 1b: Responses to questionnaire items

In regard to off-label medications, which of the following suggested laws is considered practical, respects patient autonomy, and reduces physician liability?	The disclosure that the medication is off-label is not needed	14 (22.6%)
	The disclosure that the medication is off-label is needed	36 (58.1%)
	The physician is liable if the indication is scientifically not supported	21 (33.9%)
	The physician is liable if an approved alternative is available with an equal efficacy	30 (48.4%)
	The physician is not liable and these medications can be used freely	5 (8.1%)

Figure 2: Variability in responses among certain items in the survey



recommended that physicians are held liable if the indication is not scientifically supported.

When asked about which of the presented laws regulating off-label prescription are practical, respect patient autonomy and reduce physician liability, the most frequent answer was the need for disclosure (58.1%), followed by liability if an approved alternative is available with an equal efficacy (46.8%), liability if the indication is not supported scientifically (33.9%), disclosure not needed (22.6%), no liability and prescription can be offered freely (8.1%). Only 41.9% of respondents either agree or strongly agree with the item stating that the same malpractice lawsuit if reviewed by multiple medico-legal panels will result in the same verdict.

Variability in responses among medicolegal committees' members

To assess the variability of responses to items pertaining to off-label use and reproducibility of the verdicts of the survey, we conducted both Kolmogorov-Smirnov and Shapiro-Wilk tests to quantify normality of distribution. Both normality

tests revealed statistically significant results showing all responses to be not normally distributed. **Figure 2** represents the responses to tested items, with a clear presentation of non-normally distributed data. Moreover, we assessed the skewness of data in each item. All responses were not skewed Except for the statement "The Law of Practicing Healthcare Professions needs further elaboration on off-label prescriptions".

Comparison between surgical and other medical specialties

The surgical and medical specialties groups were compared using both independent samples *t*-tests and Mann-Whitney *U* tests (Table 2). Moreover, a Chi-square test of independence was also performed. Medicolegal members from the medical specialty group (M = 3.94, SD = 1.21) agreed with the statement that physicians should be liable for any adverse event when using medications off-label statistically significantly higher than their surgical counterparts (M = 2.31, SD = 1.45). Other items didn't show any significant difference responses between medical and surgical specialties as shown in **Table 2.**

Table 2: Comparison between medical and surgical specialties.

Question	*t*/*U*	*p*
If a malpractice lawsuit was trialed by multiple medical-sharea panels, it will have the same verdict every time.	0.93	.358
How much percentage of the cases you examine fall in the previous category?	0.27	.792
Implementing the "Law of Practicing Healthcare Professions" in training and licensing will reduce physician liability.	-0.14	.892
The physician should be held liable for any adverse event due to off-label medication use.	144.00	< .001
The physician should disclose if the medication is used as off-label.	320.00	.581
The "Law of Practicing Healthcare Professions" needs further elaboration on off-label prescriptions.	-0.35	.726

Comparisons based on demographics

The relationships between questionnaire items and demographics (age, number of years in the panel, number of cases) were tested by correlation analysis. **Table 3** shows that age is a statistically significant variable. The older the medicolegal panel member, the more likely they were to deal with malpractice cases that occur due to lack of knowledge of the rules (r_s = 0.28).

Table 3: Correlation analysis between demographic data and questionnaire items

Question	Age	Years	Cases
If a malpractice lawsuit was trialed by multiple medical-sharea panels, it will have the same verdict every time.	-.10	.24	.19
How much percentage of the cases you examine fall in the previous category?	.28*	.11	-.02
Implementing the "Law of Practicing Healthcare Professions" in training and licensing will reduce physician liability.	-.08	-.17	.18
How much reduction of physician liability do you anticipate if this type of training is implemented?	.23	.12	-.08
The physician should be held liable for any adverse event due to off-label medication use.	-.25	.00	.00
The physician should disclose if the medication is used as off-label.	-.03	-.02	-.20
The "Law of Practicing Healthcare Professions" needs further elaboration on off-label prescriptions.	.09	-.07	-.23

4. Discussion

Medical malpractice combined with adverse events is a major cause of morbidity and mortality worldwide. The World Health Organization (WHO) estimates that 4 in 10 patients globally are harmed during primary and outpatient care and 80% of such harm is preventable.[15] This could explain the global increase in medical litigations. In Saudi Arabia, efforts to improve patient care and safety include the establishment of the Saudi patient safety center[16], the Saudi central board for accreditation of healthcare institutions[17], and the LPHP. Improving patient safety doesn't necessarily decrease physician liability.

The LPHP was introduced in 2005 through a royal decree and has undergone minor modifications since then. Many of the articles within the LPHP are consistent with universal standards of practice such as informed consent, autonomy, and the reporting of infectious diseases. However, some articles are not universal, for example, prohibition of publishing procedures in social networks for advertising, even with the patient's consent.[10] Thus, certain provisions of the law may subject physicians to increased liability due to a lack of knowledge of the law, despite practicing the best patient safety measures. In addition, LPHP is not detailed and probably has some deficiencies which are left for the legal committees to interpret. This may increase subjectivity and lead to different verdicts among similar cases. Physician

members of the medicolegal committees in Saudi Arabia are among the most highly respected professionals in the field of medical litigations. Their observations and opinion are valued highly, especially in the absence of detailed research on malpractice lawsuits in Saudi Arabia.

Most of the surveyed medicolegal committee members (67.7%) agree that some physicians are liable only because they lack the knowledge of the rules and not because of errors in planning or executing a treatment. Between 29% and 39% of the cases are observed to be due to the lack of physician knowledge of the LPHP rules and not due to errors in the planning or execution of treatment. Respondents expect an average of 61% reduction in medical litigations after the implementation of LPHP knowledge assessment in both licensing and training. According to the MOH, 66.6% of physicians in Saudi Arabia are foreigners.[11] Given the high number of foreign physicians, the probability of foreign physicians being unaware of local laws is more likely. In general, physicians and other healthcare professionals should familiarize themselves with the laws of the country of practice. And such a percentage should only add to the importance of implementing knowledge assessment in hopes of reaching the optimal healthcare environment for both the patient and the physician. Mandating an introduction to LPHP assessment during physician training and licensing may be cost-effective by minimizing reviewing unnecessary cases and reducing physician liability. To the best of our knowledge, there are no published data demonstrating changes in medical litigations after implementing knowledge assessments of the law. We recommend more research into quantifying the cost of medical litigations due to a lack of knowledge of the policies and rules in addition to implementing knowledge assessment.

In our study, we aimed to assess off-label prescription as an example of LPHP deficiency and to illustrate the variability in responses among medicolegal committees' members, which will impact their decisions. Rates of off-label use are variable and may be affected by the specialty itself and country of practice. In a review by Bavdekar and Gogtay across Germany, the United Kingdom, Ireland, Germany, Israel, Australia, and some of the European countries, the off-label drug use varied from 10.8 to 66.0%. The magnitude of off-label use varied according to the level of health care, subspecialty, and certain patient characteristics.[18] In Saudi Arabia, few studies regarding off-label medication were published and all were related to the pediatric population. Albeit, off-label medication use was reported to be up to 30% of the patients.[13,14]

In a study including 46,021 patients who received off-label medications, 3484 experienced adverse events, demonstrating a higher rate of adverse events compared to on-label use (19.7 vs 12.5 per 100,000).[19] In our study, 38.8% of medicolegal panels members believe that physicians should be held liable for any adverse event due to off-label medication use. In the United States, the FDA and AMA state that physicians are at liberty to prescribe approved drugs for any scientifically supported use, whether on- or off-label.[20] To minimize liability, physicians should prescribe medications only for indications that they believe and can argue are in the best interest of their patients.

Most of the respondents (58.1%) agree that physicians should disclose if the medication is used off-label. However, it should be noted that such disclosure could frighten patients and lead to refusal of treatment and unforeseen consequences.[21] In the US, no court decision has mandated that a physician must disclose, through an informed consent process, the off-label use of a drug.[22] In Saudi Arabia, although it is a common practice, LPHP does not regulate its use. Another potential drawback to disclosure is that doctors would be burdened by focusing on reading more governmental materials and the approval status of each drug rather than focusing on patient care.[23] Physicians' fear of facing litigations in the event of off-label use may introduce an environment of uncertainty to physicians and possibly enforcing the practice of defensive medicine, without providing the proper "off-label" treatment. Defensive medicine will subsequently increase the cost of patient care.[21]

72.6% of respondents agreed that LPHP requires further elaboration about off-label medication use. The optimal situation in regulating off-label use of medications is to provide a legal system and policies that are practical, respect patient autonomy, provide room for scientific development and reduce physician liability. In the setting of such a high percentage agreeing that LPHP requires further elaboration on off-label use, we asked our study members to pick recommended laws that will provide more clarity. Most of the respondents recommended

that physicians should disclose that the medication is off-label (58.1%), the physician should be liable if an approved alternative is available with equal efficacy (48.4%), and physicians are liable if the indication is not scientifically supported (33.9%). On the other hand, only a few respondents stated that disclosure that the medication is off-label is not needed and physicians are not liable in such cases.

In a perfect world, all medications would have solid scientific support. However, this is not always true. Off-label use of medication is an integral part of contemporary medicine and the scientific cycle and providing space for physicians to prescribe such medications will assist in providing such an environment.[24] We recommend that policymakers and physicians introduce policies and laws that provide a culture of utmost freedom of using medications off-label and minimizing patients' safety compromises. Such a culture will hopefully propel research and innovation, maintain optimal patient care, and regulate clinical practice without increasing liability.

Moreover, we assessed the variability of responses among medicolegal members, regarding off-label prescription, using normality tests and skewness. We noticed a high variability in the responses of medicolegal panels' members. Such variability reflects the necessity of elaboration and standardization of LPHP, as deficiencies in the law will create room for subjective rulings and inequality between different lawsuits. This finding was emphasized by the fact that only 41.9% of respondents agree that the same malpractice lawsuit would result in the same verdict if it was reviewed by multiple medico-legal panels. Disagreement among professionals is common and occurs in up to 30% of physicians.[21] In a study that reviewed 20 years of medical malpractice claims, it has been suggested that providing jurors with scientific material in a comprehensible manner could improve the consistency of verdicts in malpractice cases.[25] Variability among verdicts is inevitable, but further efforts should be done to minimize it. We suggest standardizing LPHP articles, making them more comprehensive, and consulting specialists in each field to provide an expert's opinion.

5. Conclusion

We recommend further elaboration in LPHP based on the need and difficulties faced by medicolegal committees. In addition, we recommend the implementation of LPHP in training and licensing to establish higher adherence to Saudi Arabia's law. Further objective research in the field of medicolegal litigation in Saudi Arabia is needed.

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Statement of Ethics

Approval to conduct this paper was obtained from the Ministry of Health. Written electronic consent was obtained from participants prior to beginning the survey.

Conflict of Interest Statement

The authors have no conflicts of interest to declare

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Author Contribution

MA: Data collection, Data analysis, Manuscript preparation and editing.

RA: Conception, Ethical Approval, Manuscript Review.

Data Availability Statement

All data generated or analyzed during this study are included in this article. Further enquiries can be directed to the corresponding author.

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Original Research Article

Post validation of Multiple Choice Questons in Forensic Medicine & Toxicology

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Key words
Assessment,
Difficulty Index,
Discrimination Index,
Distractor efficiency.

Abstract

Background: Item analysis examines student responses to individual test items (questions) to evaluate the quality of those items and the test as a whole. **Materials and Method:** The study was conducted in the Department of Forensic Medicine & Toxicology as a part of the internal assessment with 55 MCQs from Forensic Medicine subject. These questions were administered to 90 (batch of 115) students of fifth semester (second year MBBS students). Answer sheets were evaluated; the scores were then arranged in decreasing order. The whole list was then divided into the first 30% of students (high achievers) & the last 30% (low achievers). The difficulty index (Dif I), discrimination index (DI), and distractor effectiveness (DE) were calculated using standard formulae. These MCQs and distractors were classified as per standard reference ranges. **Results:** The difficulty index of 32 (58.18%) items was in the acceptable range (Dif I= 30–70%), 14 (25.45%) items were too easy (>70%), and 09 (16.36%) items were difficult (<30%). The discrimination index of 10 (18.18%) items were excellent (>0.35), 19 (34.55%) items were good (0.25–0.35), and 25 (45.45%) items were poor (<0.2). A total of 55 items had 165 distractors. Amongst these, 32 (19.75%) were non-functional distracters (NFD), 133 (80.60%) were functional distracters (FD). **Conclusions:** Post-validation of MCQs must be performed to filter MCQs of acceptable validity, which would increase their quality as assessment tools thereby making assessment more meaningful.

1. Introduction

Item analysis, also known as post-validation, is the process of analysing the performance of a multiple-choice question (MCQ) after it has appeared in a question paper/test.[1,2]

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Item analysis primarily creates a question bank of hundreds of questions with known difficulty levels and discrimination.[3]

The National Medical Commission's new curriculum makes objective assessment paramount in medical education. The Competency Based Medical curriculum (CBME -2019 onwards) has introduced MCQs (Multiple Choice Questions) for both summative and formative assessment for MBBS students in India. MCQs shall be granted weightage of not more than 20% of the total theory marks.[4] Framing of good MCQ is a time-consuming and challenging process. A well-constructed MCQ objectively measures knowledge, comprehension, application, analysis & evaluation.[5,6] Present study has been undertaken to evaluate MCQs or items and develop a good number of valid items by analysing with difficulty index (Dif I), discrimination index (DI), and distractor effectiveness (DE).

2. Materials and Methods:

This cross-sectional study was conducted in the Department of Forensic Medicine & Toxicology, Karwar Institute of Medical Sciences, Karwar, Karnataka as a part of the internal assessment. Pre-validation of the paper was done by all the faculty members of the department before the assessment. A total of 90 second year MBBS students took MCQ's test comprising 55 questions with a single best response. There was no negative marking, and the time allotted was 60 minutes. Each MCQ had a single stem with four options, including one correct answer and three distractors (incorrect answers). Each MCQ was assigned one mark. The maximum score possible was 55, and the minimum was zero.

Post-validation of the paper was done by item analysis. The scores of all the students were arranged in a decreasing order. The upper one-third (n=30) students were considered as high achievers and lower one-third (n=30) as low achievers. Paper with average scores, i.e., middle third (n=30), were excluded from the study. Each item was analysed for difficulty index (Dif I), discrimination index (DI), and distractor efficiency (DE). Difficulty index or P value was determined using formula Dif I = H + L/N ×100. Dif I represents the difficulty index, H represents the number of students answering the item correctly in the high-achieving group, L represents the number of students answering the item correctly in the low-achieving group. N represents the total number of students in the two groups (including non-responders). The discrimination index was calculated by the formula DI=H-L/N x 2, where the symbols H, L, and N represent the same values as before.

Items with Difficulty Index (Dif I) between 30-70% were considered acceptable; those with values over 70% & below 30% are very easy & difficult, respectively. Likewise, the items with a discrimination index between 0.25 to 0.35 are good, those with more than 0.35 are excellent, and those with values below 0.2 are poor discriminators. Negative discrimination indicates a defective item or wrong key answer.[2,3] An item contains a stem and four options, including one correct (key) and three incorrect (distractor) alternatives. Non-functional distractor (NFD) in an item is an option other than the key selected by <5% of students and a functional or practical distractor is the option chosen by 5% or more students. DE ranges from 0% to 100%. If an item contains three or two or one or nil NFDs, then DE would be 0, 33.3%, 66.6%, and 100%, respectively.

Statistical Analysis:

The data are reported as a percentage and mean plus or minus standard deviation (SD) of n (55) items. The relationship between the difficulty index and discrimination index values for all items was determined using Pearson's correlation coefficient and SPSS 16.0

3. Results:

A total of 90 students gave the test consisting of 55 MCQs.

Table 1: Range, Mean & standard deviation of Difficult, Discrimination Indices & Distractor efficiency (n=55)

Parameter	Range	Mean± Std Deviation
Difficulty index	13.3 – 91.7	52.20 ± 20.82
Discrimination index	0.03 – 0.73	0.22 ± 0.14
Distractor efficiency	33.3 – 100	83.57 ± 21.95

Table 2: Distractors and categorization of MCQs according to distractor efficiency

Parameter	Number (%)
Total MCQ	55
Total Distractors	165
Functional distractors	133 (80.60%)
Non functional distractors (NFD)	32 (19.75%)
Items with 0 NFD (DE 100%)	28
Items with 1 NFD (DE 66.6%)	22
Items with 2 NFD (DE 33.3%)	05
Mean DE	83.57± 21.95
Range	33.3 – 100

As seen in **Table 1**, the mean Dif I was 52.20 ± 20.82, while the mean DI was 0.22 ± 0.14. The

distribution between difficulty indices (range 13.3–91.7) and discrimination indices (range 0.03–0.73) in all 55 MCQ items was analysed. A total of 55 items had 165 distractors. Amongst these, 32 (19.75%) were Non-functional distractors (NFDs), and 133 (80.60%) were functional distractors (FD). The mean distractor efficiency was 83.57 ± 21.95, and the distribution ranged from 33.3% to 100% **(Table 2)**.

Figure 1: Difficulty index of multiple-choice questions

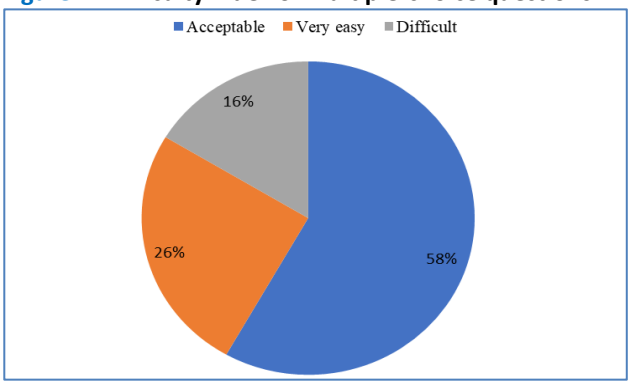
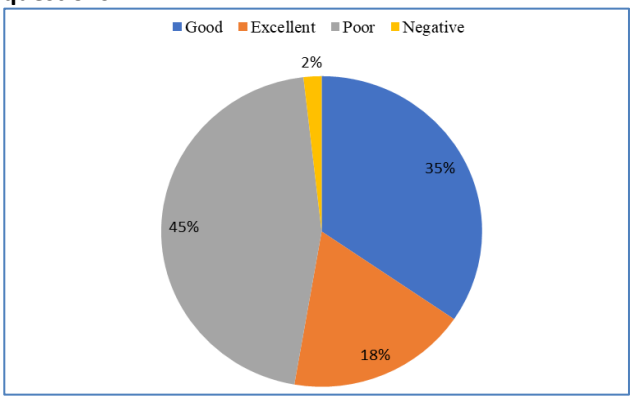


Figure 2: Discrimination index of multiple-choice questions



Out of a total of 55 items, difficulty indices of 25.45% (14) MCQ items were easy (Dif I > 70%), and about 16.36% (09) were difficult (< 30%). The remaining 58.18% (32) of the items were within an acceptable range (30–70%) **(Figure 1)**. The discrimination indices (DI) for 55 items showed 45.45% (25) of the items with poor discrimination power (<0.2), and 18.18% (10) of the items exhibited excellent discrimination (>0.35). The remaining 34.55 % (19) were acceptable and good (0.2 to 0.35) **(Figure2).**

4. Discussion:

Item analysis is particularly useful for improving items that will be used again in subsequent tests. It can also be used to eliminate ambiguous or misleading items in a single test administration. MCQs have the limitation of not assessing the psychomotor and affective domains, despite assessing the cognitive domain of learning with higher order thinking.[7,8] The parameter Difficulty Index is a misnomer. Few authors termed Diff I as a facility value indicated by the symbol 'P', as more is the Diff I, easier is the item, and vice versa.[2,5,9]

In a study conducted by Rao C et al. on 120 students of pathology for 40 MCQs, mean Dif I 50.16± 16.15 was reported.[10] Out of 40 items, 34 (85%) of the items were within the accepted range (Dif I=30-70%), 2 (5%) were easy (Dif I=>70%), 4 (10%) items were difficult (Dif I=<30%). The study reported by Mahjabeen W et al. showed a Mean Dif I of 58.74 ± 14.39.[11] They conducted the test on 110 pathology students with 65 MCQs. 53 (81%) items were in an acceptable range, 11(17%) were too easy, and 1(2%) was difficult. In another study by Kaur et al. on 150 students in Pharmacology for 50 MCQ mean Dif I was 59.18± 15.14.[5] The Dif I of 38 (76%) items were in the acceptable range (30-70%), 11(22%) items were easy (> 70%), and 1(2%) item was too difficult (<30%). The study by Mehta G & Mokashi V with 50 MCQ for 100 students of anatomy showed Dif I as 63.06± 18.95.[12]

The Dif I of 31 (62%) items was in the acceptable range (30-70%), 16(32%) items were easy (>70%), and 3(6%) items were difficult (<30%). Our study findings correspond with the study done by Mehta & Mokashi V, having a mean Dif I of 52.20 ± 20.82. The Dif I of 32 (58.18%) items were in the acceptable range (30-70%), 14(25.45%) items were too easy (<70%), and 09 (16.36%) items were too difficult (<30%). Too difficult items (≤ 30%) can lead to deflated scores, while the easy items (> 70%) may result in inflated scores and a decline in motivation.[13,14] Items with high DIF I (>70%) should be placed either at the start of the test as "warm-up" questions to enhance the confidence of students or removed. Similarly, difficult items (<30%) should be either revised or removed.[5,15] In our study, 09 items were too difficult and removed from the list. Items that were too easy[14] were, modified and kept for subsequent use, along with items within the acceptable range. Discrimination Index of an item indicates its ability to differentiate between students of higher and lower abilities & is used for selecting students as in an entrance examination.[2]

It is apparent that a question that is either too difficult or too easy will have nil or poor DI.[13] Generally, items of the middle level of difficulty are likely to have maximum discrimination. In a study by

Rao et al. out of 40 items, 24 (60%) items were excellent (DI >0.4), 4 (10%) items were good (DI= 0.3-0.39), 6 (15%) items were acceptable (DI=0.2-0.29) and 6 (15%) items were poor (DI <0-0.19).[10] The study conducted by Mahjabeen W et al. showed Mean DI of 0.35 ± 0.16 with 15 (23%), 5 (8%), and 11(17%) items demonstrating good, acceptable, and poor discrimination, respectively.[11] The study reported by Kaur et al. showed mean DI of 0.37 ± 0.15 with 7 (14%) items being poor (DI < 0.2), 12 (24%) items being good (DI ≥ 0.20 and ≤0.35), and 31 (62%) items were excellent (DI > 0.35).[5] In a study done by Shahid R et al. (with 50 MCQs) showed a mean DI of 0.27 ± 0.14 with 19 (38%) items being poor, 17 (34%) items being good, and 14(28%) items being excellent.[16]

The present study findings with 55 MCQs were similar to this study and showed mean DI of 0.22 ± 0.14, with 25 (45%) items being poor, 19 (35%) items being good, and 10(18%) items being excellent in discrimination power. In our study, 1(2%) item had negative (less than zero) DI, and it was discarded because of the ambiguity since lower-ability students answer questions correctly than those with the higher ability & tend to decrease the validity of the test. Some other studies have shown negative DI in 10 (20%)13 and 2(4) % 15 MCQ items.

Analysis of distractors is done to determine their usefulness in each item. Designing plausible distractors & reducing NFDs is an important aspect of preparing MCQs.[13] In a study of item analysis by Rao et al. showed a total of 40 items with 120 distractors, mean DE was 89.99 ± 24.426.[10] Out of 120 distractors, 6 (5%) were NFDs, and 114 (95%) were FDs. Study by Kaur et al. reported 150 distractors for 50 MCQ.[5] The mean DE was 83.98 ± 24.52 with 123 FDs and 27 NFDs. In Mehta G and Mokashi V study 50 MCQs showed 150 distractors; 53 (35.33%) were found to be NFDs, and 28(18.66%) were FDs.[10] More NFDs in an item increase Diff I (easy item) and reduces DE. Similarly, item with more FDs decreases Diff I (difficult item) and increases DE.

Our study showed a Mean DE of 83.65± 21.95, with 133 (80.60%) FDs, and 32 (19.75%) NFDs. So, Items with acceptable Dif I and the NFDs were modified and kept for future test assessment.

5. Conclusion:

Items analysed in the study were neither too easy nor too difficult (mean Dif I = 52.20±20.82), which is acceptable, but the overall DI was 0.22. Therefore, items were acceptably difficult but were poor at differentiating higher and lower-ability students. DI was poor due to the one item with negative DI. Items with negative DI and NFDs will decrease the validity of the test & must be removed from the subsequent assessments.

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Original Research Article

Knowledge, Attitude and Practice of Medical Ethics and Medico-Legal Issues by Clinicians: A Cross-Sectional Study at a Tertiary Healthcare Centre In Maharashtra.

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Key words
Medico legal cases, Casualty Medical Officers, Postgraduate residents.

Abstract

Background: Medicine is a noble profession, but there is also growing anxiety both within the profession and in the community regarding increasing trends of complaints and lawsuit against clinicians. The trainee period is an important time for fostering ethical reasoning in clinicians. Health care providers are at high risk for litigations. Being aware about medico-legal aspects, performing the duties ethically can be a safe side for oneself against risks of litigations. **Material and Methods:** Institutional Cross-sectional study was conducted, using questionnaire based study among the practicing, CMOs, PG residents and interns in a tertiary care centre in Nashik. **Results:** Total 120 participants were included in our study. We found that 108 (90%) intern, 7 (5.83) and 5(4.17%) post graduate students had no proper knowledge in handling medico legal cases independently. (45%) participants were of opinion that the present current overall knowledge of medico legal cases is appropriate not sufficient for them to tackle medico legal cases. **Conclusion**: Large numbers of medical professionals were detected to have gap between their knowledge and practice. Many of them were of the opinion that Medico Legal aspects to be incorporate and make compulsory at every level with advanced skill based practical knowledge.

1. Introduction

A medical practitioner's primary responsibility is to save a patients' life. At the same time, bound by ethical and legal obligations, he needs to abide by the laws of the land while discharging his duties. Health care decisions should be based on clinical, technical and ethical grounds. It is essential for the attending doctors to maintain a proper medical record of the patient, especially in 'medico-legal' cases in accordance with the law of land.[1,2]

Forensic practitioners have the necessary expertise in the area of documentation,

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description, analysis of the degree of causation, the timing of assault, identifying the causative agent/instrument and the manner of infliction. But it is difficult to have a forensic doctor present at every hour in a hospital or clinic to address the medico-legal cases. This responsibility of recognizing such medico-legal issues then lies with the attending physicians. Patient information confidentiality should be strictly adhered to while conducting history and examination.

With an increase in the awareness about medical negligence in India, hospital[3] managements are now frequently facing complaints against the facilities, standards of professional competence, and the appropriateness of their therapeutic and diagnostic methods. Since the Consumer Protection Act, 1986 has come into force; some patients have filed legal cases against doctors and have established that the doctors were negligent in their medical service.[4] Since an expert opinion is required from doctors in medico-legal issues in the court, it is important for them to have sufficient knowledge.[5] It is necessary that doctors be aware of the legal aspects to their profession and takes the needful measures to protect themselves and their patients from legal traps. Knowledge, medical ethics and attitude and medico legal issues are as fundamental to the practice of medicine as clinical skills.[6]The increasing trends of medico-legal issues encountered at trauma centres or casualty emphasizes the need to have physicians who are equipped to deal with such situations. It's well known that in an era of escalating crime, litigation and gap in doctor- patient relationship, ignorance of law would lead to pitfalls in practice.[7,8]

This study was filled the gaps in the available literature on the prevalence of knowledge, attitude and practice among clinicians (medical officers, PG residents and interns) involving medico-legal issues.

2. Methodology:

This study was be a cross -sectional, institutional, questionnaire-based study among the practicing medical officers, PG residents and interns in a tertiary care centre in our institute -Nasik District of Maharashtra- India. The duration of this study was 6 months from May 2021 to Nov 2021. The sample size of the participants was including all the target population actively engaged in the hospital during this period. A complete enumeration method was used to select the sample population by using the records from the attendance register kept in the casualty and the respective clinical departments. An informed consent was taken from the participants in the beginning of the study before the distribution of the questionnaire. The questionnaire was distributed via Google forms to the participants. A structured, close-ended, rating scale (linker model), pre-designed, pre-validated and standardized questionnaire was used to collect the data from the sample population.

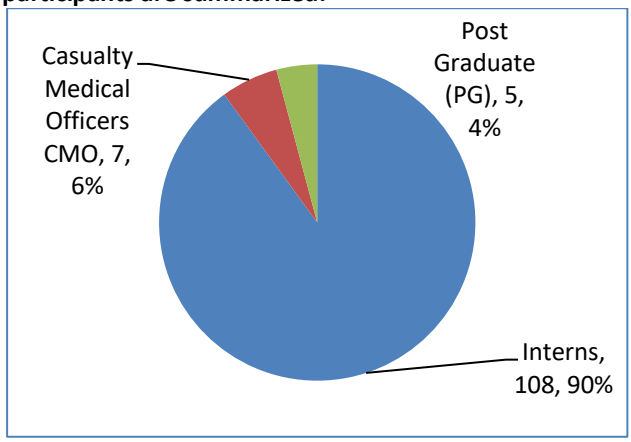
Inclusion Criteria

1. All the participants who were either casualty medical officers, post graduate residents and interns was included in the study
2. Exclusion Criteria
3. All those who would not like to be a part of this study
4. Any participants who have been on a long term leave during the study was not included.

3. Results

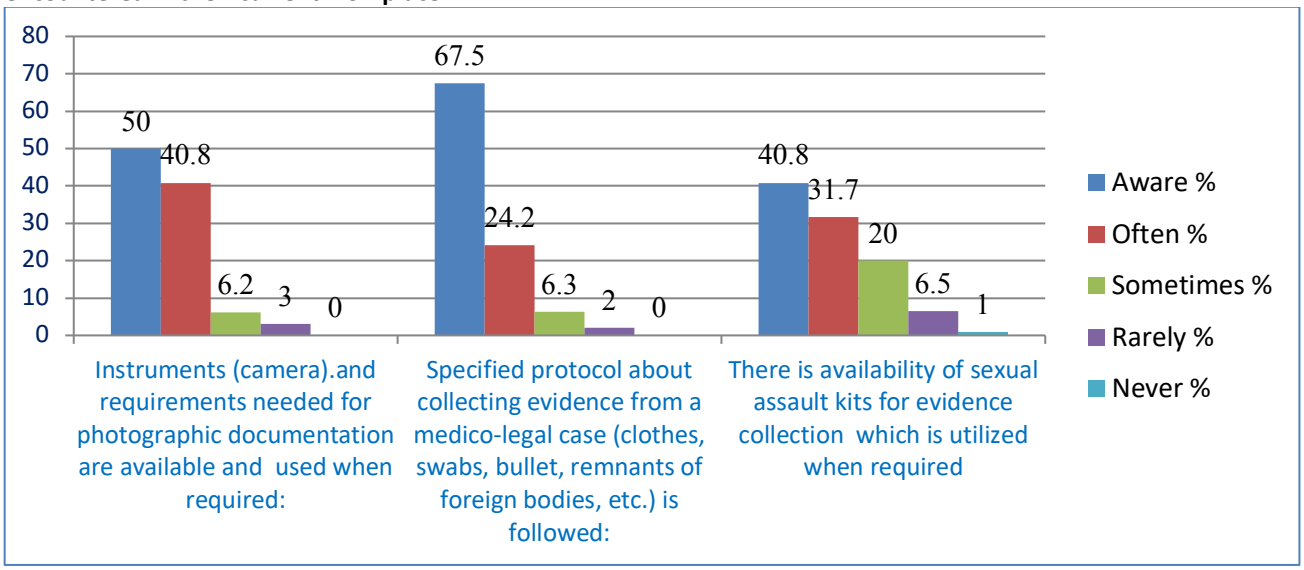
120 medical professionals completed Google questionnaire which resulted in a response rate of 100%. Among the respondents, majority are females= 65 (54.17). The majority of participants are interns *n*=108 (90 %) **(Graph 1)**. The majority of 50 % Medical Professionals always want to Instruments (camera) and requirements needed for photographic documentation are available and used when required.

Graph 1: The socio demographic characteristics of the participants are summarized.

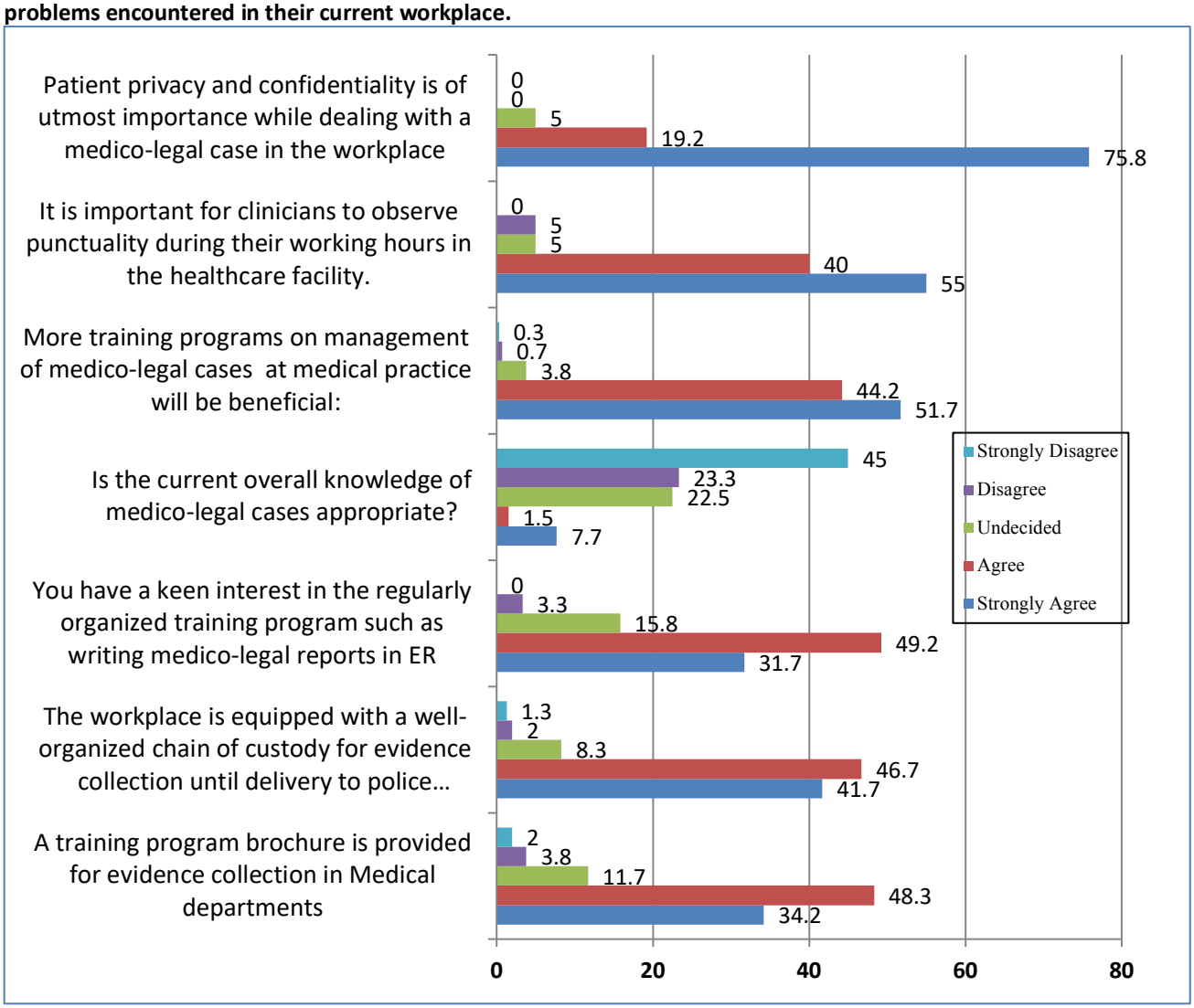


Out of 120, 75.5% always and 24.2% required Specified protocol about collecting evidence from a medico-legal case (clothes, swabs, bullet, remnants of foreign bodies, etc.) is followed. Among the total 40.8% always with there is availability of sexual assault kits for evidence collection which is utilized when required **(Graph-2)**.

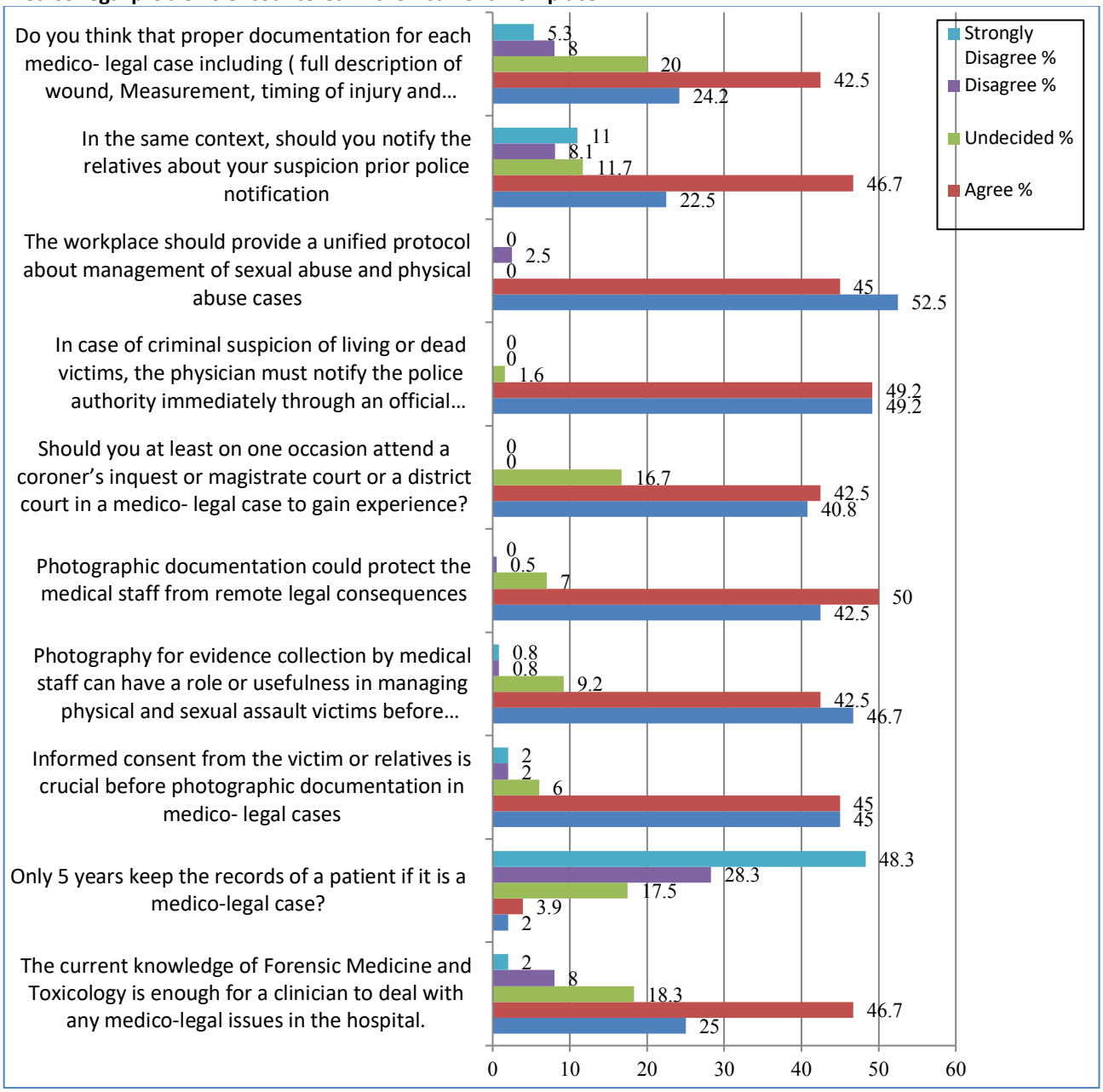
Graph 2: Attitude of Casualty medical officer, Post Graduate students and Interns on Medico-legal problems encountered in their current workplace



Graph 3: Attitude and Knowledge of Casualty medical officer, Post Graduate students and Interns on Medico-legal problems encountered in their current workplace.



Graph 4: Knowledge of medico- legal problems of Casualty medical officer, Post Graduate students and Interns on Medico-legal problems encountered in their current workplace.



Out of 48.3 % agree and 34.2 strongly agree to "A training program brochure is provided for evidence collection in Medical departments". Among participants 41.7 % agree and 47.7% strongly agree that "The workplace is equipped with a well-organized chain of custody for evidence collection until delivery to police authority:" among 49.2 % agree that "You have a keen interest in the regularly organized training program such as writing medico-legal reports in ER". Majority of participants 45% disagree that "Is the current overall knowledge of medico legal cases appropriate?"In the present study 51.7% participants strongly agree that "More training programs on management of medico-legal cases at medical practice will be beneficial:" Among all doctors 55% strongly agree that "It is important for clinicians to observe punctuality during their working hours in the healthcare facility." 75.8% participants are strongly agreed that "Patient privacy and confidentiality is of utmost importance while dealing with a medico-legal case in the workplace" **(Graph-3)**.

All of this medical staff 46.7% were agrees that "the current knowledge of Forensic Medicine and Toxicology is enough for a clinician to deal with

any medico-legal issues in the hospital." Out of which 48.3% medical doctors strongly disagree for Only 5 years keep the records of a patient if it is a medico-legal case, 45% participants strongly agree and agree that "Informed consent from the victim or relatives is crucial before photographic documentation in medico - legal cases." 46.7% strongly agree that "Photography for evidence collection by medical staff can have a role or usefulness in managing physical and sexual assault victims." 42.5 % strongly agree and 50% agree that "Photographic documentation could protect the medical staff from remote legal consequences."

Majority of the participants are 42.5% agree and 40.8% strongly agree that "Should you at least on one occasion attend a coroner's inquest or magistrate court or a district court in a medico- legal case to gain experience". All of this 49.2% strongly agree and agree that "In case of criminal suspicion of living or dead victims, the physician must notify the police authority immediately through an official procedure". Out of 120 participants 52.5% strongly agree that "The workplace should provide a unified protocol about management of sexual abuse and physical abuse cases." In the same context, should you notify the relatives about your suspicion prior police notification? 46.7 participants were agreeing for this statement. 42.5 agree that "do you think that proper documentation for each medico- legal case including (full description of wound, Measurement, timing of injury and photography" **(Graph No.4)**.

4. Discussion

In accordance with the law of the land, by law enforcement agencies is essential to establish and fix responsibility for MLCs of an injury/illness, eliciting history and examining the patient where the attending doctor thinks that some investigation in the case is required.[1] Due to questions by police personnel, harassment by the lawyers, attending the court, and unwarranted laws and regulations, many doctors are apprehensive in handling such MLC because of fear.[9]The immediate issue is concern to all medical fraternity is that there are more cases against doctors with an increase in awareness among public on subject of ethical conduct of medical practitioners with the increase in use of internet and social media. Hence all medical practitioners must be aware of their clinical practice& legal and ethical implications. Therefore, we have carried out a study to determine the Practice of Medical Ethics and Medico-legal issues, Attitude and Knowledge by clinicians: A cross-sectional study at a tertiary healthcare centre. In our study of 108 (90%) interns, 7 (5.83%) CMO and 5 (4.17%) PG students we noticed that PG students were more aware about MLCs than that of interns due to possibility of more exposure MLCs during the tenure of post-graduation. This is consistent with the study done by Dash S.K. in 2010.[10]

Majority of interns (48.3 %) agree and 34.2% strongly agree to the fact that in medical department's workplace, a brochure of training is provide for evidence collection and and along with 49.2% health professional agree that writing medico-legal reports in emergency room (ER). But 49.2% of health professional participants strongly agree that in case of criminal suspicion of living or dead victims, the physician must notify the police authority immediately through an official procedure: or Informed consent from the victim or relatives is crucial before photographic documentation in medico legal cases. Some emergency physicians have found to be compatible with collecting physical evidences from a suspected criminal act, whereas others of a view that this practice as incompatible with the best interests of their patients.[11]

While dealing with a medico-legal case in the workplace, patient privacy and confidentiality is of utmost importance. Between the doctor and his patient, a confidentiality term contract is implied.[12] In the course of his professional work the doctor is obliged to keep secret, everything he comes to know concerning the patient. There are situations where doctors of a treating team must know all details about the patient even if it is about HIV or Hepatitis.[13] For legal consequences of the medical staff from remote photographic documentation could protect. A Physicians or a treating clinician should act respectfully with patient consent in condition where collecting evidence, including photographing and recording, is part of treatment of victims.[14]Few studies on health care workers thought that managing of forensic cases was problematic due to the aggressiveness of the patients' relatives. All intern students received training in ER during their internship as per their curriculum. However, their practical approach of forensic cases was inadequate as only 14.5% of them had been previously involved in photographic documentation.[15]

All the health professionals' (67.7%) strongly agree that specified protocol about collecting

evidence from a medico-legal case (clothes, swabs, bullet, remnants of foreign bodies, etc.) is followed. Regarding knowledge of Clinical Forensic Medicine, as very few were familiar collection of evidences in sexual assault cases. It was also observed that very few interns and postgraduates were aware of the details about injury certificate. Medical council of India (MCI) has recommended that it is desirable and compulsory for MBBS graduates and post graduates to know about reporting of injury, collection of biological material and all aspects of medico-legal cases.[1,16]

Most of the Interns and PG students were well aware about written informed and valid consent but less was aware about medico legal record keeping in hospital. Most of them were of opinion that there is no specified time limit after which the Medico Legal reports can be destroyed; hence, they have to be preserved. In view of the multitude of cases against the doctors under the Consumer Protection Act, it is advisable to preserve all the inpatient records for a period of at least 5 years and outpatient department records for 3 years.[1] This was known to fewer participants. These finding are similar to study conducted by Rai JJ, et al among interns and postgraduates about medical law and negligence in Vadodara in 2016.[17] Written records, which include medical history, chart notes, radiographs, and photographs, must be meticulous, and it is necessary for the documents to be signed and dated with time. It can be done by introducing dedicated Clinical Forensic Medicine Unit.[18,19] Legally, physician written records carry more weight than patient's recollections.[20] In our study, 48.3% strongly disagree and 28.3% disagree only 5 years keep the records of a patient, if it is a medico-legal case because record keeping and maintenance that records of medico-legal cases must be maintained till the judgment of the case.

5. Conclusion

Knowledge, Attitude and Practice of Medical Ethics and Medico-legal Issues by clinicians' study was prepared for future practice and good knowledge and positive attitude to the medico legal problems. Large number of interns was detected gap between their knowledge and practice. Interns were unaware about medical legal issue such as incomplete reporting, they did not know exactly how to deal with relatives, lack of knowledge how to handle document medico legal cases and did not distinguish the necessity of taking informed consent from patients or their families. Therefore, we recommended that unavoidable rotator posting in Forensic Medicine Department should be introduced in their training period to increase the awareness and knowledge about Medico Legal issues. Should try to organise seminars, case discussions, MLCs Simulation programme and CMEs for interns and post graduates to increase awareness and to update them about Medico Legal issues in medical practice.

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Case Series

Survivors of Child Sexual Violence in India and Their Search for Justice: A Case Series and Review of Literature

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Child Sexual Abuse, POCSO Act, Secondary Victimization, Sexual Offences.

Abstract

The Protection of Children from Sexual Offenses (POCSO) Act, formulated to deal with all forms of sexual offence against children, was notified on November 14, 2012. POCSO Act is gender neutral, in that crimes committed against children will be governed by this act regardless of their gender. Reporting of abuse to Police is mandatory under this Act. The Act has laid down child-friendly practices to mitigate the consequences of reporting child sexual abuse (CSA), especially the associated social stigma. The Act prescribes for special courts, expedited trials, provisions to prevent secondary victimization of the survivor and ensuring confidentiality. Upon a cursory glance, the POCSO Act may seem like the ideal legislation to protect children from sexual offences. Unfortunately, our experiences from managing survivors of CSA have revealed a different truth. The harsh reality is that investigating authorities often blatantly disregard protocols, causing secondary victimization. These authorities sometimes fail to consider health issues and the long-term consequences, like sexually transmitted infections, pregnancy, and post-traumatic stress disorder. Survivors and their families feel frustrated with and alienated from the criminal justice system. We present here a series of 4 survivors of CSA, highlighting their plight after experiencing an adverse life event and discuss the relevant review of literature. Though POCSO act is a comprehensive law addressing the huge public health malady of CSA, there is scope for amending the law based on evolving medical and social research.

1. Introduction

The Protection of Children from Sexual Offenses (POCSO) Act is a gender-neutral law, against all forms of child sexual abuse (CSA). It came into force on November 14, 2012, making reporting of a CSA case mandatory.[1] The Act prescribes child-friendly practices to

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mitigate the consequences of reporting CSA, setting up of special courts, expedited trials, and guidelines to prevent secondary victimization and ensure confidentiality.

The POCSO Act seems like the ideal legislation to protect children from CSA; unfortunately, our experience reveals a different truth. The harsh reality is that investigating authorities often blatantly disregard protocols, causing secondary victimization. They fail to consider health issues and the long-term consequences, like sexually transmitted infections, and post-traumatic stress disorder. As a result, survivors and their families feel frustrated with the criminal justice system. We present here a series of cases of survivors of CSA, highlighting their plight.

2. Case presentations:

Case 1: Eight-year-old Ms. B was brought by her parents with an alleged history of digital penetration by an unknown adult male in the school toilet during lunch break. The child recounted the assailant inserted his fingers "near the place where she passes urine". When she cried out, he slapped her, threatened her with further violence and warned her not to tell anybody. When she went home, she had pain during urination and narrated the incident to her parents, who brought her to our hospital the following day. On examination, she was cooperative but anxious and withdrawn. Systemic and genital examinations were normal. The incident was reported to the police. The child was, however called to the police station to give a statement during which time she was interviewed alone and was not allowed to answer in the presence of her parents. She was also told that she should be truthful otherwise her parents would get in trouble.

Case 2: Twelve-year-old Ms. A was brought by her parents with an alleged history of digital penetration by a local godman, who had convinced the parents to perform a special religious ritual. He sent the parents to procure ingredients for the ritual, and when he was alone with the child, he made her remove her undergarments and inserted fingers into her genitalia. When she cried in pain, he threatened her with a "death curse" and warned her to not tell her parents. However, she confided in her parents and was taken to a private practitioner who referred her to our centre. On examination, she was alert and cooperative but appeared very anxious. In the genitalia, there was an abrasion measuring 5mm x 2mm over the posterior fourchette. Anus and oral cavity revealed no injuries. Systemic examination was unremarkable. The incident was reported. In view of her anxiety, she was hospitalized for 2 days, during which time she was stable. On discharge, she was treated with regular therapy under Child & Adolescent Psychiatry. She now seems well-adapted and doing well in academics. However, the accused has political connections and made death threats against the survivor and family and tried to pay money to the father of the survivor to withdraw the case.

Case 3 & 4: Eleven-year-old & seven-year-old master's C & D respectively were brought by their mother who noted aggression, frequent night terrors and declining interest in academic and religious activities, in her previously well-mannered sons. They would cry whenever a particular male relative visited. On enquiry, the elder son revealed repeated sexual abuse by his father, uncle, grandmother, and another male relative. Also, he recounted that before these incidents, he was given a drink, which made him sleepy. He recalled his paternal grandmother exposing her naked body to him and multiple incidents of anal penetration by the men. The abuse had started 3 years ago and occurred three to four times a month. He was also shown pornographic material and forced to perform oral intercourse. When he tried to resist, he was beaten and threatened that they would be hurt badly.

On examination, they both were well-oriented but withdrawn and wouldn't maintain eye contact. General and systems examinations, including oral cavity, genitalia and anus were normal. They tested negative for sexually transmitted diseases (STI). The incident was reported to the police, family received regular psychiatric treatment and support over several months. The mother was determined to get justice for her sons. According to the son's most of the abuse happened when they were abroad in their father's house, however recently it had happened in their maternal grandparent's house in India as well. The police called the children to the police station for an interview however the mother refused to take her children to the police station. During the court proceedings which happened 3 years after the complaint, the survivors were made to face the accused many times who tried to intimidate them on every occasion. The lawyer for the accused cross-examined the survivors for many hours making the

children very uncomfortable, to the extent that the children cried in court. This brought up memories of the past trauma to the boys who were otherwise adjusting well. The defense lawyer emphasized that the children had made up the allegations and were mentally ill or brainwashed by the mother.

3. Discussion & Review of Literature

a. Directives regarding medical examination of survivors of CSA

Previously, medical officers were reluctant to examine and treat a child survivor of CSA, unless a case was registered and a request for examination came from the investigating officer.[1] Supreme Court in 2000, condemned such practices and described the examination of a case of CSA as a "Medico-Legal emergency."[2] Section 27 of POCSO Act and rule 6, subsection 3 of POCSO Rules 2020 mandates an examination irrespective of registration of a case, to prevent delay in examination and loss of crucial evidence.[3-6]

b. Challenges related to police inquiry

A child survivor is often too young or in shock so as to recount all the details. When a child presents with indicators of CSA without verbalizing details of abuse, a diagnosis of 'suspected CSA' should be made. A child may not be able to recount details accurately. If the exact location, date, and time of the incident are not documented in the MLC form, it is usually not accepted by the police. As per the POCSO Act, the doctor then is at risk for penalty for not reporting. With such refusal by the Police, the MLC intimation form would then be scanned and sent as an email attachment to the Superintendent of Police and the Local Police Station.

POCSO Act specifies guidelines for police interaction with a child. Unfortunately, these instructions are not strictly followed. As per the Act, Police should not wear uniforms when visiting the child and family, which they often neglect to follow. In case 1, the child was called to the police station to give a statement. Also, the child had to undergo police questioning while the parents had to wait outside, which is against the guidelines. In another case, we had a survivor who was made to go to multiple police stations in one day and more than 30 male police officers asked her questions over the duration of the entire day. There is no mechanism available to rectify such violations of guidelines by the Police and to protect the survivors from secondary trauma. In one instance when the parents refused to file a police complaint, two police officers went to their house late in the night to convince the father to file a complaint. This resulted in the father suffering a panic attack and refusing further cooperation.

In another instance, police transported both the survivor and the accused in the same vehicle to the court and made them wait in the same room, which is against the guidelines and such arrangements had been allegedly made due to lack of finances. Prevalence of inappropriate practices during police enquiry have been noted by the National Commission for Protection of Child Rights (NCPCR). In 2018, The NCPCR instructed the Director General of Police of all States/Union Territories to cease such harassment as it is a violation of the Act.[7] Such practices are said to be done possibly due to Section 173 CrPC, which mandates completion of investigation within 3 months. [8]

The Tamil Nadu Commission for Protection of Child Rights (TNCPCR) has acknowledged that POCSO Act applies to boys, girls and third gender children. However, most stakeholders are unaware that children of all genders are vulnerable to sexual abuse.[9] Certain State Commissions for Protection of Child Rights (SCPCR) have blamed child survivors and their families for being uncooperative.[10,11]

c. Issues related to child safety and protection by various agencies:

SCPCR monitors the functioning of the Child Welfare Committee (CWC), District Child Protection Unit (DCPU), and other agencies in the state. Police should inform CWC and Special Courts about a case within 24 hours.[12] If the child needs care and protection, the police should within 24 hours ask CWC for an assessment report which should be furnished within 3 days. If a child needs protection, CWC assigns a support person, and informs the police/Special Juvenile Police Unit (SJPU) who then informs the Special Courts within 24 hours.[13]

In our experience, sometimes the children were left in an unsafe environment causing further trauma. In case 2, the alleged accused had political clout and made several death threats against the family. However, the police and CWC did not take any action on the complaint from the father. This raises questions on the ability of CWC and other agencies to protect a child survivor.[14] In cases 3 & 4 the child survivors had to face the accused many times when they visited the court. The accused used the opportunity to intimidate the survivors. In many

instances if the reporting happens from a police jurisdiction but the incident happened in another state, there seems to be no efficient method to ensure that filing of complaint and investigation happens in a time bound manner.

d. Issues related to judicial proceedings:

The POCSO Act lays down guidelines for judicial proceedings including creating special courts in each district to fast track the cases. However, in our experience, there was an undue delay in court proceedings in several cases. In a case, the child was unable to identify the model of car used to kidnap her and the accused was acquitted. In one case, forensic lab analysis revealed the presence of semen, but the accused was acquitted based on a technicality.[15] In some cases, during the court proceedings, child had to face the accused, causing additional trauma. In some cases, acquittal of accused by lower courts has been reversed by the higher court. The Supreme court has commented that judicial reliance on the testimony of the survivor for corroboration is not a requirement of the law but rather "a guidance of prudence under given circumstances." [16,17]

Courts should consider the effects of even a seemingly minor form of sexual abuse on a child and should be cognizant of the difficulty a very young child may have in recalling details of the event. It is difficult for a child to recollect details and POCSO Act lays the burden of proof on the accused. Hence, reliance on child's testimony should be avoided especially if they are very young. The parents do not want undue attention on their child because of the abuse and want to protect their child's future and thus are often hesitant to pursue the case in court. In one instance, the father stated that the whole family would commit suicide if police came to their house. This is a challenging situation for the doctor, who is mandated to report and on the other hand, must be vigilant about the mental condition of an entire family threatening suicide. Provisions under POCSO do not address such peculiar but not uncommon situations.

In majority of cases due to delayed reporting to hospital, there may be no physical evidence to suggest sexual violence, and this could be used as a defence by the alleged accused. For example, children present to a pediatrician or a child psychiatrist due to a fall in grades or behavioural changes which could be due to sexual abuse. Young children just a few years old are also survivors of child sexual abuse and often are not able to recall details of the incident. Children who are not sexually active if presented with sexually transmitted disease, then it is beyond reasonable doubt that he/she was a survivor of sexual abuse. Such young children are often unable to recount graphic details of the abuse and forcing them to recall such detail leads to secondary victimization. The judiciary should be made aware of such scenarios, and also to recognize the psychological effect of such traumatic incidents in a child and to admit those symptoms as a sign of child sexual violence.[18,19]

e. Clarity on legal age for sexual activity under POCSO

POCSO Act clearly labels all sexual activity involving a child as illegal. However, it does not consider the developmentally normal sexual exploratory activity in children. The law also criminalizes certain tribal customs where sexual activity among children younger than 18 years is culturally acceptable. Tribal communities are greatly affected by the POCSO act because the provisions of the act doesn't approve of their practices.[20,21] Also, in a case Hon'ble Karnataka high court has clarified "Intent of POCSO Act not to punish teens in love" whereas in another case the Hon'ble Delhi High court said "its hands were tied" when dealing with relationships involving teenagers that came under the POCSO Act, till parliament amends the law. Hence, it is evident that there is an urgent need to lay down clear guidelines about dealing with such scenarios and amend the act for social justice.[22,23]

f. Misuse of the POCSO act

Sometimes the girl's family files a POCSO case against a boy because they don't approve of the boy and the relationship between them. Since the age for consent for sexual activity is 18 years, any consensual activity among teenagers is deemed illegal. There is scope for the judiciary to consider these aspects while deciding on the verdict. Judiciary should also be aware of the stages of Child Sexual Abuse Accommodation Syndrome (CSAAS) i.e., secrecy, helplessness, accommodation, disclosure, and retraction[24]; and the cultural background of our country where a survivor fears social discrimination and stigma.

Despite the burden of proof being on the accused, the accused is often acquitted due to lack of evidence, inconsistencies in medico-legal documentation and survivor deposition, overambitious prosecution, and inconclusive

presentation of trace evidence. [25] The court proceedings should be completed in one year as per Section 35 of the POCSO Act, but it rarely happens. Data from 2016 to 2020 reveals the national conviction rate to be abysmally low (33.66%). This is another reason why the family is reluctant to seek legal remedy.[26-28]

g. Issues related to awarding compensation:

The Supreme Court has ruled that compensation is a constitutional right of survivors of sexual assault.[29] The Criminal injuries compensation board provides compensation to the survivor irrespective of the verdict, while the court of law awards compensation for the survivors only if the accused is convicted. While calculating the compensation, the Board takes into consideration the pain and suffering of the family, loss of earnings due to pregnancy, expenses of childbirth that was secondary to CSA, etc.

Guidelines categorize compensation into two parts: Interim and Final compensation based on factors like age, gravity of the injuries sustained, non-pecuniary loss (emotional or mental trauma), treatment costs, etc.[12,13] Compensation also depends on the offence committed under the POCSO Act, 2012. Under these guidelines, survivors are entitled to receive half the compensation amount decided by the special court at any stage after the FIR is registered. According to rule 7 of POCSO, the State Government should discharge the amount from the Victim compensation scheme or any other scheme within 30 days from the order of the special court.[5] Supreme court had stated explicitly that the compensation amount should be discharged without any discrimination among the survivors.[30]

4. Recommendations:

1. Police officers & Members of the Judiciary should undergo regular training sessions on the POCSO Act and Rules and other relevant legislations and guidelines.
2. Government can formulate a system to certify Police officers who have been trained in child-friendly practices. Only such officers should be allowed to interview a child survivor.
3. Regular training for Registered Medical Practitioners to manage their medico-legal duty while handling a case of CSA
4. RMPs should be oriented towards a multidisciplinary approach while handling a case of CSA
5. One Stop Centre's (OSC) with facilities for complete management of all cases of sexual offences, could be made functional across the country.
6. While managing CSA cases, all stakeholders must implement a holistic approach in providing comprehensive care and preventing further victimization of a survivor, so that long-term consequences can be avoided.[31,32]
7. Strengthen legal aid services to provide support and guidance to those in need and enhance protection measures for both victims and witnesses of such cases.[33,34]
8. Increase the education/awareness drive for school children and their parents and guardians, medical professionals and to promote the inculcation of good moral values and attitudes.[33-35]

5. Conclusion:

Though POCSO act is a comprehensive law addressing the huge public health malady of CSA, there is scope for amending the law based on evolving medical and social research. Although, OSCs are intended to curtail several challenges faced by the survivors, the practical feasibility and use of such facilities are far beyond reach at the moment. Stakeholders should make serious efforts to develop such facilities and ensure the functionality across India to help the afflicted.

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Original Review Article

The Role of Forensic Dentistry in Detecting Crimes in Jordanian Law and Judiciary

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Abstract

This research dealt with the topic of the role of forensic dentistry in detecting crimes in Jordanian law and the Jordanian judiciary. The aim of present study is to the role of forensic dentistry as part of forensic medicine in determining the identity, age, and gender of body owner, as well as estimating the time period of death and determining the cause of death, particularly in the cases of hanging or strangulation, and investigation of incidents of assault by biting that accompany many crimes such as rape. The extent to which legislators and the Jordanian judiciary consider forensic dentistry reports to detect the crimes committed. The need to explicitly stipulate in the Jordanian Criminal Procedure Law that forensic dental reports are considered one of the means of detecting crimes, and stimulating the role of the judiciary in adopting forensic dental reports during the process of detecting crimes, because of its practical importance and accurate and rapid results.

1. Introduction

The importance of the research lies in that it addresses the role of forensic dentistry in detecting crimes in Jordanian law and the Jordanian judiciary. The extent of the role of forensic dentistry in detecting crimes and recognizing the causes of death or physical injury, also, the research topic is one of the current and important topics that have a great impact on practical reality, and by consulting the jurisprudential opinion in forensic dentistry and the provisions of laws related to the subject of the research, and according to the jurisprudence of the Jordanian judiciary, the research will clarify all aspects of the subject, whether theoretical or practical. In addition, it will address the insufficiency points in the Jordanian medical constitution and the Jordanian Law of Criminal Procedure.

2. The historical development of forensic dentistry

It should be noted that while researching the historical development of forensic dentistry in "1937" at (Chantilly) city it was observed that a person was convicted of murder as a result of the bite marks left by the assailant on the victim's body, moreover, in (1946), "Duality" and "Glasgow" recommended setting up a system in which (500) cards of dental fundamentals could be entered in just one minute on a computer set, whereas, (Dr Talresal) recommended the "Lilith System", a system that operates with punched cards to match results, later, the “American Board of Forensic Odontology (ABFO)” was founded in (1967) and examined over one hundred and and examined over one hundred and sixteen forensic dentists, where the quantities of bodies identified

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through forensic dentistry increased from (17) in (1973) to (91) in (1995).[1]

All organs of the human body were an integrated unit where the general physician takes care of all the organs of the body, including oral and dental medicine, later, since the middle of the nineteenth century and early twentieth century until now, dentistry has become an independent speciality, and it has become an individual speciality. It has its various branches and many specialities. Nowadays, forensic dentistry has its own specialized identity, where it works alongside forensic medicine and many other medical specialities, in exposing some criminal social incidents and solving forensic medical issues to which it is attributed to reveal the signs and clues related to the mouth, jaws and teeth, as well as in some cases with common oral manifestations.[2]

3. The definition of forensic dentistry

The crime scene is the key to solving the crime mystery and is the first and important starting point for starting the handling of the criminal case, so that if the measures taken at the crime scene are correct, the whole process of investigation of the case will be correct, where specialists visit the crime scene only once. After that there will be no crime scene if the legal experts visiting crime scenes are inaccurate and untrained. Suppose necessary measures are not taken for the permanent and future preservation of this scene and its contents. In that case, the most important part of the criminal investigation into this case will be lost forever, where legal crime scene previewing is a professional and specialized task that requires many years of practical experience along with continuing education and training.[3]

Forensic medicine in general is a science that deals with many medical topics, as other departments of medicine, including forensic dentistry, are part of it, it deals with the topics and issues brought before the forensic physician by the judiciary or law enforcement departments, and since it direct the judge to find out the causes of the crime, the date and time of its occurrence, hence the name of "forensic medicine", in the sense that everything that is required from the forensic physician for the benefit of law and the judiciary , forensic medicine has a direct impact in combating crime and providing security statistics for the most widespread criminal cases in order to take preventive measures to prevent crimes, also, the judiciary in many cases is unable to adjudicate many lawsuits without referring to the forensic medicine.[4] Based on the preceding, forensic dentistry means: "The employment of dental sciences in a way that serves forensic medicine and the judiciary in general, and to enhance knowledge of legal aspects that can be based on tooth evidence".[5]

It is observed that universities have a role in creating special programs for teaching forensic dentistry courses due to its importance in detecting crimes; in addition, the physician assigned to detect the crime is a specialist in forensic dentistry with strong background, having the particular technical expertise to preview, for example, the body, or explore cases of sexual abuse by revealing the location of the bites with the teeth.[6]

4. The importance of forensic dentistry in detecting crimes

Identification of an unknown during mass disaster or any criminal activity is one of the main objectives of the medico-legal personnel's.[7] And The importance of forensic dentistry with regard to the effect of a bite using teeth should be noted, the human bite in sexual crimes is most often observed in the body of the victim or the body of the accused, and the bite is usually seen in the organs responsible for sexual practice, the human bite may appear on the body in the form of a small part of the dental arch (close to the shape of a circle or oval) representing the area between the canines with a small gap on the sides, which is the space between the upper and lower jaws, the bite may be in the form of abrasions, bruises, ruptures or a mixture of that, and the bite sometimes appears in the form of parallel lines as a result of the fangs sliding on the skin from top to bottom for a distance of up to a few centimeters, the impact of the human bite is treated with caution and accuracy from different angles, especially the direct front view angle, in the presence of appropriate lighting, in addition to taking color photos and black and white photos, as well as taking a swab from the bite mark by wiping a wet cotton swab by passing it from the outer edges of the bite to the inside of the bite, another swab shall be taken from another area of the body that has no trace of the bite, the swabs are kept in the freezer until they are sent to the laboratory, and if the capabilities are available, a mold is made for the sting effect by placing a plastic material (rubber or silicone with a substance that stimulates hardening) on the trace of the bite and leave it to harden.[8]

The importance of forensic dentistry also appears by revealing the crimes of torture if tooth biting was used against the victim. By previewing the forensic dentist on the traces of a tooth bite, the culprit and who committed the crime of torture was identified. Accordingly, the details and circumstances of that crime are revealed.[9]

If these possibilities are not available during the autopsy, the part of the skin containing the bite mark can be removed and placed in the freezer so that the trace of the bite can be compared to the accused's teeth, it is also necessary to inspect the accused's teeth to compare them with the mold or the trace on the saved skin, by checking the accused's teeth in the event of a full or partial denture, the number of teeth in the jaws, missing teeth, distinctively broken, or deformed teeth, irregularity of the cutting edge of the teeth, crooked teeth, and the presence of large spaces between the teeth, note that the comparison between the trace of the bite and the teeth of the accused has several methods, while some forensic dentists prefer to compare images of the magnified bite trace of ratio (1: 1) with pictures or drawings of the teeth, the image can be made from a positive mold of the bite mark, in which the cutting edges of the front teeth are inked, transferred to transparencies and placed on the image to determine the degree of compatibility between them, other forensic dentists prefer to use a negative image of the teeth and put it on a positive image of the bite mark, taking into account the degree of magnification between them, and then comparing the compatibility between them.[10] And means the determination of individuality of a person Determination of the identity of an individual is important for civil and criminal matters and to obtain a profile of unidentified dead bodies regarding their age, sex, percentage of bodies that remain unidentified.[11]

The purpose of the check of the body by the forensic dentist is to find out the cause of death and to indicate the pathological conditions if the person was infected with it before his death concerning his speciality as a dentist, by determining the causes of death from the point of view of forensic dentistry, whether it was a murder, fortuitous accident, or a common disease, as well as determining the time of death and identifying the body if its identity is not known. In order to perform forensic dental tasks, there must be many equipment and tools needed for checking and dissection purposes, which are both fixed and mobile equipment.[2]

5. The applications of forensic dentistry in Jordanian law and the judiciary

A forensic medicine report is defined as a written medical certificate related to a judicial matter that deals with the causes, circumstances.[12] And Forensic dentistry has a role in the Jordanian criminal justice methodology so that it is linked to the law and judicial procedures, as well as in the formation of judicial discretion authority in offences related to the dental forensic report.[13] It is worth noting that the Jordanian legislator has indirectly regulated the mechanism of performing forensic dentistry in detecting crimes, as Article (15) of The Jordanian Medical Constitution, The Duties of The Physician and The Ethics of the profession" stipulated that: "It is not permissible for a doctor to issue a certificate about a deceased person who did not witness his death struggle, or who did not follow up the disease of death before death case unless he is convinced with the cause of death according to his medical experience, and in the suspected criminal incidents, the doctor must inform the judicial authorities, which then has the right to allow to be buried the corpse after preview by a forensic doctor, either phenotypically or anatomically, as the attending physician in criminal cases ending in death shall refrain from issuing a death certificate and shall inform the authorities who have the right to dispose of the incident."[14]

Article (39) of the Jordanian Law of Criminal Procedure stipulates the following: "1. If the distinction of the nature and circumstances of the crime is based on knowledge of some arts and crafts, the public prosecutor shall accompany one or more masters of arts and crafts. 2. The court may take urgent measures to verify the health status of the injured or the defendant or verify the validity of the medical reports submitted in the lawsuit without the litigants' request."[15] Also, Article (40) of the same law stipulates the following: "If a person dies by murder or for unknown reasons that raise suspicion, the public prosecutor must seek the assistance of one or more doctors to prepare a report for the causes of death case and the condition of the corpse".[15]

It is also noted that the Jordanian penal legislator regulates the liability of the forensic dentist for his report so that the forensic dentist will be criminally liable for any mistake that may occur from

him, given that the report issued by the forensic dentist is one of the important reports that aim to reveal the truth or acquit the accused of the crime.[16] As for the relationship between the forensic dentist and the judiciary, this relationship appears if the dentist deals with an accident involving an oral injury and fractures in the teeth as a result of a car collision, in judicial cases, the forensic dentist will be asked to give his opinion on whether the wound will last for a long time to heal, how long it takes to heal, will the injury leave a distorted effect on the mouth or teeth, the cost of prosthetic industrial works for the cosmetic bridges, and whether the injury will leave a permanent disability such as the adhesion of temporomandibular articular , the judicial role of the dentist is also shown in the forensic dentist's relationship to the corpses, if a corpse is found, the forensic dentist can assist the judiciary by establishing the personality and identity of the corpse, based on the data of the dental card and remedial procedures such as fillings, bridges, partial or complete devices fitted in the mouth and the teeth of that corpse, by matching the data of dental card to what is already in corpse mouth.[2]

Accordingly, and based on the rulings of the Jordanian judiciary, the Jordanian Court of Appeal in its criminal capacity ruled in its judgment No. (43308/2018) and dated 23 Oct. 2018 by the follows: "In response to all the reasons for the appeal, the result of which was that the Court of First Instance erred in not considering the request by forming a quinquennial committee or a central committee to clarify the patient's condition, which is subject to suspicion and ambiguity, where the regional medical committee consists of non-specialized general practitioner and non-specialized dentist, also, the court erred in declaring that it did not have jurisdiction to consider this case, because the list of accusations issued by the Public Prosecutor, which includes suspicion against all parties on charges of harm, contradicts the provisions of Article (334) of the Penal Law, and the court erred in relying on the medical report issued by the medical committees on 26 Mar. 2018 regarding the patient and that the patient does not have any disability rate because the period of unemployment is two weeks and it is among minor injuries and that the percentage of disability is not commensurate with the duration of the disability and that the medical report is shrouded in ambiguity and contrary to reality".[17]

Irbid Magistrate's Court also ruled in its judgment No. (3750/2020) dated 27 Aug. 2020 by the following: "Based on the foregoing, the court considers that through the testimony of the defendants and the initial and conclusive medical report for each of them, the defendants committed the crime of harm attributed, by hitting each other, and the effect of this was proven by the initial medical report organized against the accused…on 5 Feb. 2020 Pains in the head, mouth, back, left thigh, upper limbs, bruises and blue in the hands and feet, pain and difficulty moving, bruises in the back, lower back pain, bruises in the neck, and the duration of unemployment mentioned in the conclusive medical report, which is five days from the date of the initial injury, and the initial medical report organized against the defendant dated 5 Feb. 2020 of pain in the head and neck, and the presence of bruises, hits, cuts, and one day old of two superficial scratches on the left humerus, longitudinal superficial scratches on the neck, and traces of a tooth bite on the right shoulder and redness on the neck, all these signs are an indication that the criminal behavior took the form of beating by pressing on the body tissues, And since the will of the defendants tended to hit each other".[18]

6. Conclusion

Through forensic dentistry, the physician can determine the identity, age, and gender of the corpse owner, estimate the period of death, and determine the cause of death. The importance of forensic dentistry is demonstrated by detecting incidents of biting abuse that accompany many cases, such as rape. The necessity of amending the Jordanian Criminal Procedure Law by explicitly stipulating the role of forensic dentistry in detecting crimes.

Adding legal texts to the Jordanian medical constitution regulates the performance of the forensic dentist in terms of the availability of educational qualifications in dealing with criminal cases. Activating the judiciary's role in accrediting forensic dentistry in detecting crimes due to its practical importance and its accurate and rapid results.Expand the role of forensic dentistry in detecting crimes due to the accuracy of forensic dentistry detection and its discovery of things that were not discovered by a forensic physician who is not specialized in forensic dentistry.

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Original Review Article

Euthanasia and Living Will - Right to Die with Dignity: A Literature Review.

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Right to life.

Abstract

Euthanasia can be the matter of concern pertaining not only to India but across the globe. Euthanasia is linked directly to right to life with dignity as well as right to die with dignity. Word Euthanasia was coined from Greek words “Eu” meaning well and “Thanatos” meaning death which literally means easy death. The term euthanasia refers to purposeful killing of the individual contracted with incurable disease by the relatives by any act or omission of any treatment. The phrase "living will" refers to a written instrument in which a person expresses instructions concerning his or her life in the form of advance directives for the administration of treatment when he or she is terminally ill and unable to express assent. Additionally, if a medical board determines that the patient is beyond medical help, it permits family members, close relatives, and nearest friends to turn off the life support equipment. The Apex court stated that "The Advance Directive can be executed only by an adult person who is sound mind and healthy state of mind and in position to express his/her views, relate and comprehend the purpose and consequences of executing the document.

1. Introduction

Euthanasia can be the matter of concern pertaining not only to India but across the globe. Euthanasia is linked directly to right to life with dignity as well as right to die with dignity. Word Euthanasia was coined from Greek words “Eu” meaning well and “Thanatos” meaning death which literally means easy death. The term euthanasia refers to purposeful killing of the individual contracted with incurable disease by the relatives by any act or omission of any treatment. Physician assisted suicide is type of euthanasia where the person is relieved by any act of commission or omission by the treating doctor. [1,2]

The first steps towards legalizing euthanasia in India were made in 1985. A private bill regarding euthanasia was introduced before the legislative council of the state of Maharashtra. This particular bill mentions provisions regarding civil and criminal protection to doctors, who assist in death of terminally ill patient on their request.[3,4]

Concept of assisted suicide became a debatable issue after the judgment given by Supreme Court in the case of P Rathinam.[5] In the journey of legalizing euthanasia in India the Aruna Shanbagh case was proven to be a mile stone. After the judgment of Aruna Shanbagh case, all the contradictory issues settled and the apex court clearly stated that all forms of euthanasia practice are not legal in the India. The Supreme Court opened a gateway for the legalization of passive euthanasia and provide proper

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guidelines regarding how to do it smoothly.[6] Later in the Common Cause case,[7] the Supreme Court held that the right to die with dignity is a fundamental right enshrined in the right to life under Article 21 of the Constitution of India. This is how passive euthanasia got legalized in India. Currently active euthanasia is not legalized in India while Passive euthanasia is allowed in few conditions with court permission. Hence, physician assisted euthanasia is not allowed in India and is considered to be unethical. [8]

2. Sanctity and Quality of Life

The "sanctity of life" is closely related to the practice of euthanasia. As well as a wide range of bioethical issues such as abortion, embryo research, cloning, genetic engineering, and many more. The phrase "sanctity of life" is used as a tool to combat behaviours or technology that violate the intrinsic value of human life. Every life has value and status, which should be acknowledged and safeguarded before any steps are thought through to extinguish or terminate life, according to the "Sanctity of Life" philosophy. The Sanctity of Life argument applies to all life, not just human life only.[9]

According to Craig Paterson, purposefully killing an innocent person is always wrong, regardless of the circumstances or the motivation for doing so.[9] Even a person, who is in coma too has value because they are still human, thus it doesn't matter that they are unaware of their surroundings and have no loved ones or friends to worry about them.[10] The proponents of the sanctity of life takes into consideration about the persistence of life and rejects the concept related to the quality of life. It may be said that experiences gained in life and interaction with others are deciding factors of quality of life'. If any life which can no longer be capable to gain experience and in which relationship with others are impossible, that life is not worthy or life with quality. So it may be said that quality of life is the deciding factor in cases of euthanasia.

3. **Individual Autonomy & Freedom of Choice**

It contends that people should be free to live their life whatever they like as long as their decisions do not negatively affect other people. Any intervention into a person 's life, whether it be from the government or another person, must be limited. Euthanasia proponents contend that everyone should have the freedom to decide how and when to die. According to the idea of autonomy, people should be able to manage their own bodies and live their lives as effectively and independently as possible. Every person should have the liberty to choose the manner of their death, and if there is need of the assistance of others, they should have the freedom to comply without worrying about facing legal repercussions. The argument put rip by proponents of euthanasia that people who oppose the practice are trying to impose their own moral or religious beliefs on others is also used to criticize those who disagree with it.[11]

4. Medical Ethics and Duty of Physician

Unless there is a valid reason, no doctor will refuse to treat a patient and refer him to another doctor. The only time a doctor declines to treat or sent a patient who is in pain to another doctor is when the patient's condition is beyond the range of the treating doctor's competence. In air dale case' [12] judgement states that "the doctor who is caring for any patient cannot be under absolute obligation to prolong patient's life by any means available to hint regardless of the quality of the patient's life." In the same case Lord Brown Wilkinson stated that the doctor has no obligation to the patient to keep them alive, particularly in situations where keeping them alive would require invasive medical treatment that they would not want.

5. Living will

The phrase "living will" refers to a written instrument in which a person expresses instructions concerning his or her life in the form of advance directives for the administration of treatment when he or she is terminally ill and unable to express assent. Additionally, if a medical board determines that the patient is beyond medical help, it permits family members, close relatives, and nearest friends to turn off the life support equipment. The Apex court stated that "The Advance Directive can be executed only by an adult person who is sound mind and healthy state of mind and in position to express his/her views, relate and comprehend the purpose and consequences of executing the document. The court further said that it must contain decision relating to the circumstances in withholding or withdrawal of medical treatment can be resorted. There should be intention that executor may revoke it anytime and executor has understood the consequences of executing it. It should also specify name of the guardian and close relatives of the execrator. If there is more than one valid 'Advance Directive' then the most recently signed 'Advance Directive' will be given effect to. The court further said that the 'Living Will' document should be signed by

executor in the presence of two attesting witnesses and countersigned by judicial magistrate of first class or designated by the concerned District Judge. The concept of' Living Will' is related with passive euthanasia but it is not an easy task to legislate upon it. The medical treatment of terminally-ill patients (protection of patients and medical practitioners) Bill recognized the concept of a living will in India but unfortunately it does not make 'Living Will' concept binding on the medical practitioners in India. The 'living will' cannot be executed by any patient in absence of any 'Advance Medical Directives' for Physician- assisted suicide (PAS).

The highlights of Living will document are 1) Expedient mode of dying is included in right to live with dignity. 2) Right to self-determination had upper edge over the sanctity of life in case of debilitated persons. 3) Presence of proper statutory regime to satisfy the issues raised against euthanasia.[13]

6. The Euthanasia Debate

The debate over euthanasia is based on three main points: first,that death is an inevitable part of human life: second, that death may be brought on by human effort; this means that, like most human acts, the act of dying takes on moral dimensions: and third, that euthanasia is concerned with the position of the individual regarding the "Right to be informed" fully about his or her condition. The argument made by euthanasia proponents is that if euthanasia is authorized in some form, it will benefit all patients who are suffering physically and mentally as a result of an incurable illness. There is argument that a greater number of individuals—including the elderly, persons with disabilities, those who are ill, and others—would feel threatened by a law permitting euthanasia.[14]

Pro-euthanasia arguments

Miseries of terminally ill patients can be decreased by legalization of euthanasia. Patients should be given the option to choose induced death if they have an incurable disease or if their quality of life would not be negatively impacted by adequate treatment. When all other medical interventions have failed and there is little chance of recovery, euthanasia should be used as a last resort. In the anthropological analysis of euthanasia and assisted suicide, discourses about the notion of sovereign bodies, moral individualistic, and freedom of choice within the notion of human rights have traditionally predominated.

Arguments given in favour of euthanasia

Euthanasia is a kind and human act for those who are suffering with unbearable pain. Compassion is a noble emotion that people feel and suffer along with the sufferings of others who are in terminally-ill position. There are many persons who support euthanasia on the ground of compassionate feeling towards those who are in pain and suffering.

a. 'Dying with dignity' is a strong argument that is given in favour of euthanasia. To have dignity means to be able to look at oneself with respect with certain degree of satisfaction. Dying with dignity refers that no one should depend on others for daily activity in life. Because dependency on others during life due to serious illness is worse than death. One could argue that euthanasia upholds the right to life by respecting the right to a dignified death.[3,15]
b. People should be free to decide their own fate since they have a right to self- determination. It could be preferable to help someone pass away rather than have them endure further suffering. Many people who are chronically unwell or in a persistent vegetative state do not want to bother their family members.
c. Maintaining a life support system against a patient's wishes is improper and unethical according to both legal and philosophical medical standards. Passive euthanasia becomes possible when the right to refuse medical treatment is recognized.
d. Patients who are terminally sick have the option of organ donation thanks to euthanasia. Because patients who are waiting for organ donations and have organ failure may receive new lives as a result of organ donation, this excellent and honorable deed.
e. Euthanasia legalization will always result in favorable outcomes. In order to prove that euthanasia is not generally problematic, pro-euthanasia activists frequently cite examples of nations like the Netherlands and Belgium as well as places like Oregon in the USA where the practice is permitted.
f. Health care costs are not always bearable by the patient's family. So, in that situation euthanasia should be legalized.[16]

Cons of euthanasia arguments:

It is not morally correct to kill someone. Homicide and murder of any person cannot be defended except in certain situations when private defense comes in

picture. The advancement of medical technology has created an environment where the length and quality of human life can be improved. Palliative care and rehabilitation facilities are better options for assisting persons who are disabled or nearing death to enjoy a better and pain-free life.[17] Euthanasia is illegal in many nations throughout the world for a variety of reasons. The arguments that may be made in favour of euthanasia include the fact that it is against medical ethics, there is a hope for future medical advancement, pain and suffering at the end of life may always be regulated, etc.

Arguments may be given in opposition of euthanasia

a. Euthanasia is against the 'Hippocratic Oath' which is bond of trust between doctor arid patient. Date to legalization of euthanasia doubt will exist in the doctor-patient relationship. It is not proper and good for any society.
b. People who oppose euthanasia contend that if the right to die with dignity is accepted, those who suffer front terminal illnesses will be expelled front civilised society. It means that" if legalization of euthanasia is made then it will place society on a slippery slope, which will lead to more acceptable consequences in the society". There is palliative care which may provide a relief to patients suffering with terminal illness and in pain.
c. All deaths are not painful. The person who are against legalization of euthanasia argues that euthanasia should be legalize because all deaths are painful, which is not true.
d. The modern age is the age of scientific development, inventions and of discovery. So there is always a possibility about the medical development and discovery relating to cure terminally-ill patient, who is in pain.
e. It is said that "power corrupts and absolute power corrupts absolutely". Euthanasia would become authorized, giving doctors excessive authority at the expense of people.
f. Euthanasia is not a desirable situation for any society since it will impede the search for novel therapies for terminally sick individuals.
g. Those who are against the autonomy argument replied to the autonomy argument supporter that in any situation physicians thirst not be forced to perform an immoral act such as voluntary active euthanasia in the name of physical sufferings of patients due to incurable diseases.
h. Article 21 of the Indian Constitution recognizes the right to life as a fundamental human right; yet, the practice of active euthanasia is analogous to agreed murder, which is inherently unnatural, immoral, and criminal. As a result, it is incompatible and inconsistent with the idea of life.
i. India accepts the idea of a welfare state. Therefore, it is the responsibility of the state to safeguard human life while simultaneously ensuring that its people live honourable lives. There will be tremendous concern that the state may refuse to fund health and related initiatives if euthanasia is permitted (working towards right to life). Poor patients will experience problems as a result.
j. Due to a severe likelihood of misuse of euthanasia by family members or relatives to get the patient 's property in the present period, there is a lack of morality, justice, and good conscience.
k. Difficulty of determining voluntary consent.
l. The usage of contemporary painkillers eliminates the requirement for resorting to voluntary euthanasia.
m. Risk of incorrect medical diagnosis.

Apart from the above reasons, there are some basic questions which needs reply regarding the practice of euthanasia in genuine needs. The first question that must have an answer is how to determine whether a mental condition qualifies for mercy killing.[18]

Living will was an advance medical directive on end-of-life treatment. The Supreme Court's 2018 order on passive euthanasia wherein it recognised the right to die with dignity as a fundamental right and an aspect of Article 21 (right to life) notwithstanding, people wanting to get a "living will" registered were facing problems due to cumbersome guidelines, prompting a reconsideration by the top court. Supreme court judgement state that the document will now be signed by the executor of the living will in the presence of two attesting witnesses, preferably independent, and attested before a notary or Gazetted Officer.As per the top court's 2018 judgement, a living will need to be signed by the person making the will in the presence of two witnesses and a Judicial Magistrate of First Class (JMFC).

The top court also agreed to the suggestion that the executor shall inform and hand over a copy of the advance directive to the family physician, if any. The court had in its March 9, 2018 judgment recognized that a terminally ill patient or a person in a persistent

vegetative state may execute an advance medical directive or a "living will" to refuse medical treatment, holding that the right to live with dignity also included "smoothening" the process of dying. It had observed that the failure to legally recognize advance medical directives might amount to "non-facilitation" of the right to smoothen the dying process and that dignity in that process was also part of the right to life under Article 21 of the Constitution. The court had laid down principles related to the procedure for execution of advance directives and spelt out guidelines and safeguards to give effect to passive euthanasia in both circumstances where there are advance directives and where there are none. The verdict had come on a PIL filed by NGO Common Cause seeking recognition of the "living will" made by terminally-ill patients for passive euthanasia. [19]

7. Way forward

There is need for standardising procedure and protocols by Central government for euthanasia. These protocols can serve as cornerstone for state governments for effective implementation of supreme court judgement.

8. Conclusion

Currently there are huge number of recent advancements in medical science which can prolong the life of the individuals suffering from various diseases. But on other hand this can also put more economic burden on families of the patients. These issues can pose multiple ethical concerns in the medical field. For passing any law in favour or against the euthanasia, all the points should be taken into consideration before framing the law which will be in synchronisation with the situation in that country.

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Short Communication

Executive Summary of the FORENSICON 2022 - 25th Annual State Conference of Medicolegal Association of Maharashtra (MLAM).

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Abstract

FORENSICON 2022- the Annual State Conference of Medicolegal Association of Maharashtra (MLAM) had been organized by Department of Forensic Medicine & Toxicology, Dr. Vasantrao Pawar Medical College, Hospital & Research Centre, Nashik (Maharashtra) India, under the aegis of Medicolegal Association of Maharashtra (MLAM) on 18th & 19th November, 2022. It aims to inculcate recent updates of forensic Medicine & Jurisprudence and to discuss various medicolegal aspects of clinical practice & to promote the research culture. The conference was attended by many national, international experts and delegates from various disciplines. The conference facilitates to put forth novel solutions for complex Medico-legal Problems. It helps to ignite young minds and enabled Forensic Experts & other delegates to get exposed to newer practices in Forensic Fields.

1. Introduction

The "25th (Silver Jubilee) Annual State Conference of Medicolegal Association of Maharashtra (MLAM) 'FORENSICON 2022', was held on 18th & 19th November, 2022. It was then organized by Department of Forensic Medicine & Toxicology, Dr. Vasantrao Pawar Medical College, Hospital & Research Centre, Nashik (Maharashtra) India, under the aegis of Medicolegal Association of Maharashtra (MLAM) as it was finalized in the Annual state conference at LTMMC, Sion Mumbai in year 2021.[1] The objectives of this Conference were to inculcate recent updates of forensic Medicine & Jurisprudence and to discuss various medicolegal aspects of clinical practice & to promote the research culture.

The conference was hosted by Dr. Vasantrao Pawar Medical College, Hospital & Research Centre, Nashik (Maharashtra); India under the eminent leaderships of institute management & Hon'ble Dean Dr. Mrunal Patil Madam. The conference was attended by almost 141 registered delegates and above, from various states. The Delegates were the Faculty, Medical Officers, Post graduate students and researchers from various parts of the country.

On Day 1, November 18th morning, the Grand Inauguration Ceremony was held at Ashwini Hall of Dr. Vasantrao Pawar Medical College, Hospital & Research Centre, Nashik. The conference has declared open by Dr. Rajesh Dere,

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Photograph no. 1: Chief Guest Hon'ble Dr. Ved Prakash Mishra, Guest of Honour Hon'ble Dr. Neelam Mishra, Sarchitis of MVPs Adv. Nitinji Thakare, Dean Dr.VPMC Hon'ble Dr. Mrunal Patil, Hon'ble Registrar MUHS Dr. Rajesh Bangal, Hon'ble COE MUHS Dr. Sandeep Kadu& MMC Observor Dr. Ajit Pathak on the dias at Inauguration Ceremony of Conference, 18.11.2022.

Photograph no. 2: Chief guest & key Note Speaker Hon'ble Dr. Ved Prakash Mishra - Pro chancellor of Datta Meghe Institute of Medical Sciences, Nagpur addressing the conference, 18.11.2022.

General Secretary Medicolegal Association of Maharashtra (MLAM). Dr. Ved Prakash Mishra, Pro chancellor of Datta Meghe Institute of Medical Sciences, Nagpur. Dr. Neelam Mishra, Vice Chancellor of Krishna Institute of Medical Sciences, Karad was the Guests of Honour. The Inauguration Ceremony was presided by Adv. Shri. Nitinji Thakare, Sarchitnis of Maratha Vidya Prasarak Samaj, Nashik **(Photograph 1)**. Organizing Secretary Dr. Navinkumar M Varma Professor & Head of Forensic Medicine department presented the welcome address. Dr. Rajendra Bangal, Registrar of MUHS, Dr. Sandeep Kadu – Controller of Examination, MUHS, Dr. Mrunal Patil, Dean of Dr. Vasantrao Pawar Medical College, Nashik & Dr. Ajit Pathak , MMC Observer were among the eminent guest, who were present on the Dias. Organizing Joint Secretary Dr. Tej B. Chhetri, Associate Professor of Forensic Medicine department read the vote of thanks on behalf of the organizing committee.

2. Scientific Sessions:

Key Note address was delivered by Chief Guest Hon'ble Dr. Ved Prakash Mishra, Pro chancellor of Datta Meghe Institute of Medical Sciences, Nagpur **(Photograph 2)**. The release of Souvenir **(Photograph 3)** & MLAM's official journal – *'Journal of Forensic Medicine Science & Law'* also took place during the ceremony **(Photograph 4)**. Dr Ravindra Deokar, Editor-in-chief was called to join with dignitaries for the journal release.

The scientific sessions were prudently crafted and an innovative holistic Interactive approach was employed whereby speakers, students and the faculty shared the same session. There were **13 speakers' presentations** which included keynote addresses & the lectures. The Keynote Address delivered by Dr. Ved Prakash Mishra on "Journey of Forensic Medicine & Jurisprudence – past to Future".

Photograph 3: **Release of Souvenir of Conference by the dignitaries at the conference, 18.11.2022.**

Photograph 4: **Release of the MLAM's Journal by the dignitaries at the conference, 18.11.2022.**

Photo

A guest lectures delivered by eminent speakers as a pragmatic approach towards teeth: Collaboration between Forensic Odontology and Forensic Anthropology by the resource Person : Dr Derek Congram & dr. Darshna Sharma ; "**Digital Autopsy (Virtopsy) and Humanitarian Forensics**- Steps taken and Journey ahead" by the Resource Person : Prof. (Dr) Adarsh kumar ; **Avenues in Forensic Medicine**: by Dr Shailesh Mohite ; **Nano Forensics** by Dr R C Dere ; **HOTA 1994, 2011 Amendments & Rules** with focus on deceased donation by Dr. Pravin Shingare ; **Medicolegal Aspect of Organ Donation** by Dr. Ravindra Deokar ; **Functions & Role of ROTTO-SOTTO** by Dr. Akash Shukla / Mrs. Sujata Ashtekar ; **Issues**

Faced at ground level during organ donation in MLC cases – Studies & Experiences by Dr. Sanjay Rakibe, Dr. Anirudh Kulkarni & Mr. Pramod Shinge.[2] The speakers, chairpersons were felicitated **(Photograph 5 & 6)**. The interactive Panel discussion The speakers, chairpersons were felicitated **(Photograph 7)**. took place on **Medicolegal Examinations to Testimony – Guidelines & Protocols**. The Panelist were Dr S C Mohite, Lt. col. Dr Satish Dhage, Adv. Deepshikha Bhide, SDPO Shri. Arjun Bhosale & Shri Shrikant Ladhe.

Photograph 5: Felicitation of Speaker Prof. Dr. Adarshkumar by Hon'ble Dr. Shailesh Mohite , Dr. Mandar Karmakar & Dr. Mrunal Patil 18-11-2022.

Photograph no. 6: Felicitation of Speaker Dr. Pravin Shingare by Hon'ble Ex DMER Dr. V.L. Deshpande , Dr. Ajit pathak & Dr. Rajesh Dere on 18-11-2022

In all, total **38 oral scientific presentations** & **11 e-Poster presentations** were made by the students and faculties. The high quality of the research was well appreciated by all the attendees. The organizers also hosted a marvellous banquet to enable the delegates to interact with the eminent academicians and researchers.

Photograph no. 7: Panel discussion - Dr. Vikas Meshram, Dr. Chikhalkar, Dr. Shailesh Mohite, Dr. Satish Dhage, DYSP Mr. Arjun Bhosle, Adv. Deepshikha Bhide, FSL Mr. Shrikant Ladhe on 18-11-2022.

The participants were entertained by a well-known Orchestra of Nashik. The grandeur of the venue and the gastronomic delighted menu left the attendees spell bound. This gave the delegates a

much needed chance to unwind and interact in an informal setting.

On Day 2, November 19th, the various sessions, including **'Recent updates on Forensic Psychiatry** by Dr. Suresh Bada Math; **New Trends in Forensic Sciences** by the Resource Person: Dr. Sandeep Chetti ; **How to critically evaluate research article?** by Dr. Avinash Supe **(Photohraph 8)**; **Medicolegal aspects of Anaesthesia & Operative Death** by Dr. Naresh Zanjad ; **Ethical and Legal issues in Medical Practice** by the Resource Person: Dr. Praveen Arora, were among the topics discussed in the conference. Major emohasis given on research and future innovations.[3]

Photograph no. 8: Felicitation of Speaker Ho'ble Dr. Avinash Supe by Dr. K.D.Chavan & Dr. Sandeep Kadu 19-11-2022.

The two day extravagance came to an end with the valedictory function. **Shri. Jayant Naiknaware Commissioner of Police, Nashik** was the chief guest for the valedictory function. He enlightened the audience about the importance Forensic Medicine in crime investigation & advised delegates for an effective medicolegal practice. He also gave away the awards for the best scientific presentations at the conference. Dr. K. D. Chavan, President of MLAM, Dr. Rajesh Dere, general Secretary of MLAM, Dr. Kalpana Devane Deputy Superintendent of MVP Hospital were also present for valedictory function.

The conference helped us put forth novel solutions for complex Medico-legal Problems. It ignited young minds and enabled Forensic Experts & other delegates to get exposed to newer practices in Forensic Fields. The conference was hailed as one of the land mark Academic meeting at the Dr. Vasantrao Pawar Medical College, Hospital & Research Centre, Nashik

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Case Report

Decapitation of a Farmer due to Agriculture Machine

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Autopsy.

Abstract

The history of agriculture in India dates back to the Neolithic and India ranks second worldwide in farm outputs. Decapitation is the complete separation of the head from the body. Decapitation has been reported to occur in accidental, suicidal and homicidal manner of deaths. Autopsy surgeon should consider the history, type of injury, level of decapitation, circumstances, type of weapon which can inflict such injury, incident scene visit are important before formulating any final opinion in cases of decapitation. The cases on decapitation are reported in literature but only few cases have explained the mechanism of such decapitation in detail. In the present case, the authors have discussed the mechanism of decapitation and report an infrequent case of accidental decapitation while using Rotavator (tractor drawn implement which is mainly used for seed bed preparation) by agriculture worker in the field to save the life of a cattle. The autopsy findings of this case are important to ascertain the 'manner of death'. Further, the level of decapitation is also important for the clinicians in interpreting and outcome of victim of neck trauma.

1. Introduction

The World Health Organization (WHO) defined "accident" as an unpremeditated event resulting in a recognizable injury; they later elaborated the same to include an event, independent of the will of a person, caused by a quickly acting extraneous force and manifesting itself by an injury to the body or mind.[1] Separation of the head from the body can occur at various levels of the neck. The majority of decapitations occur at the mid-neck (second to fifth cervical vertebrae), followed by the upper neck and then the lower neck.[2]

Accidental decapitation can be the result of an explosion, a vehicular or industrial accident improperly administered execution by hanging or other violent injury.[3] In suicide, decapitation involves the deceased placing his or her head on a train or tramline, resulting in severing of the head by a moving engine.[4] The differentiation between the modes of decapitation death is usually difficult to explain for a forensic expert without proper history, complete autopsy, incident scene visit and the decedent's decapitated head. In the present case, a farmer was working in his field and Rotavator machine was operated by agriculture worker in same field during which, cattle came in front of tractor; to save the life of that cattle; worker had suddenly turned the

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Rotavator and cause beheading of farmer. Complete autopsy and meticulous examination of such wound is also important for Medico legally point of view, to avoid any forged allegation on innocent and to gain the claim under various government schemes for farmers. Hence, the circumstantial evidence, types of injuries, a crime scene examination and a complete autopsy are always essential to reaching a correct diagnosis.[1]

2. Case report

The dead body without head of an average built, 35 years old male was recovered by Police and the same were subjected to medicolegal autopsy at nearest District hospital. Later, the case was referred to the medical college for expert opinion and autopsy. The pieces of fractured bones and soft tissue in a separate carry bag were also brought along with the body.

Figure 1: Depicting torn pieces of the victim's clothes and blades and wheels of Rotavator.

Figure 2: Headless corpse on the ground with pool of blood under and in the vicinity of the neck region.

As per Inquest report and statement of the eye witnesses, the deceased was working in field and agriculture worker was driving tractor with Rotavator (tractor drawn implement which is mainly used for seed bed preparation) in the field. Suddenly, cattle came in front of tractor. To save the life of cattle, driver turned the tractor towards the deceased and neck was entangled in the wheel of the Rotavator and ultimately resulting in decapitation. Photographs of the incident scene were taken by police. The pieces of clothes, which were allegedly worn by deceased, tags of soft tissues were entangled in the axle of the Rotavator with dried blood stains present over the blades of Rotavator at places **(Figure 1)**. There was a pool of blood under the neck region of the corpse **(Figure 2)**.

Figure 3: Depicting decapitation wound and yellowish coloured gastric content over the neck.

Figure 4: Depicting head of the Victim with a piece of dura matter and soil particles at places.

Post-mortem examination was conducted on the next day. The autopsy was conducted with the following relevant and important findings: On external examination, soil particles were present over the clothes and wounds at places. The length of lower segment of body was 76 cm. Rigor mortis was present in the passing off phase. Postmortem staining was faintly visible over the back of his body except over pressure areas and it was fixed. Decapitation was noticed at the level of second intervertebral disc with comminuted fracture of third cervical vertebrae exposing the spinal cord. Remaining cervical vertebrae were found sub-luxated with comminuted fracture of spinous and transverse process at places.

All the fractured ends of bones showed infiltration of blood in their bony trabeculae. The margins over the available portion of neck were found reddish, irregular and contused. The available neck muscles showed diffuse extravasation of blood. On dissection, intima of the bilateral common carotid arteries and the internal jugular veins were found transected with crushing of margins. The trachea and esophagus were identifiable and transected at the level of the 6th cervical vertebrae. The gastric contents were present over the severance plane. Spinal cord was severed at the same level and clotted blood was present in cervical vertebral column**(Figure 3)**. Soft tissues in the vicinity of wound were found to be contused.

The portion of head with upper part of neck were received in a separate carry bag. The head and face were completely deformed and they were found contused, crushed and lacerated and smudged with soil at places. The skin over the face was pale and showed no cyanosis, congestion, or petechiae. The available tissues showed multiple pockets of ecchymosis with minimal infiltration of blood in their bony trabeculae**(Figure 4)**.

Apart from the decapitation injury, the other injuries including abrasions and contusions were also present almost all over the trunk on the front as well as on the back involving gluteal region. Bones of left foot were also found fractured at multiple places. On internal examination, all the organs were found pale. There was no history of any previous disease while toxicological analysis performed was negative for any poisonous substance including alcohol. The cause of death was opined to be antemortem decapitation which was accidental in manner, recent in duration and sufficient to cause death in ordinary course of nature.

3. Discussion

Decapitation has been used for execution throughout the world, and is still prevalent as death penalty in some countries including Saudi Arabia.[2] In forensic practice, decapitation accounts for about 0.1% of total autopsies. Decapitation can be antemortem or postmortem and can be suicidal, accidental, or homicidal.[4] Most of the time, decapitation occurs postmortem; dismemberment of corpse done by the perpetrator of a crime to facilitate the disposal of a body or to conceal the identity, or as a manifestation of significant psychiatric illness of the offender that may be associated with ritualistic behavior. Decapitation is not the cause of death in these cases and can usually be distinguished from antemortem injuries by the absence of hemorrhage and vital reaction.[5]

Decapitation resulting from occupational accidents is often associated with heavy machinery in workshops or farm equipment being towed behind a tractor can occur at any age. Peyron et al. (2017) reported a case of farmer who was accidentally decapitated when his clothing were caught in the drive shaft of a tractor.[5] Byard (2017) conducted a national study and reported that farmers represented 17% of all worker fatalities. Fatal injuries that occur tend to be severe with limb amputations, evisceration, crushing and decapitation and animals such as cows, buffalo and horses may cause severe injuries, and death may result from most significant injuries involve the head and face, and then the upper torso. In our case also major injury was present over the head and neck.[6]

Similar to the present case, Demirci et al. (2009) reported a case of accidental decapitation of a farmer in which the rotating helix elevator machine tightened the scarf around the neck resulting in hanging/strangulation noose that, by continued tightening, caused decapitation of the victim. The victim's body was found on the ground. The autopsy revealed that the neck was severed at the level of the second and third cervical vertebrae.[7]

In the present case, the Rotavator that caused the death is an appliance connected to a tractor. It is mainly used for seed bed preparation and for removing and mixing residual of maize, wheat, sugarcane etc., thereby, helps to improve soil health and save fuel, cost, time and energy as well. A Rotavator machine generally consists of 4 parts: (1) Single or multispeed and gear box, (2) Blades with safety cover (3) Cardan shaft (4) Rotor shaft. The Rotavator machine mechanism is simple: when wheels rotate around axle, it moves the blades and wheels forward and upward. The victim was bent downward during work in field and accidentally trapped between the rotating wheel and blades of Rotavator which deliver dynamic and blunt force to head and neck tissues causing contusions, crushing of soft tissues including spinal cord, comminuted fracture of bones and finally decapitation. Thorough, complete investigation, crime scene evaluation, eyewitness statements and thorough and meticulous autopsy helped in deciding the manner of death in this case i.e. accident.

4. Conclusion/Suggestion:

Accidental work-related decapitation is rarely reported with the agricultural machinery. This case stresses the need for strengthening protection measures concerning agricultural machines to prevent this type of accident in the future. If there had been a safety cover over the blades of Rotavator, such an accident would not have occurred.

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Case Report

Sudden Death due to Acute Splenic Sequestration Crisis in Sickle Cell Disease: A Case Report with Active Post-Mortem Follow up.

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Acute Splenic Sequestration Crisis, Sickle Cell Disease, Sudden Death, Young Male.

Abstract

Background: Sickle cell disease (SCD) is an autosomal recessive monogenic disorder that is common among individuals in many countries. In India, SCD is particularly prevalent in the western states. Sudden death in asymptomatic young adults with sickle cell trait, although uncommon, is usually due to infection and acute chest syndrome. Acute splenic sequestration crisis (ASSC) is an uncommon presentation among such patients. Clinically, cause of sudden deaths in SCD cases remain elusive and requires further research and reporting. **Case presentation:** In this report, we present the case of a previously asymptomatic 25-year-old male with ASSC. After complaining of fever and backache for three days, he was brought dead to the casualty of a tertiary care hospital. Apart from yellowish tinge of skin, on autopsy, we noted an enlarged spleen (weight=2010 grams) with chalky white calcified deposits on the surface. Histopathology of the spleen revealed sickled RBCs leading to ASSC and presence of Gamna Gandy Bodies. Bone marrow aspirate revealed erythroid hyperplasia. The final cause of death was opined to be splenic sequestration crisis. **Conclusion:** Sudden death due to sickle cell disease in an asymptomatic person warrants a stronger genetic vigilance. More focus on prenatal diagnosis of inheritable diseases is needed along with follow-up, guidance and counselling. In the present case, the decedent's family was followed up post-mortem, counselled for undergoing genetic screening, and was finally referred to the Sickle Cell Society of India for further guidance.

1. Introduction

In 1910, Herrick was the first to report peculiarly elongated and sickle-shaped RBCs in a dental student who suffered from severe anemia and pulmonary symptoms.[1] Since then, various *in vitro*, as well as *in vivo* experiments were conducted[2], and the phenomenon of sickling was attributed to hypoxia, or an increased concentration of carbon dioxide in blood. In 1960s, the sickle cell disease (SCD) was further described as "a disease of the childhood," with high mortality

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rates, and reported only a few survivors reaching adulthood, regardless of best medical care available at the time.[3]

SCD may manifest in homozygous or heterozygous forms, the latter usually presenting in combination with other genetic defects such as thalassemia, spherocytosis, etc. In the homozygous form, the condition is termed as sickle cell anemia (SCA). Here, the β-hemoglobin gene in Chromosome 11 undergoes a glu-6-val (substitution of amino acid glutamate by valine) mutation, leading to an abnormal polymerization of deoxygenated hemoglobin. This polymer is rope-like and forms bundle with others, thereby distorting the RBCs into crescentic, 'sickle' forms.[4] SCA has a high mortality rate and very few survive until adulthood.[3]

Heterozygous form or the *sickle cell trait* has a milder clinical manifestation, showing features of the disease only in case of extreme conditions like severe dehydration, intense exercise, high altitudes, poor physical conditioning, concurrent febrile illness [5–7], which may in turn prove to be fatal. Such adults are usually asymptomatic. In some previously undiagnosed cases, they die of acute sickle crises with painful episodes or due to acute chest syndrome.[3,8,9]

Acute splenic sequestration crisis (ASSC) is an uncommon, sudden, unexpected and life threatening entity among adult sickle cell disease patients. It is characterized by rapidly progressive anemia, circulatory compromise in setting of sudden splenic enlargement. Details regarding the fatalities in acutely-ill SCD cases remain elusive and requires further research and reporting for better understanding and prevention of sickle cell crises.[3] Herein, we discuss a case of an adult male brought dead to tertiary care center, where autopsy revealed SCD with splenic sequestration crisis.

2. Case Report

A 25-year-old manual laborer, previously healthy and no known ailments, complains of fever and backache for a span of three days. He had approached a primary health center, where his family physician prescribed symptomatic treatment with analgesics and antipyretics, with an advice to follow up. However, on third day of his treatment, he collapsed at home, and was brought to the emergency room of a Tertiary Care Centre, where he was declared dead by the medical officer.

At autopsy, it was noted that the skin and conjunctiva showed yellowish discoloration. Externally, no injuries were detected on the surface of the body. Internally, it was noted that the lungs, liver, pancreas, and kidneys congested. Spleen was grossly enlarged, measuring 18cms in length and 24cms in width, and the same weighed 2010 grams. On examination, the spleen was firm, and chalky white calcified lesions covered the surface of the organ **(Fig 1)**. Lungs, liver, kidney, pancreas, spleen and piece of sternum were sent for histopathological examination.

Fig 1: Enlarged spleen with chalky-white calcified lesions on the surface.

Fig 2: High power view of red pulp showing sequestrated RBCs.

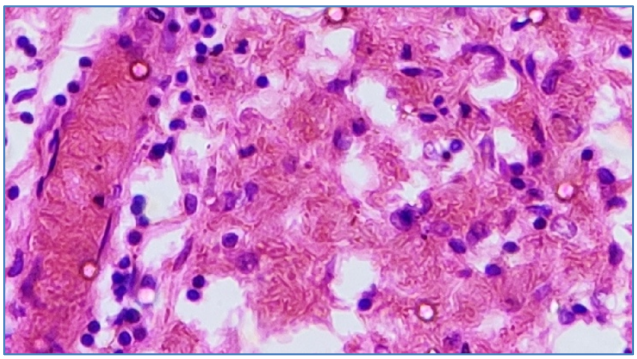
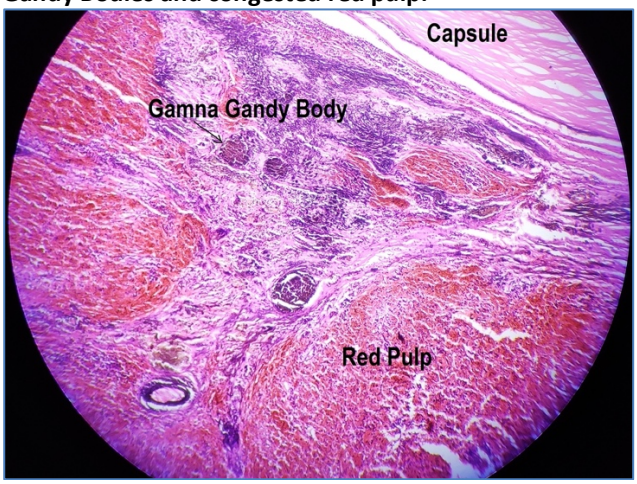


Fig 3: Low power view of spleen showing Capsule, Gamna Gandy Bodies and congested red pulp.



Histopathology confirmed the presence of sickled RBCs in the organs and bone marrow. Spleen showed marked congestion of the cords and sinuses by sickled RBCs **(Fig. 2)**, leading to ASSC. Presence of Gamna Gandy bodies were noted in spleen **(Fig. 3)**. Lungs, liver, kidneys and pancreas showed marked congestion with presence of sickled RBCs. Sections from the bone marrow (manubrium) revealed marked congestion with sickled RBCs, and presence of erythroid hyperplasia. The final cause of death was opined to be due to "splenic sequestration crisis in a person with sickle cell disease."

Furthermore, the decedent's family was followed up post-mortem, counselled for undergoing genetic screening, and was finally referred to the Sickle Cell Society of India (SCSI) for further guidance. This led to the discovery of similar deaths among other male members of his family and similar clinical manifestations in his younger brother. Finally, a diagnosis of sickle cell trait in the family tree was established and SCSI is actively following them up.

3. Discussion

SCD is an umbrella term that comprises of inherited disorders related to red blood cells, with at least one 'sickle gene' inherited in an autosomal recessive pattern. It encompasses a group of hemoglobinopathies resulting from the presence of hemoglobin S (HbS), either in the homozygous or in the heterozygous form with another abnormal hemoglobin such as HbC, HbE, fetal hemoglobins or beta–thalassemia (HbS/β-Th).[10] This could range from fatally severe clinical manifestations to asymptomatically mild ones. In the present case, the decedent had mild to almost no clinical symptoms the sickle cell condition was discovered only post-mortem.

In such asymptomatic cases with sickle cell traits, studies have shown relatively good life expectancy. About 85% of individuals with SCA and more than 95% of the individuals with SCD cross 20 years of age[3], with a projected life expectancy of 54 years.[11] Contrastingly, the decedent in the present case was only 25 years old, with lower life expectancy than expected.

The distorted shape of the RBCs *in vivo* usually results in complications like hemolytic anemia, vaso-occlusive crisis and ischemic changes that lead to reperfusion tissue damage and infarctions.[12-14] The leading causes of death in SCD are infection, chronic organ damage, renal diseases, pain episodes consequent to sickle cell crises, acute chest syndrome and stroke.[3,8,12,15,16]

The manifestation of hemolytic anemia is moderately severe in nature, with hematocrit ranging from 18% to 30%, further associated with reticulocytosis, hyperbilirubinemia, and the presence of irreversibly sickled cells.[10] In the present case, hemolytic anemia was marked by jaundice and the presence of sickled cells in histopathological sections of all organs. Erythroid hyperplasia of the bone marrow was also observed.

Until recently, there was a misconception that origin of vaso-occlusive crises were attributed purely to physical entrapment of deformed erythrocytes within microvascular network. In reality, it is a multi-factorial process, with prolongation of erythrocyte transit time in microvasculature, reduction in delay time to polymerization and other miscellaneous modulators like free-radical release and coagulation activation with pro-adhesive thrombin formation.[4]

Chronic erythrostasis in spleen can lead to splenic infarction, fibrosis and shrinkage of the organ, leading to functional asplenia and dubbed as autosplenectomy in young individuals. Autosplenectomy is fairly common (55.4%) in Nigerian individuals with sickle cell anemia.[17]Due to the intermittent nature and chronicity, splenomegaly can also be seen in such cases. In the present case, there was a massive splenomegaly, associated with areas of infarct and fibrosis. Mineral deposition following vaso-occlusion, periarteriolar hemorrhages and hemolysis within the central arteriole of the white pulp of the spleen as a chronic event is characterized by the presence of Gamna Gandy Bodies[18], which was noted in this case.

This further leads to infections, which is by far the most common cause of death in young individuals with SCD. Higher mortality rates are noted in cases with a low level of fetal hemoglobin, or total hemoglobin, and increased level of white blood cell count.[3]In the present case, acute splenic sequestration crisis without any underlying infection was noted to be the cause of death. Acute enlargement of spleen consequent to a classic sickle cell crisis, when associated with about 20% fall in the hemoglobin level (at least 20 g/l) from baseline level and increase in basal reticulocyte count, is termed as splenic sequestration crisis.[15]

A robust screening and follow-up system is the answer to reducing deaths in sickle cell anemia. In

California, HPLC is used as an initial screening method for all newborns, followed by a confirmatory lab report. Positive babies are followed up actively and enrolled into treatment systems, which includes routine Penicillin prophylaxis.[19] Contrastingly, most Indian institutions lack such screening measures, and the same is prescribed only by request, clinical suspicion or an accidental discovery following a transfusion reaction. This leads to missed diagnosis in patients with sickle cell trait, leading to sudden death in later years, as seen in the present case. This is after not taking into account the maternal deaths (1.9%).[20] Even then, autopsy reports of splenic sequestration crisis is lacking in Indian literature, which necessitated this case report.

If a diagnosis is established after autopsy, family members should be directed to a genetic center for screening and diagnosis. In this instance, the decedent's family was followed up post-mortem, counseled for genetic screening, and directed to the SCSI. Soon, the decedent's sibling was identified with sickle cell trait after genetic testing and pedigree research. Few other paternal family members who died of unexplained "natural cause" after a painful episode ultimately received a closure for their deaths.

4. Conclusion

Sudden death due to SCD is uncommon in young adults, especially where the disease is mild and clinically asymptomatic. ASSC is a rare presentation among such individuals, which is sudden, unexpected and fatal. Multiple factors are responsible for this vaso-occlusive crisis, which until recently was believed to be caused due to micro-circulatory obstruction by deformed RBCs. However, recent literature point out that the mechanism is much more complicated and multi-factorial.

Such unexpected and sudden death due to undiagnosed sickle cell disease in an asymptomatic person warrants a stronger genetic vigilance. More focus on prenatal diagnosis of inheritable diseases is needed along with follow-up, guidance and counselling. If diagnosis is made during autopsy, the information should be passed on to the family members with due diligence, explaining the details of the disease and referring them to the local genetic center for diagnosis and follow-up, as it was done in the present case. This case reinforces that forensic pathology is the study of dead that helps to serve the living better.

Conflict of interest: None

List of Abbreviations

1. ASSC: Acute splenic sequestration crisis
2. SCA: Sickle Cell Anemia
3. SCD: Sickle Cell Disease
4. SCSI: Sickle Cell Society of India

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