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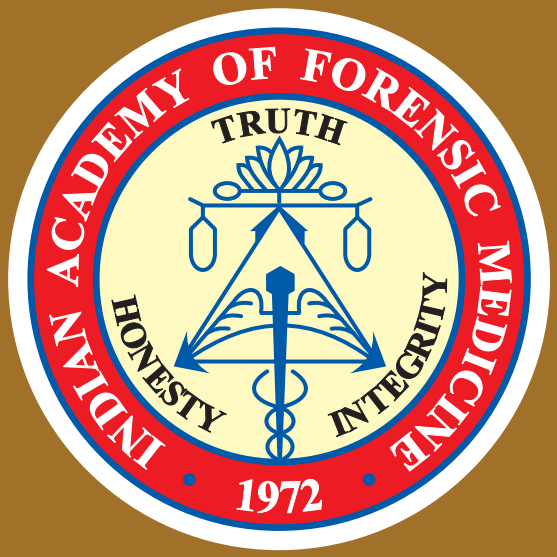

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EDITORIAL

My journey as the editor of JIAFM

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It is my privilege to pen down the editorial for this Golden Jubilee Anniversary Issue of the Journal of Indian Academy of Forensic Medicine (JIAFM). This is also the time when I am completing my three-year tenure as the editor of this prestigious journal. At the outset, I wish to thank the contributors, reviewers, editorial board members, and members of the governing council, etc. for the extraordinary support and encouragement throughout the tenure. Dr Manish Nigam (Joint Editor), and my colleagues Dr. Raghvendra Singh Shekhawat and Dr. Vikas P. Meshram needs a special mention for their contributions to the JIAFM during the last 3 years.

The journal is in its 44th issue, and has shown steady growth during its long journey. It has been the most sought-after journal for the forensic professionals from India for last many years. The credit for the success story of JIAFM undoubtedly goes to the hard work and dedication of all the previous editors, joint editors and editorial board members. Me and my editorial team too have made an earnest effort to the best of our abilities to take the journal forward. During the last three years, every effort was made to take the JIAFM forward and make it self-sufficient. Despite of the COVID-19 scare during most part of my tenure, all the four issues of the journal, each year were released well in time, and there is nearly a three-fold increase in the JIAFM funds.

Cherry on the cake is this special issue of the JIAFM, which is to be released this year during the golden jubilee celebrations of the Indian Academy of Forensic Medicine. The issue is very special to all of us as it contains articles from some of the stalwarts of Forensic Medicine from India, who have shared their knowledge and experiences, in the section, 'Memoirs of a Forensic expert'. We hope that the readers enjoy and learn from the articles, reviews, case reports, and memoirs penned down by the recipients of the “Haque and Bose” Memorial Life Time Achievement Award and those who have received IAFM fellowship in the past.

We shall always remain indebted to the past generations of forensic experts of India for their continued efforts for the upliftment of the subject speciality of Forensic Medicine and the JIAFM. Thanks to all the members of the IAFM who thought us worthy of taking up this responsibility. We hope we did not let you down. As an outgoing editor, I wish all the good luck and success to the next editor, who I am sure will take the journal to new heights.

Long live IAFM !!

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ORIGINAL ARTICLE

Determining pupillary reaction time using pilocarpine eye drop – A post mortem study

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Abstract
Post-mortem miotic changes in the pupil using pharmacological solutions have been a topic of discussion among researchers as well as medico-legal experts to determine time since death. For many decades, researchers used different methods such as eye drop method and injection method to observe pupillary changes as convenience to make this study useful in the autopsy room. However, different researchers also used the different onset of reaction time to observe pupillary miotic changes without testing its effectiveness. The objective of the present study is to determine the reaction time for effective post mortem miotic changes in pupil using pilocarpine eye drops. Total 200 deceased with known time of death were instilled with the 2% pilocarpine eye drop into conjuctival sac and changes were analysed using ImageJ freeware every 10 minutes up to 50 minutes. In this study, author observed no statistically significant difference in reactivity of both the eyes in different time interval in different sex ($p= 0.097$). However, significant difference found in reactivity of both the eyes in different time interval in different age group ($p= 0.0006$) and cause of death ($p = 0.015$) at $\alpha < 0.05$ using t-test and one way ANOVA test. Author concluded that left eye reacts faster than right eye and a significant number of pupillary miotic changes are observed up to 30 minutes. Therefore, minimum 30 minutes are effective time period to observe post mortem pupillary miotic changes for pilocarpine eye drop which could be useful to determine time since death. This is the first study of its kind on an Indian population.

Keywords
Pharmacological miotic solution; Pilocarpine eye drop; Post mortem miotic change in pupil; Pupillary reaction time.

Introduction

In criminal investigations, determination of time since death (TSD) is a major challenge for investigating bodies as well as medico legal experts. Some traditional methods such as rigor mortis, livor mortis and decomposition changes have been used to determine TSD till now.[1-3] For several decades, researchers have been trying to find some new methods to enhance the accuracy and reliability to make the criminal investigation more efficient and feasible. Recently, post mortem pupillary reactivity using miotic or mydriatic substance using eye drop method is an emerging method to determine time since death in early post mortem period i.e. 24 hour.[4-6] A miotic drug pilocarpine, used for the treatment of glaucoma,[7] is a convenient method for researchers to observe the pupillary constriction after death in different time intervals as well as the different causes of death using different methods.

In previous studies, scientists had curiosity about the effectiveness of pupillary miotic changes as well as mydriatic changes after death. In 1884, Marshall was the first who observed post mortem pupillary changes using different miotic and mydriatic substances in early post mortem period.[8] Klein & Klein (1978) observed pupillary changes using different miotic and mydriatic solutions into eyes and considered 5 to 30 minutes variation for pupil reaction.[9,10] After this time period, several researchers noted post mortem changes in eye with or without pharmacological solution.[11-15] Orrico et al.[16] observed actual effectiveness of pupil changes by miotic and mydriatic substances in 309 patients using injection method and raised question on determination of time since death. In 2016, Larpkrajang et al. studied time of death using pilocarpine eye drop in left eye only with 10 minutes reaction time for pupillary muscles with pilocarpine eye drop.[17] Kohlar et al.[18] also observed the miotic and mydriatic changes in pupil using injection method and considered 15 minutes reaction time for pupillary changes. Researchers have used onset time period between 10 min – 30 minutes, for pupillary reactivity according to convince.[17,19] No one observed the effective reaction time or range for miotic change in pupil due to action of pilocarpine eye drop in previous studies.

The objective of the study is to determine the reaction time of pilocarpine eye drop to the iris muscles and observe the effective miotic changes of pupil in different time period in different sex, cause of death and also compare the reactivity time for both the eyes to find which eye react faster to use this method in autopsy room as well as in crime scene.

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Materials and Methods

This is an observational cross-sectional study approved by ethics committee of VMMC-Safdarjung hospital. Informed consent had been taken from deceased family members prior to study. Post mortem pupillary reactivity for pilocarpine eye drops was studied in 200 deceased with known time of death. Out of total deceased, 146 were male and 54 were female with the age group of 10-99 years and time of death ranging between 2hr 25 min to 47hr. Individuals were declared dead by the hospital and sent to the mortuary of Vardhman Mahavir Medical College and Safdarjung Hospital, New Delhi to perform autopsy. All the medico legal cases were studied and categorised into natural death, asphyxial death, traumatic death, burns, and poisoning which were used as inclusion criteria for the study. Exclusion criteria included ophthalmic diseases, ocular injuries and corneal opacity. Miotic pharmacological solution, 2% Pilocarpine eye drop was used and instilled 3-4 drops (0.15-2.0 ml) into conjunctival sac at same time in both the eyes simultaneously.[17] Pupillary reactivity was seen in each eye 10 minutes from instillation of the drops up to 50 minutes and miotic changes in pupil were photographed before and after instillation of the eye drops in both the eyes using Sony digital camera model DSC-W710/SC E32. All the digital photographs were analysed using ImageJ freeware,[20] and t-test and one way ANOVA was used for statistical analysis.

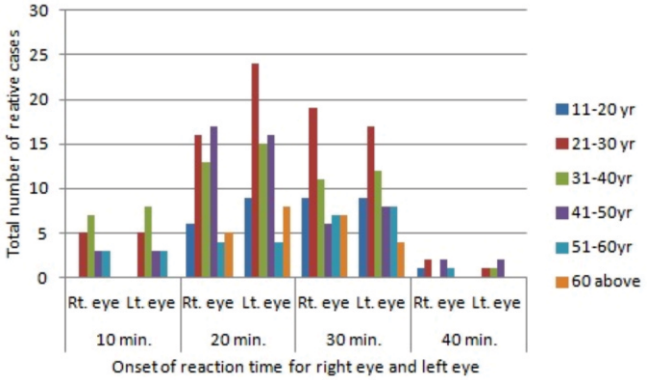

Figure 1: Reactivity of both eyes separately in different onset of time in different age groups

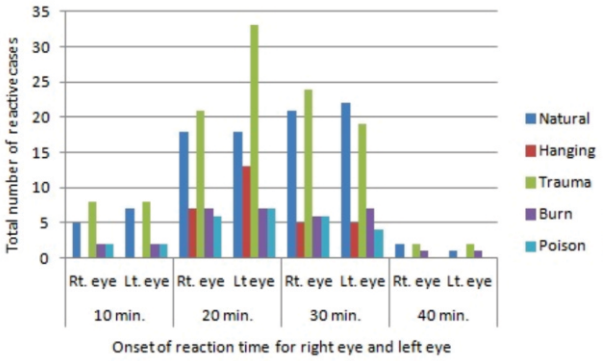

Figure 2: Reactivity of both eyes separately in different onset of time in different cause of death

Table 1: Reactivity of both eyes in different onset of time in different age groups (years)

Age (years)	10 min.		20 min.		30 min.		40 min.	
	Rt. eye	Lt. eye	Rt. eye	Lt. eye	Rt. eye	Lt. eye	Rt. eye	Lt. eye
11-20	00	00	06	09	09	09	01	00
21-30	05	05	16	24	19	17	02	01
31-40	06	09	13	15	11	12	00	01
41-50	03	03	17	16	06	08	02	02
51-60	03	03	04	04	07	08	01	00
60+	00	00	05	08	07	04	00	00

Rt. - Right, Lt. – Left, Min.- Minutes

Table 2: Reactivity of both eyes in different onset of time in different cause of death

Cause of death	10 min.		20 min.		30 min.		40 min.	
	Rt. eye	Lt. eye	Rt. eye	Lt eye	Rt. eye	Lt. eye	Rt. eye	Lt. eye
Natural	05	07	18	18	21	22	02	01
Hanging	00	00	07	13	05	05	00	00
Trauma	08	08	21	33	24	19	02	02
Burn	02	02	07	07	06	07	01	01
Poison	02	02	06	07	06	04	00	00

Rt. - Right, Lt. – Left, Min. - Minutes

Results

Total 200 deceased (400 eyes) were involved in this study. Out of 200 deceased, 146 (73%) were males and 54 (27%) were females all between the age of 10 to 99 years (Mean – 37.52, Median- 35, St. deviation – 14.82) with time of death ranging between 2hr 25min to 47hr (Mean- 15hr 30 min, Median – 14hr 06min, St. deviation- 08hr 10min). All the medico legal cases, included in this study, were brought to the mortuary of VMMS-Safdarjung hospital, New Delhi for autopsy. The cases of natural deaths were 55 (27.5%), asphyxial death were 18 (09%), trauma was 89 44.5%), burns were 22 (11%) and poison was 16 (08%) of total cases. Out of 200 deceased, 160 (80%) showed post mortem miotic changes and the remaining 40 (20%) were unresponsive to the pilocarpine eye drops.

The onset reaction time for pupillary miotic changes in different time period were observed in different sex, age groups and cause of death. The different onset of reaction time for males and females were compared using t-test where no statistically significant difference found between the means of two groups in right eyes and left eye ($p= 0.097$, $\alpha < 0.05$). For different age groups, reactivity for left and right eye is mentioned in Table 1 and found significant difference between the onset of reaction time for both eyes ($p=0.0007$) and the right eye and left eye separately ($p=0.0008$ and $p= 0.0005$ respectively, $\alpha < 0.05$). In

different cause of death, all the groups were compared to determine difference in the miotic changes for both right and left eyes (p=0.0153) and right eye and left eye separately (p= 0.017 and p= 0.016 respectively, $\alpha < 0.05$) which were significant for the study. Reactivity for left eye and right eye with respect to onset of reaction time is mentioned in Table 2. Across all the age groups, both eyes showed variation between the different age groups and maximum number of miotic changes were found at 20 and 30 minutes from first instillation of the drops (Figure 1). Same as age group, in different cause of death, we observed that highest number of miotic changes was observed at 20 minutes from first instillation of eye drops. After 30 minutes, there was a sharp decline found at 40 minutes and no pupil changes have been recorded in 50 minutes (Figure 2).

Discussion

The effectiveness of post-mortem pupillary reactivity using pharmacological solutions is still a topic of debate for scientists. Since 1884, Marshall and other scientists have used different method and onset of reaction time to make the study effective and reliable. Previously injection, eye drops or combinations of both the methods along with different miotic solutions as well as mydriatic solutions, were used to observe pupillary miotic changes for determination of time since death. In this study we used pilocarpine eye drop which is pharmacological miotic solution, generally used to reduce the pain for the treatment of glaucoma.[7] Pilocarpine eye drop is easily available in general medical stores and hospitals and its easy availability, application and low cost makes this method convenient instead of injection method

In previous studies, researchers used the different onset of time period for the pupillary changes to pharmacological solutions between 10-30 minutes,[17-19] as convinced. However, the effective time period for reactivity of pupillary muscles for pilocarpine eye drop has yet to be defined.

In present study, we observed the miotic changes in both eyes up to 50 minutes of post instillation and found a sharp decline in pupillary constriction after 30 minutes and no reactivity was observed after 40 minutes in both eyes. Authors included factor such as sex, age and different cause of death to observe the effective reaction time for both eyes. We observed no statically significant difference in onset of reaction time for miotic changes between males and females in both the eyes which showed that reaction time for pupil miotic changes doesn't depend on sex.

Authors concluded that pupil reacts effectively in 20 minutes post instillation in maximum number of cases in all cases and age group. However, in several cases, miotic changes had also been seen in 30 minutes that could not be ignored. Therefore, we suggest the effective onset of reaction time for pupillary miotic changes to pilocarpine eye drops should be 30 minutes. Previously, Bardzik et al.[15] recorded the miotic changes faster in his study (5-10 minutes) using injection method. Longer time period for reaction time than injection method may be caused due to passive absorption of drops in conjuctival sac. Larpkrajang et al.[17] used 10 minutes as reaction time and Kohlar et al.[18] used 15 minutes as reaction time for their study which is less time period to observe effective miotic changes Indian population. However, Kohlar et al.[18] have used injection method to conduct their study which is completely different from our study. Further research is suggested using a greater number of cases with different cause of death and compare the onset of reaction time in individual case homogeneously for better analysis within the group.

Pupillary diameter was measured using ImageJ freeware (version 1.6.0_20; 32 bit) - a Java-based software,[20] which has been already been used by previous researchers.[18,21] It has advantage over the other measuring techniques such as pupilometer, tape methods[16] and vernier calliper,[17] which are limited by factors such as high cost, low accuracy and difficulty in handling, respectively. One more advantage of ImageJ software is its diverse plugging and functions. This is the first study in India and there has been no previous research that observed the pupillary reactivity to pilocarpine separately in both eye.

Conclusion

Previously, researchers used different onset of reaction time to observe the pupillary miotic changes to evaluate the effectiveness of pupillary changes for their studies. Our study showed that left eye reacted considerably faster than the right eye in all the different cause of death as well as in different age groups. We found that minimum 30 minutes post-instillation is the best suited time interval to observe the maximum number of effective miotic changes in eyes to pilocarpine eye drops. Therefore, this method could be used for the determination of time since death preferably in autopsy room.

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Conflict of interest: None to declare

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ORIGINAL ARTICLE

Profile of Forensic Autopsy Cases Conducted by Boards/ Panel from Delhi, India

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Prof. Satish Kumar Verma is a recipient of the IAFM Fellowship in 2004

Abstract

The term board means a committee of persons organized under the authority of law to exercise certain authorities, have oversight or control of certain matters, or discharge certain functions of a magisterial, representative, or fiduciary character. Among forensic cases which may be pertaining to clinical forensic medicine or in case of doubtful death, such medical boards are now becoming quite prevalent in India. There is paucity of data related to profile of such cases both from India and other parts of world. Therefore a study was planned and executed to analyze the cases pertaining to forensic autopsies conducted by medical boards in capital city of Delhi. This is a descriptive retrospective study based upon the data retrieved from the departmental records of Forensic medicine belonging to a tertiary care medical teaching institution located in East Delhi, India for three years consecutive period from January 2015 to December 2017. A cluster of 70 such case that fit in the inclusion criteria were inducted in the study and analyzed. The mean age of such cases was 30.5 years, with male: female ratio of 7:2. The prominent reasons for constitution of medical boards were allegation of medical negligence and custodial deaths (both judicial and police). In more than 1/3rd of cases the cause of death established by medical board was natural. There is an increasing tendency for constitution of boards for conduction of forensic autopsies in state of Delhi despite lack of provision in law of land.

Keywords

Forensic autopsy; Medical boards/ Panel of doctors; Medical negligence; Custodial death

Introduction

The term board refers to a committee of persons organized under the authority of law to exercise certain authorities, have oversight or control of certain matters, or discharge certain functions of a magisterial, representative, or fiduciary character. In medical scenario boards are constituted by a competent authority consisting of more than one medical expert. Among forensic cases which may be pertaining to clinical forensic medicine or in case of doubtful death, such medical boards are now becoming quite prevalent in India. In cases of suspicious deaths in India, a legal proceeding called inquest is held by law enforcing agencies. The inquest is defined as an inquiry or investigation into the cause of death.[1] There are two types of inquest to be held for investigations, namely: a) police inquest and; b) magistrate inquest. Police inquest is the most popular method of conducting inquest and is described under the Criminal Procedure Code (CrPC), 1973 under Section 174. It is done by local police when the officer in charge of a police station empowered by the state government, receives information that a person has committed suicide, or has been killed by another person or by an animal or by machinery or by an accident, or has died under circumstance raising reasonable suspicion that some other person has committed an offense. The other type of inquest i.e. Magistrate inquest also comes under Criminal Procedure Code, 1973 Section 176 and is considered superior to police inquest. Inquiry is held either by executive or judicial magistrate, when any person dies while in the custody of police or suicide by women within seven years of her marriage; or any other case mentioned in subsection (1) of section 176 CrPC.[2] However under both the above laws i.e. Section 174 & 176 of CrPC, there is no provision for constitution of medical boards for conduction of forensic autopsies. But, still such medical boards are routinely constituted by administrative/ judicial authorities in the state of Delhi and rest of India. Commonly, the members of the boards are drawn among doctors/consultants working in the department of forensic medicine and number varies from 2-4.

Guidelines for the constitution of the medical board for conducting post-mortem examination are issued by the Department of Health and Family Welfare, Government of National Capital Territory of Delhi, India (vide letter no.- H&FW/112248262/2013/1115-32, Dated 06/02/2015). According to section "C" post mortem examination in exceptional cases, which is further, divided in sub-sections (i), (ii) and (iii); Section (i) states deaths in police custody or police encounters; Section (ii) states deaths in judicial custody such as jail or remand home, which is further divided into two sub-categories such as (a) death of a person due to the natural cause of illness while in judicial custody and (b) case of suspected unnatural death in judicial custody such as suicide or murder

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and Section (iii) includes deaths due to medical negligence cases. According to section "D" of the guidelines, whole post mortem should be conducted under video recording or still photography.[3]

Though, the constitution of medical boards for conduction of forensic autopsies is not a novel phenomenon in Delhi, India, but, in the last few years it has been observed that the frequency of such cases is rising steadily. However on literature search the information pertaining to profile of such cases is very limited both nationally and internationally. Therefore, the present study was planned and executed to analyze and explore the profile of such forensic autopsy cases conducted by medical boards in a tertiary care medical institute, falling within the geographical boundary of East Delhi, India.

Materials and Methods

The present study is a descriptive retrospective study. The data for three consecutive years from January 2015 to December 2017 were retrieved from the records of the Department of Forensic Medicine, University College of Medical Sciences and Guru Teg Bahadur Hospital, Delhi, India. During the search, it was found that total 70 cases were conducted by the medical board of doctors during the above cited period, fullfiling the inclusion criteria i.e., they were conducted by medical boards duly constituted by competent authorities of Health Dept. of National Union Territory of Delhi or Judicial officers. This cluster of 70 cases consisting of post mortem reports and inquest papers were examined retrospectively concerning different parameters such as age/sex of the cases, religion, residential status, board constituting authority, reason for constituting medical board, time since death, and cause of death. The appropriate statistical analysis was done by Chi-square test and p value of < 0.05 was taken as significant.

Results

During the period of three consecutive years from January 2015 to December 2017, a total 5898 forensic autopsies were conducted out of which 70 autopsy cases were board cases (1.18%) and varying from 0.88% in the year 2015 to 1.70% in the year 2017. The year wise distribution of these 70 cases is given in the Table 1. The frequency of cases has almost doubled in the year 2017 in comparison to 2015 and 2016. The Chi-square test value was 18.0429 & p-value was 0.000121 and was highly significant statistically. The age range varied from new-born to 72 years with mean age of 30.5 years. When the age is divided into sub groups as a) under 18 years there were 22 cases comprising 31.4%, b) aged between 18 to 40 years had 28 cases (40%) and; c) more than 40 years with 20 cases (28.6%). The Chi-square test gave the value as 2.2286 and p value was 0.32815 which was not significant statistically. The sex wise distribution of the total 70 board cases showed that male sex was more prevalent (n=51) as compared to female sex (n=19) and the difference was statistically significant (p value <0.0001).

Out of total 70 cases, 60 (85.8%) cases were belonging to Hindu community, 9 (12.8%) cases were Muslims and remaining 1 (1.4%) case was belonging to Sikh community. The Chi-square test value was 131.7 and p value was <0.00001 and was again highly significant statistically. Total 42 cases were from Delhi; 26 cases were from outside Delhi and 2 cases had no confirmed residential status.

In the study we found that in most of the cases, boards were constituted by competent authority of Government of NCT, Delhi (50 cases) and in the 20 cases (28.6%) by Judicial Officers. The difference was highly significant statistically (p value <.00001). The time since death among cases of medical boards on conduction of forensic autopsy varied from less than a day to more than 4 days. The distribution of cases according to the duration subgroup constituted was as follows: a) Less than one day (05 cases); b) one to two day (26 cases); c) two to three day (15 cases) and; d) three to more than four days (23 cases). In 93% of cases the time taken for conduction of autopsy was more than 24 hours following death. (Table 2) The causes of death among 70 cases established by the medical board after forensic autopsy is shown in Table 3. For more than 1/3rd cases natural death was the cause of death. Similarly in about another 1/3rd cases the cause of death was pending for analysis of viscera and/or histopathology report at the time of writing of this manuscript. (Table 3)

The most common reason for constitution of medical board was allegation of medical negligence which accounts for 40 cases (57%). Custodial deaths either in police or judicial custody actually forms 17 cases (24%). Rest was of miscellaneous reasons such as allegation of foul play, death in mental hospital, de-addiction centre etc. accounting for 13 cases (19%) as shown in Figure 1. Among the 40 cases of alleged medical negligence, in 28 cases (70%) allegation was against the private hospitals whereas in 12 cases (30%) the allegation was on the government hospitals which were less than half in comparison to private institutions. The difference was statistically significant.

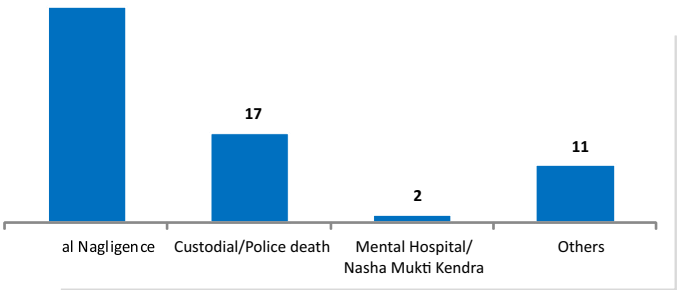

Figure 1: Distribution of cases

Table 1: Year-wise distribution of forensic autopsy cases conducted by medical boards

Year	Total cases	Board cases	%
2015	1804	16	0.88%
2016	1923	17	0.87%
2017	2171	37	1.70%
Total	5898	70	1.18%

Table 2: Distribution of cases vis-à-vis time since death

Groups	Time since death	N	%
1	< 1 days	05	7 %
2	1-2 days	26	37%
3	2-3 days	15	21%
4	4 days	24	35%

Table 3: Distribution of cause of death among forensic autopsies by medical boards

Cause of death	N	%
Natural	26	37%
Unnatural	10	14%
Still pending	24	34%
Undetermined	02	3%
Still and dead born fetus	04	6%
Post-partum haemorrhage	04	6%
Total	70	100%

Discussion

A medicolegal autopsy to ascertain the cause of death or others factors concerning death in unnatural death or suspicious cases is generally conducted by a single autopsy surgeon. But some cases like custodial death, medical negligence cases or circumstances of death being highly suspicious and large public interest may require more than one doctor or panel of autopsy surgeons to conduct autopsies ordered by the competent authority. In India, few researchers conducted studies on board cases, but most of them had taken custodial death cases or medical negligence cases separately.[4] To the best of our knowledge no combined autopsy study was conducted (custodial deaths and medical negligence cases together) till date and this is the uniqueness of our study and we aimed to give a combined profile of forensic board cases.

In medical negligence cases, India reports approximately 5.2 million cases a year, basically due to the wrong dose, wrong surgery, incorrect prescription etc. Despite improvements in the health care system of India, litigation against doctors has increased in the last few years. In the year 1995, Indian Medical Association vs V.P. Shantha case, the supreme court of India verdict brought the medical professional under the purview of the consumer protection act, 1986, based on deficiency of service.[5-7] Under this law there is a provision for award of compensation by consumer forums/commissions in case allegation of compensation is proved. Therefore such allegations are quite frequent in India. Since these allegations of medical negligence are fancy with media and attract large public interest, administrative and police authorities usually ask for constitution of board of doctors for conducting forensic autopsies on such deceased persons, despite of lack of legal provision.

Human Rights Commission of India was constituted under the Protection of Human Rights Act, 1993 for protection of human rights in custodial deaths. As per this order custodial deaths should be reported within 24 hours and a postmortem examination should be conducted by a board of doctors under videography.[8]

In this study we analyzed 70 board cases conducted over a three years period constituting 1.18% out of total forensic autopsy cases of 5898.

The age group of 18-40 years was most common among the autopsies conducted, however when these cases were subdivided into: a) medical negligence cases and; b) custodial death cases, most common age group for alleged medical negligence was <18 years which is consistent with the study conducted by Choudhary.[9] This is contrary to another study conducted from Wuhan, China that describes medical negligence death as being more common among older age group.[10] When compared with studies conducted by Kushewar and Bardale, our study has similar finding with respect to custodial death as the most common for age group of 18-40 years.[11,12]

In our study, involvment of male sex was predominantly higher. Further when the religion of cases was analyzed 85% cases was Hindu whereas 12.8% cases were Muslim. This is because majority of population of jurisdiction for conduction of forensic autopsies is Hindu. These figures are in consonance with latest available census data (2011) wherein the population of these two communities residing in Delhi state was 80.21% (Hindu) and 12.78% (Muslim).[13] Delhi is surrounded by many states and has mixed population comprising people migrating from different states, and many patients are referred for better health care facility to Delhi from nearby states. In our study 60% of board cases comprise residents of Delhi where as 37% cases were from outside Delhi (nearby states). For these cases board were constituted either by Government of NCT Delhi or Medical Superintendent of this hospital. In 71% cases boards was formed by order of Govt. of NCT Delhi.

Among these cases of medical negligence, 70% (more than

2/3rd) cases, allegations were over the private hospitals as compared to 30% (less than 1/3rd) cases allegation were on the Governmental/ Public Hospital. The main reasons might be the higher cost of treatment in private hospital and decrease faith over the doctors, insurance policies and intolerance of patient relative. Government hospitals provide heath facilities and treatment free of cost, so do not come under consumer protection act and leads to lesser allegations of medical negligence

In our study we review time since death also which was not studied previously for medical negligence cases and custodial death cases. We found that only 1.7% cases autopsy were conducted within 24 hours and in more than 1/3rd cases (35%) more than 72 hours (03 days) passed when the boards were formed and forensic autopsy was conducted. The reasons behind this long delay in constituting board might be because of involvement of multiple authorities and time taken for the formalities and documentation and sometimes time taken in arranging doctors from different institution. In many cases patient were referred from others nearby states and kin take time come to reach the mortuary for identification of their relative's bodies, an essential prerequisite for conduction of forensic autopsy.

When cause of death was analyzed in this study, we found natural death was the reason in 37% cases (malignancy, sepsis, consolidation and ttuberculosis of lungs, coronary artery disease, and interventricular hemorrhage) and unnatural in 14% cases (due to hanging, blunt trauma). These results were in tune with other study on custodial deaths from this part of world.[14,15] In 24 cases (34%) the cause of death was inconclusive because of pending reports of toxicological analysis and histopathological examination reports**.** Whereas in remaining cause of death were either due to other miscellaneous reasons like still/dead born fetus and post-partum hemorrhage (6% each) or other indeterminate causes in 3% cases.

Conclusions

There is no legal provision at present for formulation of medical boards in fatal forensic cases, however through administrative order issued in the year 2015 for alleged medical negligence deaths and custodial deaths, by Health Department of Govt. of NCT of Delhi, these boards are constituted in majority cases. It has been observed that in some cases even if the cases does not fall in above category just to satisfy the public demand/ police request such medical boards are constituted by passing the Govt. order. Hence as evident from the results the frequency of constitution of such boards is increasing. In large number of such cases, the death is due to natural disease clearly described in the hospital records and death certificate, but still boards are constituted in very routine manner with going into merits of the case. The constitution of medical boards delays the performance of last rites by relative as evident from time since death of even more then 4-5 days is observed in such cases. In about 37% cases the cause of death cause natural, it puts a big question mark on the competency of the investigating agencies since forensic autopsies are meant to be conducted in cases of unnatural deaths only.

Limitations & Recommendations

In about 1/3rd cases the final cause of death was not available due to non-availabilty of viscera analysis and/or histopathological reports. There is a need for formulation of rules & regulations under legal provisions by amending Section 174 and 176 of CrPC so that it applies uniformly across the country and not on the wisdom of the Administrative/ judicial officers. There should be clear law/regulations for constitution of medical bords, the number of experts to be employed for this purpose, and the institutions authorized to conduct forensic autopsies by medical boards.

Ethical clearance: A prior approval was obtained from the Institutional Ethics Committee

Conflict of interest: None to declare

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ORIGINAL ARTICLE

Correlation between regular physical activities with perceived stress in undergraduate medical students during Covid-19 pandemic

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Abstract

The world wide spread of covid-19 has vexed the ordinariness of every human being's day to day life, forcing population to social distancing and self-isolation. Like the rest of the world, medical undergraduate students are suffering from stress. The objective of the study is to assess whether regular physical activity has any correlation with perceived stress scale (PSS) of medical undergraduate students during Covid-19 pandemic. The aim of the present study is to find out if regular physical activity has any correlation with perceived stress level in undergraduate medical students during Covid-19 pandemic. The present study was a questionnaire based cross-sectional study on perceived stress scale and International Physical Activity Questionnaire (IPAQ). Data were entered into SPSS software and Pearson's correlation was calculated for perceived stress with sex, age, year of M.B.B.S, place of residence, involvement in regular physical activity, duration, frequency per week and METs per week. Chi-square test was used to analyse categorical variables and $P<0.01$ was considered statistically significant. 183 undergraduate medical students participated in the study. Only 26.2% were involved in regular physical activities and 56.8% scored very high on PSS. The mean PSS score was 22.37±6.42. 66.7% of the respondents had less than 600 METs per week and scored low in IPAQ. Pearson's correlation was applied between PSS score and PA and it turned out to be -0.709 which signifies strong negative correlation between the variables. Based on the current study, it can be stated that those respondents involved in regular physical activities were found to perceive less stress than those without regular physical activities. Hence, it is recommended that medical students should be encouraged to partake in regular physical activities during this pandemic.

Keywords

Perceived stress; Physical activity; Medical students; COVID-19

Introduction

The World Health Organization (WHO) declared COVID-19 outbreak as a public health emergency and a pandemic on 11 March 2020.[1] Along with pandemic, comes scarcity of resources, mortality and morbidity. One such morbidity is psychiatric and psychological diseases. On top of it, isolations and quarantines have affected the minds of all. Ever since this pandemic set foot in, binge eating practices, diminished regular physical activity (PA) and critical increments in liquor intake are on the rise.[2-5] Regular PA for 30 to 45 minutes is recommended.[6] PA is defined by WHO as "any bodily movement produced by the skeletal muscles that uses energy, this includes sports, exercise and activities like playing, walking, household chores or gardening."[7] Studies conducted in Italy and Spain during lockdown suggested that reduction of total PA had profound negative impact on wellbeing of population.[8,9] According to WHO, physical inactivity counts as the fourth leading risk factor worldwide for mortality.[10] Hence, this study was conducted to find the correlation between perceived stress score and regular physical activity in medical undergraduates, who have to undergo an unprecedented curriculum with trainings during this pandemic and be prepared for the days to come as a caregiver.

Materials and Methods

The present study was a cross-sectional study done at a tertiary institute in North Eastern India, for a period of one month during March 2021, where e-Google forms were supplied to the e-mails of the undergraduate students. Permission for this research was granted by institutional ethical committee. The form contained one consent form. If students consented, they could tick and then two questionnaires would open after a form on demographical data was collected. This included their sex, age, year of bachelor in medicine & bachelor in surgery (M.B.B.S), current place of residence (institutional campus/ home or other) and whether partaking in regular PA. One

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questionnaire was on perceived stress scale (PSS) which was developed by Sheldon Cohen in 1994. PSS by Cohen is one of the globally recognized and most commonly used questionnaires to assess one's perception of stress.[11] It consists of 10 questions. It is a proportion of how many circumstances in one's day to day existence are evaluated as stressful. Things were intended to decipher how erratic, wild, and over-burdened the respondents felt in their life. The scale likewise incorporates various direct questions about degrees of experienced pressure. The questions are straightforward, and the reaction options are easy to get a handle on. The questions in the PSS ask about how one felt during recent couple of months. For each situation, respondents are asked how regularly they felt a specific way. Every question would fetch answers in a scoring system, ranging from 0 (never), 1(almost never), 2(sometimes), 3 (fairly often) & 4(very often). Based on the scores, perceived stress was determined. For scoring first, we had to reverse the scores for questions numbering 4, 5, 7, & 8. On those respective questions, the scores had to be given like these: 0= 4, 1 = 3, 2 = 2, 3 = 1, 4 = 0. After summing up the scores for all the standard questions (10 in number), scores of 0-13 were considered normal, 14-26 as moderate, 27-40 as severe. The second questionnaire was International Physical Activity Questionnaire (IPAQ).[12] After scoring the IPAQ, the results can be yielded in two different formats. Results can be yielded for classifications of activity levels (low activity levels, moderate activity levels or high activity levels) or as a persistent variable which is called metabolic equivalent of task (MET) minutes in a week. MET minutes address the measure of energy used doing actual physical work. Resting, without any movement is considered equivalent to 1 MET and 2 METs is equivalent to twice the energy expenditure during resting. Walking for instance is considered to be 3.3 METs. Moderately heavy exercises like yoga and sweeping or mopping have 4 METs. Heavy physical activities like swimming, jogging or jumping have 8 METs. Numbers of such sessions were noted and average duration was noted and the sum of METs minutes per week was scored. The individuals who score high on the IPAQ participate in vigorous exercises on any 3 days and accomplish a minimum of 1500 MET minutes in a week, or, at least 7 days of mix of strolling, moderate activity or enthusiastic force exercises and accomplish a minimum of 3000 MET minutes in a week. The individuals who score moderate on the IPAQ take part in at least 3 days of heavy force movement and additionally strolling in any event 30 minutes out of every day, or, at least 5 days of moderate force movement and additional strolling for 30 minutes in a day or at least 5 days of any mix of strolling, moderate force or overwhelming power exercises accomplishing a minimum of 600 MET minutes in a week. Those scoring low in IPAQ could not be categorized in any of the two above. Only those activities that required more than 10 minutes were taken into consideration.[13] The data were entered into Statistical Package of Social Sciences v 26.0(IBM Corps, available at https://www.ibm.com/support/pages/downloading-ibm-spss-statistics-26). Pearson's correlation was calculated for perceived stress score with other variables. The independent variables were sex, age, year of M.B.B.S, place of current residence, whether involved in regular physical activity, type of activity, duration per session, frequency per week, METs per week was noted. Chi-square test was used to analyse between the categorical variables and those having P<0.01 was considered statistically significant. Confidence interval was kept at 99%.

Results

Out of 183 participants, 103 (56.28%) were males and 80 (43.71%) were females. The mean age of the respondent was 21.92 years and ranged from 18 years to 26 years. The number of students who participated in this research were nearly equally distributed from each year of M.B.B.S. About 26.2% of the respondents stated that they were involved in regular physical activities, while 73.8% stated that they lost their enthusiasm during the pandemic and were no longer involved in a physical activity routine. About 56.8% of the attendants scored very high on PSS, followed by 26.8% scoring high. The mean PSS score was 22.37±6.42. The percentage distribution of PSS score is depicted in Figure 1. About 21.3% stated that they underwent only 1-3 times of a routine physical activity more than 10 minutes and about 12 % stated that they had underwent some form of activity but could not be categorized. The percentage distribution of sessions per week of physical activity is depicted in Figure 2. About 31.1% stayed at the institutional campus while the rest 68.9% went to their homes or other places of safety for they feared of contracting the disease at the medical institutional campus and also classes became online, so they felt there was no need to stay back. Only about 18% respondents stated that they underwent more than 60 minutes of physical activity per session. The percentage distribution of minutes per session of physical activity is depicted in Figure 3. As many as 66.7% of the respondents had less than 600 METs per week and scored low in IPAQ. The percentage distribution of METs per week is depicted in Figure 4. Pearson's correlation was applied between PSS score and PA and it turned out to be-0.709 which signifies strong negative correlation between the variables, while the 2-tailed significance came out to be P=0.000 which is below 0.01 as depicted in Table 1. Relatively strong negative correlation was found between PSS score and MET minutes in a week as depicted while P=0.000 in Table 2. No strong correlation was found between PSS and sex, age, year of MBBS, place of stay or time of day of physical activity.

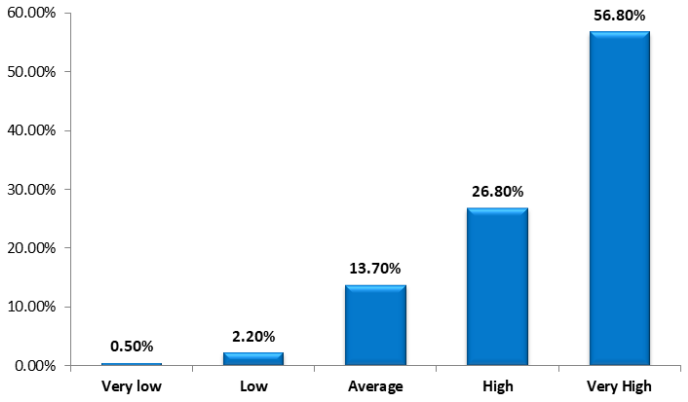

Figure 1: Percentage distribution of Perceived Stress Score amongst the respondents

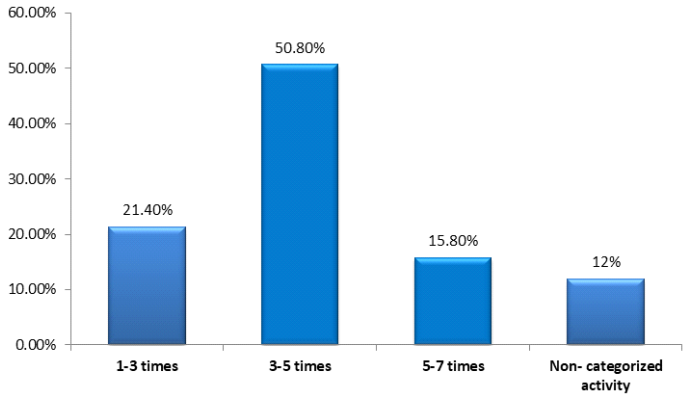

Figure 2: Percentage distribution of sessions of physical activity per week

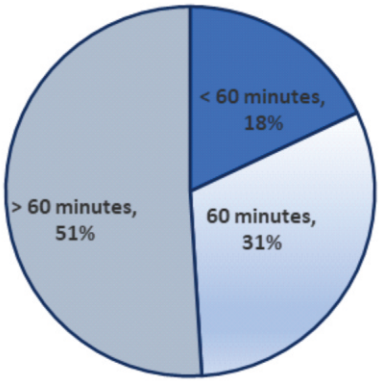

Figure 3: Percentage distribution of duration per session of physical activity

Table 1: Correlation between Perceived Stress Scale Score and regular physical activity

Correlation		PSS Score	PA
PSS Score	Pearson Correlation	1	-.709**
	Sig. (2-tailed)		.000
	N	183	183
PA	Pearson Correlation	-.709**	1
	Sig. (2-tailed)	.000	
	N	183	183
**. Correlation is kept significant at the 0.01 level (2-tailed).			

Table 2: Correlation between Perceived Stress Scale Score and METs per week.

Correlation		PSS Score	METS per week
PSSC	Pearson Correlation	1	-.556**
	Sig. (2-tailed)		.000
	N	183	183
METS per week	Pearson Correlation	-.556**	1
	Sig. (2-tailed)	.000	
	N	183	183
**. Correlation is significant at the 0.01 level (2-tailed).			

Discussion

On 18 March, 2020 WHO released one pamphlet named "Mental health and psychosocial considerations during the COVID-19 outbreak" where special mention has been given to mental wellbeing of healthcare professionals since it is expected that they will be under increased pressure of work, deprivation of sleep. Many might cope with stress by unhelpful strategies like addiction to tobacco, alcohol, drugs also thus become victims of taboos and social stigma from family members and community; they might undergo anxiety and mental depression.[14] Medical care providers during outbreaks of infectious diseases or pandemics have to overcome certain challenges in the new setup and which may play a direct effect on the management of outbreak or pandemic management.[15] Specialists bring up the need to give explicit consideration to different groups of population in danger of additional misery that may require customized interventions. Giving mental medical aid is a fundamental consideration segment for populaces that have been survivors of crises and catastrophes, previously, during and after the occasion. Determined to manage the dire mental issues of individuals engaged with the COVID-19 pandemic, some specific intervention model is required.[16] One systemic review and meta-analysis shows that even before COVID-19 about 27.2% medical students exhibited depression or depression like symptoms, and the overall

prevalence of thoughts of suicide was 11.1%. Among medical students who screened positive for depression, 15.7% sought psychiatric treatment.[17] In Pakistan Journal of Medical Sciences, one article was published regarding "The impact of quarantine on Medical Students' mental wellbeing and learning behaviours" and has findings that show that 44.1% showed a sense of being emotionally detached from family, friends and fellow students, 23.5% medical students felt disheartened. 56.2% of the total students stated that they had difficulty in studying and the time of studying was remarkably reduced. Medical students of both sexes have been found to have done work which was not satisfactory as compared to their earlier individual performances.[18] In our study too there was no significant difference between the perceived stress of male and female medical undergraduate students. Only 16.4% had scored from very low to average in the PSS, rest 83.6% perceived high to very high stress level. 73.8% of the respondents declared that they were no longer involved in regular physical activities like before. This was found in accordance to a study conducted by Meyer and colleagues on US adults. In their research, they found that 32.3% of the respondents agreed that they were living a sedentary lifestyle after the current pandemic began.[19] One study conducted on Canadian population stated that individuals who were involved in more outdoor works had lesser anxiety levels than those who were living sedentarily.[20] One systematic review done on removal of physical activity from life and consequences on mental wellbeing reported that such individuals had higher levels of anxiety, depression and stress.[21] In the present study, we found significant strong correlation between PSS and PA. Individuals who had been partaking in regular physical activities had lesser score in PSS scale. The mean PSS score was 22.37±6.42, which fell into the category of high to very high perceived stress. One similar study, done on nursing students, found the mean to be 31.69 ± 6.91 in PSS, which is very high.[22] Also, individuals involved in more METs per week (high in IPAQ) had lesser scores in PSS. No other study has been found with such variables conducted during this pandemic on medical students. Therefore, based on our study, it is recommended that medical undergraduate students be made aware of positive effects of physical activity on mental wellbeing and also be given physical tasks by their institute along with online classes, during the pandemic phase.

This study was conducted on the undergraduate students of a single medical institute. More studies in different institutes can be compiled for a better understanding of effect of physical activity on the perceived levels of stress in the current scenario of COVID-19 pandemic and thereby submitting such research to undergraduate medical regulatory boards to encompass physical activity training during this period of pandemic.

Ethical clearance: A prior approval was obtained from the Institutional Ethics Committee

Conflict of interest: None to declare

Source of funding: None to declare

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ORIGINAL ARTICLE

Clinico-demographic profile of covid 19 mortality in a tertiary care centre of Madhya Pradesh

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Abstract
Present study was conducted in ABV Government Medical college, which was the only recognised covid hospital by Government of M.P., with tertiary care facilities in Vidisha district. This study is a record based cross sectional study done to determine various clinico-demographic profile and co-morbidities associated with mortality, among covid 19 patients who died after initiation of treatment in IPD. Mean age affected was 56.64 yrs with slight preponderance of males. Almost 64.22% patient who died were suffering from comorbidities in whom the common were hypertension (11%), diabetes mellitus (9.17%), coronary artery disease (11%), renal involvement (5.5%), obesity (4.58%) and respiratory involvement (8.25%) cases. Common signs and symptoms were fever (92%), cough and cold (90%), dyspnoea (84%), fatigue and myalgia (71%) cases. Oxygen saturation was below 80 mm of Hg in 23.8 % patients and mean duration of hospital stay hospital was 4.0 days. Respiratory support in the form of Bi-pap and C-pap was needed in 17.43% cases and endotracheal intubation was needed in 7.33% cases. Treatment of cardiogenic shock was given in 22.01% cases.

Keywords
Covid 19; Clinical profile; Demographic profile; Co-morbidities; Mortalities.

Introduction

Covid 19 has been a devastating and unprecedented pandemic for the mankind which has shattered the health and the health care systems globally. Until April 2021 over 140 million confirmed cases and over 3 million deaths have been recorded globally.[1] It has affected the health care delivery system globally whether it is developed nation or a developing country like India. Vaccination has been a sign of relief but the vaccination campaign has also seen the challenges in the form of availability and efficacy. Emergence of new variant of the virus owing to genetic mutation is a potential threat to the community and the health systems. The preparation and response to pandemic has suffered majorly due to this threat.[2-5]

In the present study, covid 19 mortality cases admitted in ABV Government Medical college hospital, until first quarter of 2021 were taken. The current study is aimed to determine various clinical and demographic profile of covid 19 patients admitted in the medical college hospital who died after initiation of treatment in IPD. During the data retrieval various co-morbidities associated with mortality, were also identified.

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Material and Methods

The present study is a record based cross sectional study done at a tertiary care centre of Madhya Pradesh. Approval from the institutional ethics and research committee was taken before the conduct of the study. The data was obtained from the Medical Record Department of the institute, after permission from Medical Superintendent. Sample taken was from the mortality record of first quarter of the year 2021. The anonymity and confidentiality were maintained while handling the medical record of the deceased.

Total 109 case files were accessed for the study. Only those files which had already undergone the audit were included for the study purpose. The data regarding demography like age and sex distribution, delay in arriving the hospital and clinical details like presenting symptoms, oxygen saturation, duration of stay, comorbidities and respiratory assistance etc. were studied and entered in Microsoft excel. Frequency is shown in percentage and central tendency is shown as mean and confidence interval.

Results

Total 109 case files were included in the study. Mean age of the patients was found to be 56.64 years. 59 out of 109 (54.1%) were male and 50 out of 109 (45.8%) were female. Comorbidity were seen in 70 out of 109 (64.22%) cases. Among the comorbidity found in the patients, hypertension was present in 11%, diabetes mellitus in 9.17%, coronary artery disease in 11%, renal involvement in 5.5%. obesity was seen in 4.58% cases, both diabetes and hypertension in 0.06% cases,

respiratory involvement in 8.25% cases. Details regarding clinico-demographic findings of the present study have been shown in Table 1.

While reporting to the hospital 84% were symptomatic and 16% were asymptomatic. Fever in 92% cases, cough and cold was seen in 90% cases, dyspnoea was present in 84% of cases. Fatigue and myalgia was found in 71% cases. Out of total 109 cases the oxygen saturation was below 80 mm of Hg in 26 (23.8 %) patients. Mean duration of stay in the hospital was 4.0 days.

Respiratory support in the form of Bi-pap and C-pap was needed in 19 (17.43%) cases and endotracheal intubation was needed in 8 (7.33%) cases. Treatment of cardiogenic shock was given in 24 out of 109 cases (22.01%). Clinical findings of present study are shown in Table 2.

Table 1: Clinico-demographic parameters obtained in the present study

Clinico-Demographic parameter	**N (%)**
Age in years	56.64 ± 2.86
Sex	Male - 59 (54.1%) Female - 50(45.8%)
Co morbidities 1.Hypertension 2.Diabetes Mellitus 3.CAD 4.kidney disease 5.Obesity 6.Diabetes and Hypertension 7.Respiratory diseases	 12(11%) 10(9.17%) 12(11%) 6(5.5%) 5(4.58%) 7(6.42%) 9(8.25%)
Delay in reaching the hospital (in Days)	3.733 plus minus 0.69

Table 2: Clinical profile of cases in the present study

Clinical Profile	**N (%)**
Investigation for diagnosis	Rapid antigen test – 59 RTPCR – 50
Symptom profile 1. Asymptomatic 2.Symptomatic Fever Cough and cold Dyspnoea Fatigue and Myalgia GI symptoms (Nausea,Vomiting, diarrhoea)	 17(15.59%) 87(79.81%) 100(91.74%) 98(89.90%) 89(81.65%) 77(70.64%) 4(3.66%)
Duration of stay in hospital	4.08 ± 0.875
SPO2 more than 80 at the time of death SPO2 less than 80 at the time of death	26 (23.85%) 83 (76.14%)
Treatment profile 1. Respiratory support given 2.Endotracheal intubation 3. Treatment for cardiogenic shock	 Not needed in 90(82.56%) Needed in 19(17.43%) Done in 08 (7.33 %) Given in 24 (22.01%)

Discussion

In a similar study by Asirvatham et al. the mean age of patients dying from Covid 19 was found to be 62.5 yrs (SD 13.7) with co-morbidities in 85% cases, diabetes mellitus in 62% cases. Hypertension in 49.2% and Coronary Artery disease in 17.2 % cases. The delay in admission was IQR 2,7 and duration of stay in the hospital was IQR 4,7.[6] The results are quite similar to the present study. A research entitled Role of covid 19 deaths in SARS-COV-2 positive patients – a study based on death certificates by Grippo et al, has reported the similar results.[7]

Zhou et al. conducted a study entitled Clinical course and risk factors for mortality in adult patients in covid 19 in Wuhan. It has reported co morbidity in 48% patients, with hypertension in 30% cases and diabetes mellitus in 19% and coronary artery disease in 8% cases. Per year increase in mortality in covid 19 patients with old age was found to be 1.1 odds at 95% confidence interval[8] The difference in the mortality risk with old age in this study might be due to the fact that this study is based on the first wave of covid 19 pandemic where there was a higher risk of death with old age.

Clinical factors associated with deaths in 3044 covid 19 patients managed in internal medicine wards in Italy, by Corradini et al. has reported age (OR 2.46. P=0.000), cardiac failure (OR 1.58, P= 0.017), co-morbidities (OR 1.34, P=0.000) as a risk factor for deaths in covid 19 patients.[9]

A meta-analysis and systematic review by Khan et al. has reported hypertension as a co morbidity in covid 19 deaths in 39.5% cases and diabetes mellitus in 25.2% cases. Higher risk of deaths in cardiovascular diseases has been shown as odds 3.42 and respiratory diseases as odds 1.94 at 95% confidence interval.[10]

Another systematic review and meta-analysis by Parohan et al. has reported age > 65 years (pooled OR 4.59, CI 2.61 – 8.04), male sex (pooled OR 1.50, CI 1.06 – 2.12), hypertension (pooled OR 2.70, CI 1.40 – 5.24), diabetes mellitus (pooled OR 2.41, CI 1.05 – 5.51) as risk factors for mortality in covid 19 patients.[11] Male sex might be explained by the fact that they use to have more outdoor activities as compared to females hence exposure could be more.

Difference in clinical characteristics of covid 19 patients who died in hospital during different phases of pandemic - a national data from Italy by Palmieri et al. has reported less survival time in first wave as compared to second wave (15 days vs 46.6 days p <0.001), more female in second wave as compared to first wave (61.8% vs 41.9%) and less likely treatment with steroid in first wave as compared to second wave (41.7% vs 69.3% p<0.001).[12] In a similar study by Brehm et al. has reported almost same age in both waves with shorter duration of stay in second wave and less ICU admissions in second wave as

compared to first wave of covid 19 pandemic.[13] Iftimie et al. has also reported the similar results with younger age, less duration of stay in hospital, CVD, Diabetes mellitus as co morbidity and more GI symptoms in second wave as compared to first wave. Also, the patients were treated more often with NIV, corticosteroid in second wave.[14]

Conclusion

To conclude it could be stated that mean age is less in the second wave of covid 19 pandemic with presence of co-morbidity in majority as diabetes mellitus, hypertension and coronary artery diseases. This study does not calculate the mortality rate or the risk or odds ratio as it does not compare the factors among patients recovered and deceased.

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REVIEW ARTICLE

COVID-19: Dead Body Management

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Abstract
The pandemic of COVID-19 has posed many challenges to the medical fraternity and those involved in handling dead bodies. The challenge of dead body management has been devastating to humankind due to the enormous numbers of dead bodies in this pandemic. People get panicked while dealing with the dead bodies having infection of Severe Acute Respiratory Syndrome Coronavirus-2 [SARS-CoV-2]. Deaths occurred in such big numbers that facilities were outnumbered by the magnitude of deaths. The idea of writing this paper is the concise dissemination of knowledge about the safety of the persons involved in dealing with the dead bodies so that proper preventive measures can be taken, and that too in such a manner so that the respect for the dead body or dignity of the dead body is not compromised. Forensic pathologists are to deal with post-mortem examination cases that pose special hazards as they are more exposed to infection e.g., coming in contact with body fluids and aerosol formed during post-mortem examination. Now there is a gradual change from a panic reaction to the scientific disposal of the dead bodies thus giving proper dignity to the dead body. The scenario has changed from no autopsy in such cases to autopsy after taking proper precautions under the national guidelines.

Keywords
COVID-19; SARS-CoV-2; Dead body management; Autopsy; Cremation; Burial; Infection control.

Introduction

Deaths due to COVID-19 may take place at homes, on the way to health care facilities or in the health care facilities. At one stage a condition of helplessness had been seen due to a large number of deaths in this pandemic and poor knowledge at the beginning of this pandemic causing a panic in the population due to available facilities being overtaken by the effects of the pandemic. Populations suffered psychological effects when the dead bodies were deserted even by the close relatives and the whole burden of the disposal of the dead bodies was put on the health care providers.

Gradually guidelines were issued by the various agencies from time to time to handle the infected dead bodies and to conduct the post-mortem examination of cases of COVID-19. There are guidelines issued by the World Health Organization [WHO] [1], Red Cross [2], European Centre for Disease Prevention & Control.[3] Government of India, Department of Health and Family Welfare[4] and Government of Punjab[5] and orders issued by other states.[6-8]

COVID-19 is considered a highly contagious disease and one study reported contracting this disease from the dead body as high as 27.8%.[9] Even the dead bodies were mishandled in the hospitals and graveyards due to the fear of contracting the infection. There was not sufficient place to bury and sufficient resources to cremate such dead bodies resulting in mass burials or mass cremations, visuals of which caused big stress on the minds of the communities.[10-12] This happened not just in India but even in the most developed nations like the USA where mass burial was done.[13,14] There was a shortage of space even in the morgues in the USA[15] and other parts of the world.[16]

Guidelines are usually issued by the governments and different organizations depending upon the current scientific knowledge at that particular time. These guidelines are modified too with the advent of new knowledge. These guidelines will help all those who are going to deal with the dead bodies having a suspicion or confirmation of having infection of SARS-CoV-2. The persons who will be benefitted from these guidelines are health workers, those involved with transportation and storage of the dead bodies, police officials, religious people and those involved with the final disposal of the dead body i.e., those involved with cremation, burial or any other form of final disposal of the dead body.

The Punjab government also issued guidelines and doctors in Punjab are following these guidelines. These guidelines were issued in 2020 April. These guidelines have been developed keeping in mind that this disease is spread by the droplets. It mentions the standard precautions by the healthcare workers who are going to handle the dead body. It mentions the precautions to be taken while removing the dead body from the isolation area, transporting it to the mortuary, handing it over to relatives or police officials, transporting the dead body and cremating or burying the dead body.[5]

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In medicolegal cases, autopsies are needed to find out the cause of death in addition to fulfilling the other aims and objectives of conducting the autopsies. Management of the dead bodies especially during mass disasters in the pandemic is a big issue that can affect the psyche of the people. It needs identification of the dead bodies, proper storage and proper disposal of the dead body in a dignified manner. This pandemic should teach the governments to prepare plans for managing the dead bodies in mass disasters, especially during pandemics.[17]

Standard precautions

These include hand hygiene, use of Personal Protective Equipment [PPE], disinfecting body bags from outside, and disinfecting all linens and environmental surfaces and safely handling the sharps.[4,5]

Hand Hygiene

Hand hygiene includes avoiding unnecessary touching of surfaces, washing hands with soap and water if hands are soiled and alcohol-based hand rub.[18]

Personal Protective Equipment

Personal Protective Equipment includes aprons & gowns that should be water-resistant, masks, gloves and eyewear.[2] Personal Protective Equipment is required when there is a danger of contamination by blood or body fluids. This PPE should be discarded before leaving the room or cubicle of the patient avoiding contamination of the skin while removing the kit and hand hygiene should be taken care of after discarding the gown.[18]

Gloves

Use of gloves is recommended when there are chances of contact with blood stool, urine, mucous membrane, non-intact skin or contaminated skin and contaminated fomites. Gloves should be changed when caring for another patent or contacting skin from an infectious skin even on the same patient.[18]

Mouth, nose and eye protection

For mouth, nose and eye protection appropriate masks, face shields and goggles should be used when splashes of blood, body fluids, secretions and excretions is expected.[18]

Cough etiquette and respiratory hygiene

Cough etiquette and respiratory hygiene should be followed in this disease as droplet infection can occur. Face masks and hand hygiene should be taken care of and notices out at various places to take care of these precautions.[18] Tissues and no-touch receptacles should be provided. Mouth and nose should always be covered while coughing or sneezing. Soap should be provided at places where hand washing facilities are present and at other places, dispensers with alcohol-based hand rubs should be provided. A social distance of 3 feet should also be maintained while the epidemic is active.[18]

Linen

The linen used should be minimally agitated while handling to prevent the spread. Aerosol Contamination from the laundry should be avoided.[18]

Environmental cleaning and sanitation

Environmental cleaning and sanitation mean cleaning of all those surfaces where ever there are chances of the virus being present after the patient has been discharged or the dead body has been taken away. This includes furniture in the rooms. e.g., bed, tables, stools, IV stands and other; fittings of the bathroom, doors and handles, electrical switches and computers and their attachments, stethoscopes, cuffs of the BP apparatus, wheelchairs, Trolleys, incubators, railings, office tabletops, floors and walls. Viruses remain active for different periods on these surfaces. SOPs should be developed and followed according to the guidelines from the various agencies. Sodium Hypochlorite or Calcium Hypochlorite is commonly used. Sprays and soaked clothes are used to clean and disinfect. Floors should be cleaned last of all.[19] This will help in the reduction of the spread of the infection even at the community paces like schools.[20]

Handling of sharps

Handling of sharps should be done carefully to avoid pricks and sharps should be disposed of in the containers especially meant for these sharp objects. The protection of other health care workers is very important and should be taken care of by following the standard precautions.[18]

Training

Training of all health workers involved in the handling of the dead body is an important part of the prevention of the disease and should be given due importance to prevent the spread of the disease. All the members of the staff working in the isolation area, autopsy room, involved in the transportation of dead bodies, working in crematorium and burial process should be trained.[4]

Different precautions are advised at the different steps to handle the dead body. In some cases, post-mortem examination may be required. Post mortem examination is usually required in medicolegal cases to confirm or rule out foul play. Precautions needed, will be discussed at the different steps right from the taking out of the dead body from the isolation area in the hospital. Sometimes deaths may also occur at homes due to this disease and preventive measures will also be discussed in such scenarios too.

Post-mortem testing for CORONA-19

Doctors involved in the post-mortem examination, medical examiners and coroners can decide on the testing after considering the clinical picture of the deceased and the guidelines of the governments. A nasopharyngeal specimen

should be collected if an autopsy is not to be performed. If an autopsy is performed on the dead body, then a nasopharyngeal specimen and a specimen from the lungs should be taken.[21]

From isolation area

The body should be transferred to the mortuary as soon as possible[1]. In addition to using standard safety precautions facial precautions should be used if there is a risk of splashes. All the catheters and inline tubing should be removed and if there is a danger of fluids coming from the body orifices these should be sealed. All the wounds should be sealed too with impermeable dressings. All body orifices should be plugged. Relatives should be allowed to see the body with due precautions. They should be counselled and their sentiments should be given respect. The body should be put in a leak-proof body bag and the bag should be cleaned with 1% Sodium Hypochlorite solution.[4]

Mortuary & storage

All the employees should follow the standard precautions mentioned above. Family persons too need these precautions if they wish to see the body but they should not be allowed to touch the body or kiss the body. The body should be stored in the body bag which has been duly disinfected.[4,8] If the dead bodies are to be stored these should be stored at 4^0 C. When the body has been removed Chamber door and handles should be cleaned with Sodium Hypochlorite solution 1%. Cleaning of the mortuary at every step should be taken care of.[4]

Sometimes the family members may be in isolation or quarantine and the body may have to be stored till the family members can join the funeral.[22]

Autopsy

Evidence is poor regarding the transmission of this disease while handling the dead bodies or while doing the post-mortem examination on such dead bodies. In a study where dead bodies had a positive test for the CORONA-19, after conducting the autopsy no tests were positive on the face shields and no test was found positive after cleaning and disinfecting of autopsy table and floor. No association was observed of post-mortem interval and environmental contamination with this virus.[23]

Autopsy in such cases falls in category 3 of hazardous organisms according to the Royal College of Pathologists[24] guidelines for the autopsy has been provided by the Red Cross[2] and Royal College of pathologists.[24] Some say that autopsy should be avoided in such cases if possible[25] but according to others, this infection should not be a bar to the collection of evidence during an autopsy and investigation of the death in a proper manner taking due precautions to avoid the spread of this disease.[2] Autopsy should be done in medicolegal cases.[4] It should be done very carefully to avoid spreading infection amongst the workers in the mortuary and those conducting the post-mortem examination.[26] When the autopsy is to be performed it should be done in well-ventilated rooms. Before starting the autopsy, it should be seen that all the health workers working in the mortuary are protected by using standard safety precautions including wearing Personal Protective Equipment [PPE] Kits. The autopsy should be carried out using a minimum number of persons who should wear a mask N95 or FFP3 or FFP2.[1] Scissors used should be round ended and blades should be blunt-ended so that prick injuries do not occur. Needles should not be re-sheathed.[4] Smoking and eating in the mortuary should be avoided. Double surgical gloves and cut-proof mesh gloves should be used.[26] Shoe protection should also be used in mortuaries.[2] Sharps should be handled carefully and disposed of in the containers specially meant for sharps.[27]

If standard precautions are taken during autopsy there may not be an increased risk of infection except if the lungs are handled. Preferably one body cavity should be opened at one time.[4] All the procedures which create aerosols should be done with special care e.g., while using power saws or while washing the intestines.[1] Negative pressure should be maintained in the mortuaries.[4]

In suspicious cases during autopsy swabs from Upper Respiratory Tract [URT] and Lower Respiratory Tract [LRT] should be collected. For the URT from the nasopharynx and for the LRT from the lungs, samples should be collected for confirmation of the disease. Reverse Transcription-Polymerase chain Reaction [RT-PCR] test should be done. If other microbiological tests are needed in a particular autopsy, then separate swabs should be collected. Samples of pieces of heart, lungs, spleen and kidney in 10% formalin may be sent if details of pathological conditions of these organs are required.[21]

In suspected and confirmed cases of SARS-CoV-2 all bio-safety measures and infection control policy should be followed[21]. Persons who are collecting the specimen should follow the isolation precautions guidelines with proper training and surveillance.[18]

After the autopsied body should be disinfected with 1% sodium Hypochlorite solution and placed in a leak-proof body bag which should also be disinfected with 1% sodium Hypochlorite solution from outside. The autopsy table and instruments used should also be disinfected.[4] Body bag can be wrapped in a mortuary sheet or sheet brought by the relatives.[27]

The body can be given to the police who can hand it over to the relatives after explaining to them all the precautions and the local rules and instructions of the government should be followed. Relatives taking the dead body should be in a PPE kit.[25]

Different strategies have been advised by different guidelines but so far, no evidence has been available for an effective strategy and

there are research gaps that need to be further evaluated.[28]

Virtual autopsy in COVID-19 cases

A virtual autopsy can be of great help in dead bodies having SARS-CoV-2. The images can help in the diagnosis of the disease.[29] Virtopsy can be a measure to reduce the infection to the forensic pathologists as there will be less exposure in such cases.[30] In India a case suffering from COVID-19 disease of the virtual autopsy has been reported from Kota.[31]

Environmental cleaning

Fomites transfer of the virus is possible in this disease so the environment must be cleaned. All the instruments should be sterilized after use. All the surfaces where the body came into contact should be washed with detergent and then cleaned with 1% sodium hypochlorite solutions.[1] Beds, IV Stands, side tables, floors and railings should be disinfected with 1% sodium hypochlorite solutions.[4]

Mortuary waste should be handled as per the law of the state.[1]

Disposal of the dead body from homes

If the body is at home, gloves, face masks and face shields should be used and clothes should be washed immediately after and other clothes should be worn. Children, people over 60 and immuno-compromised people should not come near the body and others should also keep a minimum one-meter distance from the body. The number of participants at the final rites should be limited by the authorities.[1]

Repatriation of human remains

Repatriation is the process of sending human remains from one country to other at the request of the relatives or friends of the deceased. Usually, for repatriation identification, a death certificate and certificate of dead body free from infection are required and in addition to this, some countries may have their requirements like embalming of the dead body. Embalming is not done in many countries in the COVID-19 deaths. The best way is to cremate the dead body and take the ashes in the urn as this does not carry any infection due to SARS-CoV-2 but it may not be preferable in certain religions. In those countries where burial is to be done and cremation cannot be done then case to case should be discussed with the concerned governments.[32]

Transportation

Body after the autopsy in a leak-proof body bag which has been disinfected from outside poses no extra danger to the persons transporting the body if they are using standard precautions. After the body has been given for cremation or burial vehicle should be disinfected.[4]

Religious rites

Religious preachers and persons doing the last rites should be trained to take standard precautions.[4] In persons who have died due to suspected or confirmed CORONA-19, disposal of their dead bodies can be done by burial according to their religious beliefs.[1] Face of the deceased can be shown to the relatives by unzipping the body bag.[4]

Cremation

Cremation is a preferred method of disposal of the dead body as it eliminates the chances of the spread of the disease. It can be done in an electric or gas crematorium or routine manner.[25] Cremation can be done according to the religious beliefs of the dead person. A religious ritual such as chanting of prayers and a sprinkling of water over the body with no touch to the body can be done. Ashes can also be collected and disposed of from the last rites[6] and it does not pose additional risks.[4] Number of participants at the cremation ground should be limited by the authorities.[1,4] After the cremation hand hygiene is very important for the workers involved with cremation.[4]

Burial

Relatives and friends may see the body after it has been prepared for burial but no one should touch or kiss the body at this moment. Those who are going to lower the body in graves should wear gloves and masks and should wash their hands with soap after removing the gloves after finishing the job.[1] Burial should be done in airtight, thick coffins. Depth should be normal 4-6 feet deep. Preferably the area adjacent to the grave and over the grave should be cemented immediately.[25] After the burial is overhand hygiene is very important for the workers involved with burial.[4] Number of participants at the cremation ground should be limited by the authorities.[14]

Other forms of final disposal

In addition to cremation and burial bodies are also disposed of by donating to the medical institutions for training and research purposes where students do the dissection. Medical institutions have stopped taking bodies with suspected and proved infection with this virus.[33] Bodies are also disposed of by sea and sky burial. It is also done by immurement, dissolution and composting. Sometimes bodies are mummified before disposal.[34] Standard precautions should also be taken in these forms of disposal. Such forms of disposal have not been studied properly in COVID-19 cases. Bodies are sometimes also disposed of criminally just by throwing in flowing water and forests and no one is going to take precautions in such cases and it will be hazardous to the population.

Water burial in the holy Ganges River is also a method for the final rites. Dead Bodies on a temporary platform are floated on the running water. Usually, this is done by the poor who cannot afford cremation and at some places, unwed girls are also given water burial.[35] For sea burial bodies are usually buried in the sea

beyond 3 nautical miles from the shore and no such material should be used for burying which will not decompose in marine water.[36] Body can be disposed of by composting. The body is put in the big jars lining an indoor park. When the body turns into compost relatives take a pot of soil and can be used in the foundation of a flower bed.[37] The body can be liquefied by a chemical process and thrown in sewers. This is a legal procedure in Ontario and duly licensed persons can do it there in Canada. Others are turning the body into Vinyl Records, morph into beautiful trees, animals may eat the dead body, or it may be turned into a coral reef, or put the body in a burlap bag. These methods may be less harmful to the environment.[38] Bodies are also kept in the Tower of Silence after removing the clothing.[39] Bodies are also kept at hilltops for sky burial. Natural scavengers e.g., vultures will eat the body.[40] Famadihana is another ritual where people dance around the graves, open the tombs and change their clothes to speed up the process of decomposition. Others turn ashes after cremation into beautiful beads and are kept in glasses or dishes at a central place in homes. Some hang the coffins on cliffs and others entomb the body vertically in trees after hollowing them.[41]

Though no studies have come to the notice for these different forms of the disposal of the dead bodies yet standard precautions should be taken while disposing of the dead bodies. Precautions should be taken that the virus does not spread.

Embalming of the dead body

There are challenges to the embalming in the dead bodies used in medical colleges during this COVID-19 pandemic.[42] Routine embalming of the dead body is not recommended.[4] Centre for Disease Control and Prevention [CDC] says that if standard precautions are taken body can be embalmed without any undue risks. The body should not be touched and PPE will be helpful.[42]

For all those visiting mortuaries

At least wear a cloth covering the face. Wash hands with soap and water at least for 20 seconds or scrub the hands with a 70% alcohol-based hand rub. Touching the nose mouth and eyes should be avoided with unwashed hands. Maintain a social distance and follow respiratory etiquettes. Sick persons should not come and stay at home. Persons with reduced immunity and underlying conditions should avoid such places.[43]

Workers in the mortuaries

Workers in the mortuaries may be at a high risk of contracting this illness. Workers should be screened for higher temperatures. If a higher temperature is found then measures should be taken for the arrangements for testing them. Sick workers should not be allowed to do their duties. There should be flexibility for sick leaves. Identify and isolate the cases. Criteria should be developed when the recovered workers can join the duties.[43]

The ventilation system should be adjusted to allow more fresh air. Distance between the employees should be increased if possible. Increase the frequency of cleaning and disinfection.[43]

A virtual autopsy should be considered where ever possible.

Vaccination of all the workers should be the top priority. It is better that persons should be put on mortuary duty only after they are fully vaccinated. As there are chances of workers getting infected and spreading the disease there are on the priority list to get a vaccination.[44]

Material & Methods

Google search and Google scholar search for the last 2 years were searched with the keywords of COVID-19 & Dead body management. Results of the search were evaluated after reading the titles of the results and the material from the most relevant search results to the topic was included in the paper.

Discussion

CORONA-19 was declared a pandemic by the WHO on March 11, 2019.[28] Though it is a well-ascertained fact that forensic pathologists are more prone to infection by this disease and virtual autopsy can reduce this danger. It will be good in those countries where it can be afforded but in developing countries, these facilities may be very limited but will be useful where ever MRI and CT Scanning facilities are available for post-mortem examination. Routine portable X-ray machines and ultrasound machines may be helpful in certain situations.[30] Persons over the age of 60 years and those who are immune-suppressed should not interact with the body suspected of having SARS-CoV-2 infection as they are considered more prone to the disease.[1] Some states have taken the responsibility for the final rites of the deceased to prevent the spread of the disease. Family members are allowed to be present in the final rites according to their religious preferences but they are not allowed to touch, kiss or bathe the dead body but the number of people present in the final rites has been limited. Most of the states in India are following the guidelines issued by the Department of Health and Family Welfare, Government of India.[6] Dead body should be handed over to the relatives only if the test on the dead body is negative.[7]

Forensic pathologists have to play a very important role in such circumstances especially when a medicolegal autopsy is required. He is to coordinate with the different entities maybe it is the police or the relatives and friends of the deceased. He is to take care of the dead body while it is in his custody and then guide the others to mitigate the ill effects of the pandemic.

This needs planning right from the time person is dead due to this infection either in the hospital or home, proper storage of such dead bodies if required, their identification and disposal according to the religious beliefs of the people and providing adequate help and resources so that all this can be carried out in a dignified manner to avoid mental stress to the people at large and avoiding the spread of the disease by taking standard precautions and following the national and state guidelines from time to time.

Conclusion

Cases of SARS-CoV-2 are going to stay in the community and so will be dead bodies due to this disease. All forensic pathologists will have to deal with such dead bodies in the times to come. There is a big amount of misinformation and even rumours sometimes about the management of the dead body. There is a need that all those dealing with dead bodies should have evidence-based information to practice and fearlessly deal in such cases and that is possible only to be always updated on the latest scientific information concerned with the management of the dead bodies. If an autopsy is needed it can be carried out taking all the precautions. Last rites should be allowed according to the religious beliefs of the persons and both cremation and burial are allowed in the different guidelines. Precautions must be taken while doing the autopsy and last rites. Following these precautions will help in checking the spread of the diseases and giving them a dignified farewell from this world thus helping in maintaining the dignity of the dead body and preventing the spread of the disease.

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REVIEW ARTICLE

Amended MTP Act: Is it the end of medical legal dilemma?

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Abstract
Keeping in view further empowering of women by providing comprehensive abortion care to all and to expand the access to safe and legal abortion services on therapeutic, eugenic, humanitarian and social grounds, the Government of India has amended the 50 years old Medical Termination of Pregnancy Act, 1971 (Act No. 34 of 1971). Keeping in view the time-to-time directions from various courts wherein abortions were allowed beyond 20 weeks of pregnancy on various grounds, the medical professionals had judicial protection for decisions taken in good faith with proactive approach towards pregnant female, but the recent much awaited amendment of the Act has put the constitutional seal on the whole process of abortions beyond 20 to 24 weeks and related issues with an end to the medical legal dilemma for the time being.

Keywords
MTP Act; 1971; Medical board; Abortion; Arnold Chiari Type II Syndrome; Foetus; Down syndrome; Apex court.

Introduction

The Medical Termination of Pregnancy (Amendment) Act 2021 (No. 8 0f 2021) received the Indian President's assent on 25th March 2021 and came into force on 24th day of September, 2021 by Notification-New Delhi, the 15th September, 2021 of the Central Government, Ministry of Health and Family Welfare. The key amendments[1] include:

a. Upper gestational age increased from 20 to 24 weeks for certain categories of women including rape survivors, victims of incest, differently abled women, minors and other vulnerable women.
b. Opinion of one registered medical practitioner for termination of pregnancy up to 20 weeks and of two registered medical Practitioners for termination of pregnancy from 20 to 24 weeks of gestation.
c. The length of pregnancy shall not apply to the termination of pregnancy by the medical practitioner where such termination is necessitated by the diagnosis of any of the substantial foetal abnormalities diagnosed by a Medical Board.
d. Confidentiality: The name and other particulars of a woman whose pregnancy has been terminated shall not be revealed except to a person authorised by law. There is provision of punishment for contravention of this clause with imprisonment which can extend to one year or with fine or with both.
e. MTP services extended for termination of pregnancy in unmarried women under the failure of contraceptive method providing access to safe abortion based on a woman's choice irrespective of marital status.
f. Every State Government and Union Territory by notification will constitute Medical Board for the purpose of this Act. The Medical Board will have one gynaecologist, one paediatrician, one radiologist or sonologist and such other number of members as the case may be and notified.

Before this amendment, the medical termination of pregnancies was being done by the medical professionals but under judicial protections. In one case the court clearly opined that it would be difficult for the Court not to accept the recommendations made by the duly constituted Medical Board and to take a different view in the matter.[2] In fact, the courts have already emphasized that the provisions of MTP Act do not contemplate authorization or approval from the Court, in fact whenever a matter concerning medical termination of pregnancy of any ground whatsoever comes before the Court, then the Court has to invariably base its decision upon the opinion of the Medical Board.[3]

Discussion

Abortion in India is legal in certain circumstances. It can now be performed on various grounds until 24 weeks of pregnancy. Earlier, in exceptional cases, the courts have allowed termination of pregnancy after 20 to 24 weeks. There were cases of diagnosed foetal abnormalities and cases of women who were survivors of sexual abuse and had reached out to the Courts with request for termination of pregnancy beyond 20 to 24 weeks.[4] Listed below are some of the significant cases with

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requests for late term termination that have come to the Court for permission[5]: -

a. In December 2017, a 13-year-old rape survivor's father approached the Bombay High Court seeking permission for the termination of 26-week foetus. The girl was repeatedly raped by her cousin. Considering the report of the medical board which claimed that there was greater risk to the pregnant girl's life if continued. The Court held that the girl was physically incapable to deliver a child, and granted permission for termination.

b. A woman from Thane approached the Bombay High Court in December 2017, seeking permission to terminate her 22-week-old foetus that was diagnosed as suffering from various infirmities. The report of the medical committee ascertained that the child, if born, may suffer from mental retardation, while admitting that terminating the pregnancy at this stage would be risky. After the petitioner expressed her willingness to take the risk, the Court permitted her to undergo abortion.

c. After the foetus of a 24-year-old woman from Pune was diagnosed with a cardiac anomaly, she approached the Bombay High Court seeking permission to abort her 24-week foetus. The medical board asked to examine the woman advised abortion while reporting that the child, if born, may have to undergo multiple surgeries. The Court consequently, granted permission for the abortion.

d. In November 2017, a woman approached the Bombay High Court for permission to terminate her pregnancy in 26th week of gestation on grounds of skeletal and neurological abnormalities. Further to the opinion of the medical board constituted by the court, she was granted permission to terminate her pregnancy due to fetal abnormalities incompatible with life.

e. Foetuses of two women, in their 29th and 30th week of pregnancy were both diagnosed with suffering from Arnold Chiari Type II syndrome. Based on the report of JJ Hospital in Mumbai, the Supreme Court in October 2017 held that both foetuses were identical and that the continuation of pregnancy would harm both, thereby permitting the termination of pregnancy for both women.

f. In another incident in October 2017, a minor rape victim in her 23rd week of pregnancy had approached the Jharkhand High Court for permission to abort her foetus. While the medical board set up to examine the matter observed that it would be dangerous to abort at this stage, the board took it up as a challenge. The Court permitted the termination of pregnancy, and directed the government to make arrangements for the stay of the victim's parents.

g. In October 2017, a 16-year old's father had approached the Punjab and Haryana High Court to seek permission for the termination of her 26-week pregnancy that resulted from rape. The Court, following the report of the medical board that stated the abortion can be undertaken with the understanding that it involves risks, allowed the abortion and directed the board to carry out the necessary procedures.

h. The mother of a 19-year-old girl suffering from mild to moderate mental retardation had approached the High Court of Himachal Pradesh in October 2017 for permission to terminate the girl's 32-week pregnancy. The medical board constituted by the High Court observed that if the pregnancy were continued, the foetus would suffer severe cognitive and motor impairments even after surgery. The Court therefore granted permission for the termination of the pregnancy.

i. In September 2017, the mother of a 13-year-old rape survivor moved the apex court for permission to terminate her 32-week pregnancy. The Supreme Court permitted the abortion citing that it was a result of sexual abuse and the victim did not want to carry on with it, despite opposition from the Centre that argued that the pregnancy was too advanced.

j. In September 2017, a woman in her 31st week of pregnancy sought permission to terminate her pregnancy as both kidneys of the foetus were found to be not functioning. Noting that the continuation of pregnancy will cause more mental anguish to her, the Supreme Court granted her permission.

k. In August 2017, a 20-year-old woman from Pune approached the Supreme Court, seeking permission to abort her 24-week foetus that was diagnosed as having no skull. After the medical board reported that there was no treatment possible for the condition, the Supreme Court granted permission for the termination of the pregnancy.

l. In July 2017, the 24-week foetus of a 21-year-old woman from Mumbai was diagnosed with mental abnormalities. Following this, renowned gynaecologist Dr. Nikhil Datar helped the husband of the woman file a petition in the Supreme Court, to allow her to undergo an abortion. The Supreme Court granted the permission.

m. In June 2017, a Kolkata-based woman filed a petition in the Supreme Court, challenging Section 3 of the MTP Act which denies permission to abort the foetus beyond 20 weeks of pregnancy. The woman discovered that her foetus had congenital defect when she was 23 weeks pregnant, and had crossed the 20-week benchmark within which it is legal to terminate a pregnancy. The Supreme

Court in response, appointed a medical board of seven senior doctors in Kolkata, directed it to examine her. The apex court had at that time called for a need to amend the MTP Act, to make it more "meaningful".

n. In May 2017, an HIV-positive destitute rape victim approached the Patna High Court with a plea to terminate her pregnancy. After the High Court turned down the plea, saying that "it was a compelling responsibility of the state to keep the child alive", the Supreme Court was approached. The apex court then granted permission to abort the now 26-week-old foetus, directing an AIIMS medical board to examine her. It stated that "a woman, who has already become a destitute, being sexually assaulted and suffering from a serious ailment, should not go through further suffering. The quintessential purpose of life is the dignity of life and all efforts are to be made to sustain it.

o. In February 2017, a 37-year-old woman in her 27th week of pregnancy approached the Supreme Court for permission to abort her foetus that was found to be suffering from Down Syndrome. After the medical board appointed by the Court advised against an abortion, the apex court denied her permission to terminate the pregnancy, citing that the baby could be "born alive" if the pregnancy was allowed to continue, while admitting that it was "very sad for a mother to bring up a mentally retarded child". The foetus was detected with a rare abnormality called the Arnold-Chiari malformation, where the brain and spinal cord connect.

p. In January 2017, a 22-year-old woman sought permission from the Supreme Court to abort her 24-week foetus on medical grounds. Further to the medical board's report which revealed that the foetus was without scalp with bleak chances of survival, posing a threat to the life of the woman, the apex court granted her permission to undergo abortion.

q. In July 2016, a 26-year-old rape victim approached the Supreme Court seeking permission to terminate her 24-week pregnancy, as the foetus was detected with Anencephaly, a condition whereby most part of the brain, scull and scalp is missing. The medical board, after having examined her on the directions of the Supreme Court, declared that the woman's life was in danger. The apex court then granted her permission to abort the foetus.

r. In February 2016, an 18-year-old rape victim sought permission from the Gujarat High Court to abort her 24-week foetus after having unsuccessfully attempted suicide by consuming acid. The panel of doctors submitted their report, following which, the High Court granted permission, citing that the continuation of the pregnancy "may result in a grave injury to her mental health."

In all these cases, the Apex court as well as various other courts, have already allowed termination of pregnancy beyond 20 weeks and even up to 32 weeks under various grounds under the MTP Act i.e., without consideration of the length of pregnancy but acting in accordance with the recommendations of the medical boards.

However, the provisions of MTP Act do not contemplate authorization or approval from the Courts in such cases. In fact, whenever a matter concerning medical termination of pregnancy of any ground whatsoever comes before the Court, it has to invariably base its decision upon the opinion of the Medical Board and under the amended Act, the states have been authorized to constitute Medical Board to decide and recommend medical termination of pregnancies under the amended Act and victims should not be advised or directed to seek judicial protections and directions for termination of such pregnancies.

The Courts were always proactive in such matters and plea of the affected women used to be taken on priority for an appropriate action immediately. The Medical Boards had complete judicial protection in the light of above noted court decisions to go ahead with termination of pregnancy beyond 20 weeks of gestation on the grounds under the MTP Act taken in good faith without referring the cases to courts that will not only delay the termination procedure but also aggravates the mental trauma of the pregnant female and the family by way of further embarrassment and monetary losses and at the same waste of the precious time of the courts which are already overburdened. There should not be any ambiguity on the Medical Board recommendations for termination of such pregnancies under the Act.

The Punjab and Haryana High Court in Civil Writ Petition No. 6733 of 2016 had also directed that the Central Government is advised to consider making amendments to the Medical Termination of Pregnancy Act, 1971 and clarify in so many words to the doctors that they will not be unnecessarily prosecuted if they act in accordance with the rules in good faith to save the life of a victim of rape or to prevent grave injury to her physical and mental health.[6]

Experts opine the amendment in the Act as a historic move to provide universal access reproductive health services and to further empower women by providing comprehensive abortion care to all. It expands the access to safe and legal abortion services on therapeutic, eugenic, humanitarian and social grounds to ensure universal access to comprehensive care and will contribute towards ending preventable maternal mortality. The goal is to strengthen access to comprehensive abortion care

without compromising dignity, autonomy, confidentiality, and justice for women who need safe and quality services.[7]

Conclusion

The provisions of amended MTP Act do not contemplate authorization or approval from any court for termination of pregnancy even after 24 weeks of gestation. On the contrary, the very exercise of approaching the courts in such situations earlier used to result in unnecessary delay and wastage of time. Some abortions are necessary beyond the statutory limit in the light of circumstances under which they are sought and, therefore, it was required to streamline the system in this regard by making amendments to the Medical Termination of Pregnancy Act, 1971. The medical professionals dealing with medical termination of pregnancy cases had earlier complete judicial protection in the light of various court decisions to terminate pregnancy beyond 20 weeks of gestation and now under the amended Act on the grounds taken in good faith without referring the cases to the courts. It is imperative now that the recent changes, rules, and regulations are adequately communicated and widely disseminated to not just service providers but also other stakeholders, such as programme managers, NGOs and the community.

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REVIEW ARTICLE

Rules of consent in medical practice

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Abstract
The practice of medicine involves multiple risks during various diagnostic and therapeutic procedures. Due to which, there have been a number of malpractice suits based on lack of consent or inadequate consent from the patient for the diagnostic and therapeutic procedures. The other reason for malpractice suits has been increased awareness among the patients for their rights. In fact, this aspect of medical practice has been the subject matter of judicial scrutiny in majority of the cases of medical malpractice as it involves the right of a patient on one hand and the duty of a doctor to take adequate care of his patients. This is specifically important as the burden of proving legal (valid) consent lies on the doctor. It is, therefore, of great significance that proper and correct consent should be obtained by a medical practitioner before performing any diagnostic or therapeutic procedures. Consent is not an event of merely obtaining signatures on paper before patient submits to particular treatment, but it is a process of communication. It should be remembered that an informed consent is a patient's right and a medical practitioner's duty. Various legal aspects of consent with reference to practice of medicine in the Indian context will be discussed in the present paper.

Keywords
Consent; Expressed consent; Implied consent; Therapeutic privilege; Emergency doctrine

Introduction

The term 'consent' is derived from two words: 'Co' which means joint and 'assent' which means sanction or approval. The dictionary meaning of the term 'consent' is agreement; voluntary allowance or acceptance of something done or proposed; permission; approval.[1] Consent, therefore, may be defined as willingness, agreement, permission or acceptance given voluntarily without any compulsion. The concept is primitive one and is based upon the Roman maxim **"volenti non-fit injuria"**, i.e., he who consents can't complain of it.[2]

According to Section 13 of the Indian Contract Act, two or more persons are said to consent when they agree upon the same thing in the same sense. Patient must understand what it is given for and what are the risks involved.[3] Consent is an agreement enforceable by law. The parties to the contract must have the same understanding in regards to the subject matter of the contract.

In a free democratic society like ours, every individual has got the right whether or not to accept the services of any one including a doctor. In other words, the examination, diagnosis or treatment cannot be forced upon who does not wish to receive. The patient is the owner of his own body and the doctor has got no right to trespass upon patient's personal privacy and dignity without his/her consent. Treatment and diagnosis cannot be forced upon anyone who does not wish to receive them except in statutory sanction. If a medical practitioner attempts to treat a person without valid consent, he/she can be liable under both-tort (civil wrong) as well as criminal law.[4] The charge of assault and negligence can be brought against him.

Therefore, the reasons for obtaining consent are two: -

(A) To avoid allegation of assault.

(B) To avoid allegation of negligence.

Consent is of two types:

1. Implied consent.
2. Expressed consent.

Implied consent is understood, taken for granted or inferred from patient's conduct/behavior. It is the most common type of consent in both general & hospital practice e.g., a patient coming to the O.P.D. or a patient holding out his arm for an injection. The patient does not spell out his consent in words. The consent is understood to have been given. It is applicable in cases of history taking and routine physical examination like inspection, palpation, auscultation and taking pulse rate, BP etc.; and where the procedure of diagnosis and treatment is simple and straight forward and without any risk or complications. However, if there is the slightest risk or complications, the practitioner should apprise the patient and obtain expressed consent to safeguard his own interest.

There are some medical procedures in which implied consent is readily apparent e.g., in case of emergency, a comatose patient, a mentally incompetent patient when a legal guardian is unavailable, intoxicated patient lacking capacity to reasoning

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and any patient allowing treatment to proceed without objection.

Expressed consent is specifically stated by the patient which may be -

a) Verbal: when stated orally.

b) Written: when given in writing.

The terms of expressed consent are stated in distinct and explicit language. Written consent is better as it obviously has evidentiary value. Oral expressed consent has no legal value as it can't be proved when the patient turns hostile.

In Samira Kohli vs. Dr. Prabha Manchanda & Ors. I (2008) CPJ 56 (SC)[5, 6], a 44-years old unmarried woman complaining of menstrual bleeding for 9 days, underwent an ultrasound test and was advised laparoscopy test under general anesthesia for making an affirmative diagnosis. There was no mention of hysterectomy in consent. The patient, while under general anesthesia, was subjected to a laparoscopic examination and simultaneously with the consent of the mother waiting outside the operation theater, abdominal hysterectomy (removal of uterus) and bilateral salpingo-oophorectomy (removal of ovaries and fallopian tubes) were conducted.

The patient alleged that hysterectomy was done without her consent. No preoperative information about alternative modalities were given. The apex court held that consent given for diagnostic and operative laparoscopy and "laparotomy if needed" does not amount to consent for a total hysterectomy with bilateral salpingo-opherectomy. The appellant was neither a minor nor mentally challenged or incapacitated. As the patient was a competent adult (44 years old), there was no question of someone else giving consent on her behalf. Patient was temporarily unconscious under anesthesia & there was no emergency. Respondent should have waited until appellant regained consciousness and gave proper consent. Consent given by her mother is not a valid or real consent.

Question was not about correctness of decision to remove reproductive organs but failure to obtain consent for removal of reproductive organs without taking patient's consent amounts to an unauthorized invasion & interference with her body. Respondent was denied entire fee charged for the surgery and was directed to pay Rs. 25000/- as compensation for unauthorized surgery.

In a case of Mr. C. Jaypal Reddy Vs Dr. Yashoda Group of hospitals, Dr Padmini Valluri & Ors. Hon'ble Justice J. M. Malik in NCDR has categorically said that “Consent is not a mere piece of paper on which patient and his relative should sign but consent should be considered as a document of proof of communication and counselling done to the patient and his relative.[7]”

Rules of consent

1. In every medical examination, the consent of concerned person is essential and such person may be a legal guardian in case of an insane and children under 12 years of age (Proxy consent). While examining a female patient, female nurse / female receptionist / female attendant / relative of the patient should be present to obviate any allegation of assault.
2. Any procedure beyond routine physical examination such as vaginal / rectal examination requires expressed consent which should preferably be written. For more complicated diagnostic procedures like endoscopy or for surgical procedure, written consent is essential.
3. Doctrine of informed consent (Rule of full disclosure)

   Since every adult human being has the right to decide as to what is best for his own body, a doctor prescribing a particular diagnostic or therapeutic procedure must necessarily disclose all the risks associated with the procedure to the patient so as to enable him to decide whether to undergo the same or not. This is a constitutional right, protected by the law. Also, the consent so obtained should be real and valid, which means that the patient should have the capacity and competence to consent.

   It is better to obtain the consent in the presence of a disinterested third person like nurse, pharmacist or any other employee of the hospital. Before obtaining the consent, the followings should be explained to the patient in the simple language that he/she can understand all relevant information about his illness, the diagnostic procedures to be undertaken or investigations required, the nature of treatment or operation proposed, significant risks associated with every medical procedure being contemplated, information about all feasible alternative treatment options, also inform him/her that he/she has the right to refuse, and the prognosis.

The relative chances of success or failure of the treatment should also be explained to the patient. In general, the patient should be told everything about his illness.

Failure to take informed consent can expose a doctor to legal action if anything goes wrong during a particular procedure. However, in some cases a doctor is permitted to withhold some information (the risks) if he is convinced that disclosure of the same can be counterproductive to the patient's own health or that it can cause psychological harm. This is referred to as 'therapeutic privilege'. So, in such situations, 'therapeutic privilege” is an exception to the “rule of full disclosure”. Even if informed consent has been obtained in a given case, it can be deemed invalid if the doctor exceeds his brief, for instance,

carry out a different procedure from what was originally contemplated, or extending the scope of operation beyond what was told to and consented by the patient. However, the courts have invariably recognized the possibility that complete diagnosis of an internal ailment may not be certain until the incision has been made and the organ is laid bare. So, when a surgeon is confronted with an unanticipated condition for which immediate action is required, he is justified in extending the operation & doing whatever is necessary to save life of the patient (Extension doctrine).

For example: During the course of a caesarian section for placenta previa, there was uncontrollable bleeding and an emergency hysterectomy had to be performed without the consent of the patient. The court did not hold the doctor liable for negligence (MGK Vs Dr. A.O, Kerala State Consumer Redressal Commission, 1990). During the course of an appendectomy, the surgeon noticed that the uterus was diseased and performed a hysterectomy. The court refused to apply the "extension doctrine" on the grounds that there did not exist a medical emergency for the hysterectomy. (R Vs LMCC, 1994) Therefore, a broad consent to whatever is necessary (blanket consent) in such situations will protect the surgeon against allegation of negligence.

In every case of medico-legal examination, viz. age estimation, injuries, sexual offences, impotence, pregnancy, delivery and abortion etc. written consent is essential. In such a case, the person should be told that he/she has got every right not to submit to examination and that the result of examination may not necessarily go in his / her favour or interest. The court or police have got no power to compel a person for such examination. However, under Sec. 53(1) CrPC, a Medical Officer can examine an accused in a crime who is under arrest without his consent when the request is made by a Police Officer not below the rank of a Sub-Inspector. If the person is not willing, reasonable force can be used (Force should be applied by police). Under subsection 2 of this section when a female accused has to be examined, she should be examined only by or under the supervision of a female medical practitioner (lady doctor)[8].

4. A person above 18 years having attained majority, can give valid consent for undergoing operation during which he may suffer any harm in accordance with Sec. 87 IPC.[9] Further, there is clear cut provision in Sec. 88 IPC that a surgeon can perform risky operation likely to cause death or any harm in good faith for the benefit of the patient if the patient gives consent to suffer that harm. Thus, if a surgeon operates on a patient in good faith and for his benefit, the surgeon cannot be held responsible if the operation ends fatally. A child above twelve years can give valid consent to suffer any harm which may result from an act done in good faith and for its benefit. Thus, a child above 12 years can give valid consent for physical examination, diagnosis and treatment.
5. The legal guardian, in case of a child under 12 years of age or a person of unsound mind, can give valid consent for examination and treatment in good faith for their benefit (Sec. 89 IPC).[9]
6. In consent there are three separate but correlated elements that are voluntary-ness, capacity and knowledge. Voluntary-ness suggests willingness of patient to undergo treatment. Capacity means a degree of ability of the patient to understand the nature and consequences of treatment offered. Knowledge means that sufficient amount of information about the nature and consequence of treatment has been disclosed to patient. These three elements must be present in the consent, only then it is legally valid.
7. As per provisions in Section 90 of the Indian Penal code (IPC) consent is not valid one if given under fear of injury, under misconception of fact, by a person who cannot understand the nature and consequences of the act as in case of unsoundness of mind (insanity), intoxication, and a child under 12 years of age.

   Therefore, consent is valid only when it is free/voluntary, clear/informed/direct & personal and given with full possession of senses.

Consent must not be obtained by fraud, or by any under pressure or duress, misrepresentation of facts, compulsion and threat of physical injury or other consequences. If consent is refused, it is an absolute bar for examination.

8. Consent is not valid for committing a crime or illegal act i.e., performing criminal abortion (Sec. 91 IPC).
9. Consent obtained from a person who is drunk and under the influence of alcohol or intoxicated due to any other drug is invalid. However, in such circumstances examination of the case may be done and findings may be revealed only after obtaining the consent at a later period when the person becomes sober.
10. In unavoidable circumstances, when it is not possible to obtain consent (like emergency, unconsciousness, non-availability of a relative or legal guardian) treatment or operation can be done in good faith for the benefit of the patient without consent (Sec. 92 IPC). In such situations, 'the emergency doctrine' comes into operation and law presumes that consent is deemed to have been given. It protects the doctor interests giving him immunity from proceedings against him for damages, for negligence or assault (Sec. 92 IPC). So, the general rule is never, never delay life-saving treatment in order to obtain a consent[10]. In emergency situations involving children when their parents or guardians are not available, consent is taken from the

person-in-charge of the child (Loco parentis) e.g., a teacher may give consent for treating a child who becomes sick during a picnic away from his home.

11. A female can give consent for sexual intercourse at the age of 18 years. Sexual intercourse with a female under 18 years of age and with wife if she is under 15 years of age is rape even with the consent (Sec. 375 IPC). Consent must be obtained before the act & not during or after the act.
12. A patient cannot be detained in the hospital against his will or without his consent. So, patient should be discharged whenever requested, by recording such note and obtaining his signature in the admission file. Similarly, if the patient has left against medical advice, an entry to that effect should be made in the file.
13. Consent is not a defense in criminal negligence.
14. In pathological autopsies, the consent of legal in charge of the dead body i.e., the kith & kin of the dead person are essential. Therefore, pathological autopsy should not be carried out without the consent of next of kin of the deceased whereas in medical-legal autopsies no consent is required since these are done on statutory authorization. The enactment enables the autopsy-surgeon to remove the organs for further examination or analysis.
15. Nature of the illness should not be disclosed to the third party without the consent of the patient (except in the circumstances of statutory disclosure or privileged communications), even though the third party may be the employer, husband, parents or other relations etc. of the patient.
16. Marriage and conjugal obligations: The marriage contract provides bilateral conjugal obligations for sexual relationship in the form of reproduction (begetting children) and fidelity for sexual relationship. Therefore, in procedures affecting the sexual and reproductive organs of a married partner, it is desirable to obtain informed consent from the husband and wife as in sterilization operations (vasectomy in male; tubectomy in female), termination of pregnancy and artificial insemination etc. For artificial insemination written informed consent should be obtained from both partners of donor and recipient. Failure in this situation may result in doctor being sued for damages for negligence. However, the consent of the spouse is not necessary for an operation or treatment of other. A husband has no right to refuse consent to any operation including a gynaecological operation which is required to safeguard the health of his wife; the consent of wife is enough provided she is capable of giving a valid consent. In case of a married woman pregnancy can never be terminated at the request of her husband. But, if the woman is consenting, consent of the husband is not mandatory.
17. Consent of the spouse is also essential if an operation involves danger to life, impairment of sexual function or destruction of an unborn child.
18. For artificial insemination consent of the donor and his wife is essential. The woman to be inseminated and her husband must give consent in writing that an unknown donor's semen should be used otherwise anyone of the parties may sue the doctor for damages and negligence.
19. If a prisoner refuses treatment and he is likely to spread the disease he can be treated forcibly without his consent in the interest of other inmates of jail.
20. For treating an inmate of the hostel, his consent is necessary if he is above 12 years. For inmates under 12 years of age, the supervisor or warden of the hostel can give consent. If an inmate above 12-year refuses treatment and he is likely to spread the disease, he can be asked to leave the hostel. However, if he stays in hostel, he can be treated without his consent.
21. When a procedure is made compulsory under the law, consent is not required for it e.g., immunization against certain diseases.
22. Drunkenness: Here the person should not be examined and blood, urine or breath should not be collected without his consent. If the person becomes unconscious and is incapable of giving consent examination and treatment is carried out. The consent of the guardian or relatives, if available, should be taken. The findings should not be divulged to the police until after the subject regains consciousness and gives consent.
23. Intoxicated person: When a person is deeply intoxicated and cannot comprehend the informed consent it is advisable to wait till, he becomes sober and gives consent for divulging the findings to the authorities.
24. In organ-transplantation:
    a) In living cases – the consent of the donor as well as the recipient is essential. The donor must be informed of the procedure involved and possible risks. The donation should not be accepted, if there is any risk of life of donor.
    b) From dead-bodies – the consent (permission) must be obtained from the person in possession of the body (legal in-charge of the dead body) is essential before removal of tissues even if consent was given by the deceased before death (during life). However, even the consent made by the deceased, when he was alive becomes null and void after his / her death and to remove organs from dead body; consent must be obtained from the legal possessors of the dead body. No law of the land can procure any tissue/ organ from

the dead body if the possessor of the dead body refuses to give his consent to donate the tissues/ organs. Precautions should be taken to preserve the anonymity of both the donor and the recipient.

25. Consent and role of doctor in forced feeding: The Declaration of Malta of World Medical Association on Hunger Strikers state that the ultimate decision on intervention or non-intervention should be eft with the individual doctor without the intervention of third parties whose primary interest is not the patient's welfare. However, the doctor should clearly state to the patient whether or not he is able to accept the patient's decision to refuse treatment or, in case of coma, artificial feeding, thereby risking death.[11]

Informed consent has now become a must in various diagnostic, therapeutic, anaesthetic, surgical and operative procedures. In the present era of advancement of science and technology, increased awareness of the people regarding their rights, enactment of the Consumer Protection Act and Human Right Commission informed consent has acquired a vital role in Medical Practice to safeguard the interest of the members of the medical fraternity.

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REVIEW ARTICLE

Value of Medical Evidence in alleged Medical Negligence Case: Recent Views of Supreme Court of India

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Abstract
Hon'ble Supreme Court of India in a case titled: J.V.K Rao vs. Nikhil Super Speciality Hospital & Anr., 2010, observed that expert evidence is not required in all medical negligence cases - Expert evidence is necessary when Consumer Fora comes to the conclusion that case is complicated or such that it cannot be resolved without assistance of expert opinion – Fora cannot follow mechanical or strait jacket approach - Each case has to be judged on its own facts. SC further observed that fact and circumstances of the particular case will decide on the discretion of the Consumer Fora for the need to ask for or allow expert evidence. Lack of clarity on this important issue results in delay in disposal of medical negligence cases. This paper deals with study of important cases decided by the Hon'ble Supreme Court of India on the issue of need for expert evidence in deciding medical negligence cases. This will help all stakeholders to understand the importance of expert medical evidence in complicated and highly technical alleged negligence cases coming for adjudication before various consumer courts of India. Early disposal of cases of medical negligence cases is the need of the hour.

Keywords
Expert opinion; Medical evidence; Mechanical approach; Strait jacket approach; Medical opinion; Medical negligence; Consumer court; Supreme court

Introduction

In a recent case decided on 07.09.2021 by Hon'ble SC observed that having noted the decisions relied upon by the parties, it is clear that in every case where the treatment is not successful or the patient dies during surgery, it cannot be automatically assumed that the medical professional was negligent. To indicate negligence there should be material available on record or else appropriate medical evidence should be tendered.[1]

SC further observed that every death of a patient cannot on the face of it be considered as death due to medical negligence unless there is material on record to suggest to that effect. It is necessary that the hospital and the doctors are required to exercise sufficient care in treating the patient in all circumstance. However, in unfortunate cases though death may occur and if it is alleged to be due to medical negligence and a claim in that regard is made, it is necessary that sufficient material or medical evidence should be available before the adjudicating authority to arrive at a conclusion.[1]

Following questions need discussion:

1. Whether the acts or omissions of the medical practitioners or the hospital constitute negligence?
2. Why there is need for Expert Medical Evidence?
3. Whether a case is highly technical medical issues involved in deciding the case and it cannot be resolved without assistance of expert opinion?
4. Who will decide that there is need for Expert Medical Evidence?
5. What is the Duty of Expert in a Medical Negligence Case as an Expert Witness?
6. What should be the procedure for Expert Medical Evidence?
7. Can medical literature be accepted as Medical Evidence?
8. Is it necessary to have Medical Evidence in all cases of medical negligence?
9. Is there need for Medical Evidence in a case in which doctrine of Res Ipsa Loquitur made applicable?
10. Can there be a mechanical or strait jacket approach that each and every case of medical negligence must be referred to experts for evidence?

Discussion

In most of the cases the question whether a medical practitioner or the hospital is negligent or not is a mixed question of fact and law and the Fora is not bound in every case to accept the opinion of the expert witness. Court further added that although, in many cases the opinion of the expert witness may assist the Fora to decide the controversy one way or the other. [Para 54] [2]

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Division bench of the SC observed that this Court however makes it clear that before the Consumer Fora if any of the parties wants to adduce expert evidence, the members of the Fora by applying their mind to the facts and circumstances of the case and the materials on record can allow the parties to adduce such evidence if it is appropriate to do so in the facts of the case. The discretion in this matter is left to the members of Fora especially when retired judges of Supreme Court and High Court are appointed to head National Commission and the State Commission respectively. Therefore, these questions are to be judged on the facts of each case and there cannot be a mechanical or strait jacket approach that each and every case must be referred to experts for evidence.[2]

Duty of expert in medical negligence case

SC bench further clarified that when the Fora finds that expert evidence is required, the Fora must keep in mind that an expert witness in a given case normally discharges two functions- the first duty of the expert is to explain the technical issues as clearly as possible so that it can be understood by a common man, the other function is to assist the Fora in deciding whether the acts or omissions of the medical practitioners or the hospital constitute negligence. In doing so, the expert can throw considerable light on the current state of knowledge in medical science at the time when the patient was treated.[2]

Case Law: J. V. Kishan Rao vs. Nikhil Super Speciality Hospital & Anr., 2010[2]

A division Bench of SC held

Expert evidence is not required in all medical negligence cases - Expert evidence is necessary when Fora comes to the conclusion that case is complicated or such that it cannot be resolved without assistance of expert opinion – Fora cannot follow mechanical or strait jacket approach Each case has to be judged on its own facts.[1]

Case Law: Martin D'souza

In view of the discussions aforesaid, this Court [SC] is constrained to take the view that the general direction given in paragraph 106 in D'souza[3]. cannot be treated as a binding precedent and those directions must be confined to the particular facts of that case. [Para 49] With great respect to the Bench which decided D'souza.[3] This Court [SC] is of the opinion that the directions in D'souza[3] are contrary to:

a. The law laid down in **paragraph 37** of Indian Medical Association[5], and **paragraph 19** in Dr. J. J. Merchant[6]. from this deposition and affidavits, it cannot be said that the appellant was negligent. In fact, most of the doctors who have deposed or given their affidavits before the Commission have stated that the appellant was not negligent. [Paragraph 106].[6]
b. Those directions in **paragraph 106** of D'souza[5] equate **medical negligence in criminal trial** and **negligence fastening civil liability** whereas the earlier larger Bench in Mathew [7] elaborately differentiated between the two concepts:
   - Those directions in D'souza[3]. are contrary to the said Act [COPRA, 1986] which is the governing statute,
   - Those directions are also contrary to the avowed purpose of the Act, which is to provide a speedy and efficacious remedy to the consumer. If those general directions are followed then in many cases the remedy under the said Act will become illusory,
c. Those directions run contrary to principle of **'Res ipsa loquitur'** which has matured into a **rule of law** in some cases of medical negligence where negligence is evident and obvious.[2] [Para 50]

Fact and circumstances of the case will decide on the discretion of the Consumer Fora for the need to ask for or allow expert evidence.[2]

Issue of principles of natural justice and expert opinion:

It is important to note that the appellant had brought to the notice of National Commission, the lack of care shown by the Assistant Registrar, who had failed to forward the records of the treatment to the expert, by filing an application before the Commission dated 17.9.2001. This application was rejected by the Commission holding that the reconsideration of the expert opinion at this stage is not necessary.

In our [SC] view, the principles of Natural Justice require that a fair opportunity should be given to the complainant to prove his claim based on the report of the expert. Since that opportunity is denied to the appellant, the impugned order passed by National Commission cannot be sustained. [Para 26][4]

The Registrar of the Commission was directed to forward all the records of the treatment filed by the appellant before the Commission to Doctor, Neurologist, who was working at Fortis Hospital, Noida, for his expert opinion within one month from the date of receipt of the order, with a request to give his expert opinion on the basis of the records of the treatment and affidavits filed by both the parties within two months from the date the records are made available to him. After receipt of the expert opinion, the Commission is requested to pass fresh order in accordance with law. [Para 27][4]

Conclusions

Division Bench of the SC observed that this Court [SC] however makes it clear that before the Consumer Fora if any of the parties wants to adduce expert evidence, the members of the Fora by applying their mind to the facts and circumstances of the case and the materials on record can allow the parties to

adduce such evidence if it is appropriate to do so in the facts of the case. The discretion in this matter is left to the members of Fora especially when retired judges of Supreme Court and High Court are appointed to head National Commission and the State Commission respectively. Therefore, these questions are to be judged on the facts of each case and there cannot be a mechanical or strait jacket approach that each and every case must be referred to experts for evidence. Division Bench of the SC concluded that for the reasons discussed above, this Court holds that it is not bound by the general direction given in paragraph 106 in D'souza.[3] This Court [SC] further holds that in the facts and circumstances of the case expert evidence is not required and District Forum rightly did not ask the appellant to adduce expert evidence.[2] In a case the SC observed that the courts and Consumer Fora are not experts in medical science, and must not substitute their own views over that of specialists. It is true that the medical profession has to an extent become commercialized and there are many doctors who depart from their Hippocratic Oath for their selfish ends of making money. However, the entire medical fraternity cannot be blamed or branded as lacking in integrity or competence just because of some bad apples. [Para 123][3] It must be remembered that sometimes despite their best efforts the treatment of a doctor fails. For instance, sometimes despite the best effort of a surgeon, the patient dies. That does not mean that the doctor or the surgeon must be held to be guilty of medical negligence, unless there is some strong evidence to suggest that he is. [Para 124][3]

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REVIEW ARTICLE

The Art and Science of Lie detection

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Abstract
Lying is the misuse of human energy. It leads to mistrust and damages the fundamental adhesion of the relation between individuals. Lie is known from prehistorical period from Yudisthir in Mahabharata till every moment of daily life. The criminal identification system based on evidences and lying-in different forms by the concerned persons is the greatest hindrance of prosecuting an offender. So, any person entrusted for law enforcing must have an idea about how to reveal the light from darkness, from lie to truth. In this article the art and sciences behind the detection of lie has been discussed from the older one polygraphy to most recent functional MRI with legal implications.

Keywords
Lie detection; Polygraph; MRI

Introduction

The following questions should come to our mind first to understand the topic- what is a lie?, why do people lie?, when are they easy or hard to "catch?" , how do people telegraph their truthfulness?, and what are the emerging technologies in lie detection?

According to the American Heritage Dictionary, a lie is a false statement deliberately presented as being true; a falsehood, something meant to deceive or give a wrong impression. Note here the emphasis on the person's intent.

Types of lie

Protective" lies: Telling children that the stork brought them because you don't think

they're old enough to talk about sex, or reassuring your relative that he/she is not really

terminally ill

White lies: Lies that do no harm, and may do good, such as complimenting your hostess' meal even if you didn't enjoy it much (social tact)

Lying by omission: Failing to reveal one's belief in order to deceive.

Bluffing: Usually considered more of a tactic than a lie, as it occurs in the well-understood context of a game.

Jest: When we use sarcasm or tell tall tales, we assume others understand we are deliberately not telling the truth.

Careful Speaking: Avoiding the telling of an outright lie with carefully chosen words; a half-answer that is accurate but does not fully answer a question.

The development of lying

The ability is universal. Children demonstrate "Theory of Mind" at about the age of 4 years. Simultaneously, they are capable of lying effectively. The ability to lie precedes a moral understanding about the importance of honesty. Consequently, children lie frequently until they learn that this results in negative consequences. Adults probably lie as frequently as children, but about different things. Laurent Keller's robots react to the environment with a computerized "genome." Bots that find food "mate" with other successful bots and send their "genome" into the next generation. Bots can turn blue lights on and off. Bots "evolved" the ability to communicate with lights. Some flashed their lights near food, while others flashed their lights near poison. Bots gave correct information to "relatives," but flashed their lights far away from food when surrounded by "strangers."

How to diagnose

Liars will look different only when the following two conditions are fully met: the person is deliberately and knowingly telling a lie, and, the person thinks lying is wrong.

People who do not believe that lying is wrong will show few, if any, detectable signs of arousal. Psychopaths, criminal or not, are incapable of empathy or guilt. Therefore, they do not perceive that harming others is a problem, and will be effective liars.

Detecting lies in people you know is far easier than detecting lies in a stranger. When dealing with strangers, use baseline questions that nobody would lie about to establish "normal" behaviour. Assuming a person is deliberately lying and

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recognizes lying as negative; you may observe some/all of the following- reduced articulation, facial and body responses that do not "match", facial and body responses that pass quickly are replaced by more "conscious" responses, reduced upper body movement, increased lower body movement, nervous smiling or laughter that is inappropriate given the topic under discussion (smiling is a submissive signal—I'm okay, don't hurt me), eye contact (works in the generic American culture, but few others), timing. Emotions are spontaneous, instantaneous reactions to our environment. Any delay in reaction should be suspicious.

Methods for lie detection

HRC Directives on lie detection

- No Lie Detector Tests should be administered except on the basis of consent of the accused. An option should be given to the accused whether he wishes to avail such test.
- If the accused volunteers for a Lie Detector Test, he should be given access to a lawyer and the physical, emotional and legal implication of such a test should be explained to him by the police and his lawyer.
- The consent should be recorded before a Judicial Magistrate.
- During the hearing before the Magistrate, the person alleged to have agreed should be duly represented by a lawyer.
- At the hearing, the person in question should also be told in clear terms that the statement that is made shall not be a 'confessional' statement to the
- Magistrate but will have the status of a statement made to the police.
- The Magistrate shall consider all factors relating to the detention including the length of detention and the nature of the interrogation.
- The actual recording of the Lie Detector Test shall be done in an independent agency (such as a hospital) and conducted in the presence of a lawyer.
- A full medical and factual narration of manner of the information received must be taken on record.

Polygraphy

It is the oldest method. Polygraph tests are reliable about 65% of the time, even when conducted by experts. Consequently, they are not admissible in court.

Polygraphs measures heart rate, respiratory rate, blood pressure, arm and leg motion, electro dermal activity.

Limitations of polygraph lie detector

The suspect may develop mental tension due to crimes committed earlier by him though there is no link with the case under reference. This tension may give false positive results. Physiological defects like blood pressure, excessive perspiration, and excessive heart beat already present in a suspect may give false results. Also, if a suspect has a mental or psychological problem the results are unreliable. The biased opinion carried out by the expert against the suspect after going through the case history may also give rise to wrong interpretation of results. Nobody can be forced to take the tests. Willingness of the suspect in writing is necessary to conduct the test. The lie detection test report per se is not admitted in the courts of law in our country. Polygraph detects emotional disturbances in a suspect rather than detecting lies. Hence it can be used along with other circumstantial evidence

Other technical efforts include Truth serum" (Narcoanalysis), Brain mapping, Brain fingerprinting, fMRI.

Narcoanalysis

More recently researches towards the development of new and effective drugs are based on the linkages between the bio-molecule responsible for a particular bio-activity and the drug. The truth serum is the solution of the drug "Thio pentathol sodium." Thio pentathol Sodium is a thiobarbiturate derivative i.e., 5- ethyl, 5- [1-methyl butyl], 2- thiobarbiturate.

The hypnotic stage is the one used for narcosis/ narco analysis. This state helps in rapid exploration and identification of underlying conflicts, unresolved feelings about the past events and information's which could not be revealed under conscious awareness. It is therefore difficult for a person to lie at this stage. The reversal from this stage occurs immediately after the administration of the drug is discontinued. There are no either side effects or deaths attributed to sodium pentothal over dose, although its use in Psychiatric practices and surgeries has been in vogue for decades. No adverse effects attributable to the drug have been noticed even during the cardiac surgeries running for several hours, which will have patients, anaesthetized either by using large concentrations of sodium pentothal (anesthetic dosages) or in conjunction with other anesthetics

Narcoanalysis has survived the legal scrutiny under Article 20(3) of the constitution of India by orders of various courts:

1. Hon'ble Supreme Court of India in Cr. Miscellaneous Petition No.3381 of 2006 Dated 10th April 2006
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5. Madras High Court in Habeas Corpus Petition [M.D.] 123 of 2004 Dated 25-06-05

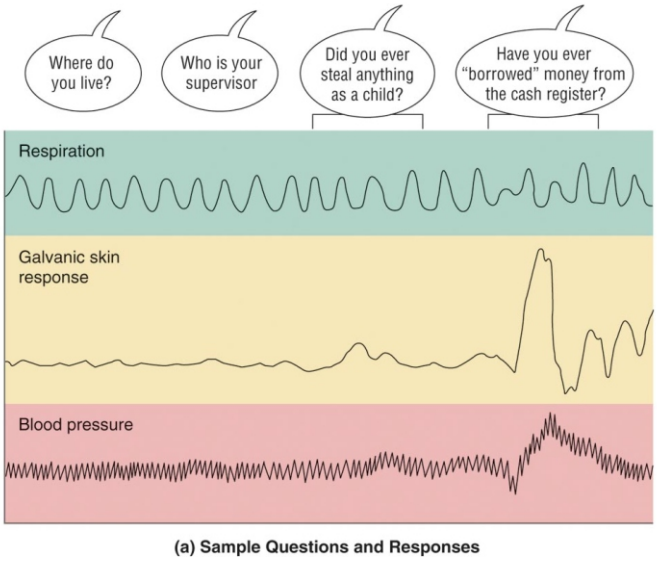

Figure 1: Polygraph

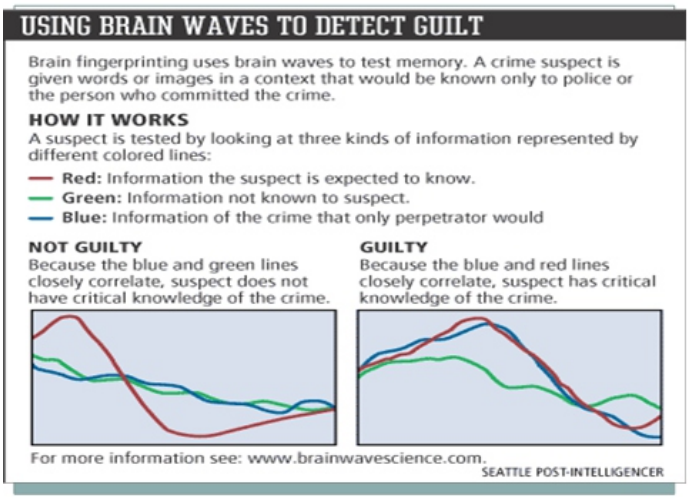

Figure 2: Brain fingerprinting

Brain mapping

Glucose activity increases in the part of brain used, and this activity is detected by a PET (Positive emission Tomography) scan.

Brain fingerprinting

Images of the crime cannot be concealed within cortices of the brain—there is no place to hide. Evidence stored in the brain will match evidence extracted at the crime scene. The pattern allows for a positive reading detected by waves occurring 300 milliseconds after a stimulus—The P3 Wave). ERP Event-related-potential is the index for how the brain process meaningful events with the distinctive P3 paradigm as events known only to a perpetrator and outside his/her control.

The fundamental difference bet. The perpetrator of a crime and an innocent person is that the perpetrator having committed the crime, has the details of the crime stored in his memory, and the innocent suspect does not. This is what Brain fingerprinting testing detects scientifically, the presence or absence of specific information.

Limitations of brain fingerprinting are same as of fingerprints and DNA typing. It involves considerable extra work and skill for investigators, significant costs in times, resources and money.

But techniques provide highly accurate information. Work is worth the effort to find more accurate & scientific means of matching evidence what does a criminal take with him from the crime scene that records his involvement in the crime. Focused on brain which is always there recording all of the events like a video camera like his DNA & fingerprints, the brain always stays with the criminal. The problem until recently was that there was no way to detect this record of the crime stored in the brain like a print. Recent advance in neuroscience made it possible to reveal these prints popularly called Brain fingerprint. Human brain central to all human acts, human brain is central to the criminal act. It was not made use in criminal investigations until Dr Farwell's discovery of 'Brain Fingerprinting "There was no scientific, objective way to match the evidence stored in the brain with evidence from the crime scene.

Dr Lawrence A Farewell developed & patented the technique which is a new computer-based technology to identify the perpetrator of a crime accurately & scientifically by measuring brain wave responses to crime relevant words or pictures presented on a computer screen. The relevant words, pictures or sounds presented to a subject by a computer in a series with irrelevant and control stimuli. The brainwave responses to these stimuli are measured using a patented headband equipped with EEG servers and data is analyzed to determine if the relevant information is present in the subject's memory. A specific measurable brain response known as P300 is emitted by the brain of the subject who has the relevant information stored in his brain but not by the subject who does not have the record in his brain. In the text the subject is fitted with a patented headband equipped with sensors and shown a series of relevant words or pictures on a computer screen.

When Brain recognizes something familiar, the brain elicits a wavelike response known as MERMER (Memory & encoding related multifaceted electroencephalographic response) MERMER in turn contains the brain response known as P300Test can be done in 10 minutes. The P300 response extensively researched for more than 30 years. Widely published in professional journalsP300 response has gained broad acceptance in scientific field of psychophysiology. Dr

Farewell research on P300 shown that the P300 was just one aspect of a larger brain-wave response that he named as MERMERDiscovery of MERMER allows the results gained through P300 testing to be substantially more accurate. Inclusion of MERMER is brainwave analysis algorithm has made Brain fingerprinting a definitive determination. More than 200 subjects already tested. Unlike polygraph the accuracy of this technique lies in the activity to pick up the electrical signal known as P300 wave before the suspect has time to affect the output Does not have anything to do with the emotions – sweating, pulse beat etc. It does not depend upon the subjective interpretation of the person conducting the test. Computer monitors the information & comes up with information present or absent

Admissibility in Court

- Not yet established
- Features of Brain fingerprinting relevant for court admissibility
- Brain fingerprinting thoroughly & scientifically tested
- Subjected to peer review & publication
- Rate of error extremely low and virtually nonexistent
- Clear standards governing scientific techno. Of operation of tech. Have been est. & pub.
- Theory & practice of BF gained general acceptance in relevant scientific community.
- Experts conducted to create a two-category series

  a) knowledgeable

  b) Not knowledgeable and

Another expert with three category series

  a) Knowledgeable

  b) With the same stimuli who was knowledgeable

  c) Not knowledgeable

- For a subject who was not knowledgeable, one category of targets was noteworthy. Likewise for knowledgeable subjects, two categories of targets (targets & probes) were noteworthy. The target provides a template for a response to the stimuli known to be noteworthy, MERMER producing stimuli. The irrelevance provided a temp. for a response stimulus that are not noteworthy (non-MERMER producing stimuli Determination of information present or absent in the brain consisted of comparing the probe response to

  (a) The target response which contain MERMER

  (b) The irrelevant response not containing MERMER

- Probe responses similar to target responses containing MERMER indicated that the subject recognizes the probe and therefore determine that the information was present (The subject was knowledgeable)
- Brain responses to the probe which were similar to those of irrelevant (lacking a MERMER) indicated that did not recognize the probe that determines the information absent. (Subject was not knowledgeable) Knowledgeable and not knowledgeable refer to the true state of the subject. Information present and information absent refer to the determinants by the Farwell MERMER system (information present and information refer are also referred responses as match and no match indicating where there is a match between information from the crime scene and information stored in the brain.) In the experiment the determinants match the true subject state in every case Brain MERMER testing was therefore 100% accurate.

Functional MRI

Brain activity during the processing of real memories and imagined events is identical. fMRI requires cooperation (no moving), cannot detect lies by omission, can detect if a person is thinking about a place versus a face, can detect extra brain activity required for lying. It is used for studying the temporal relationship of individual voxel. The end result is a 4D image and the shorter the time of acquiring each 3D image (repetition time), the better the temporal resolution.

Structural MRI (MRI)

It is used for studying the spatial relationship of voxels. The end result is a 3D image, the time dimension is collapsed to create a clearer 3D image. Generally, the longer the acquisition, the clearer the image.

These are different scientific methods for detection of lie.

Conclusion

Though there are many ethical questions about lie detection as sometimes called as “Rape of Mind” but its importance is immense in solving the crime. Though it is not accepted as evidence but corroborative evidence but it has been applied in lots of important cases and definitely, we have some fruitful positive results. More betterments are in the pipeline with the advancement of science.

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REVIEW ARTICLE

Digital Autopsy (Virtopsy) in India: Steps taken and journey ahead

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Abstract

Medicolegal/forensic autopsy is recognized as the gold standard for determining the cause and manner of death etc. The traditional/conventional medicolegal autopsy techniques worldwide comprise of opening of all body cavities and taking the visceral organs for detailed dissection. These methods are highly subjective and sometimes unable to fully elucidate the real picture as well as against the beliefs of most of the religious groups and emotions of the relatives of the deceased who often resist conduction of autopsy more so in Indian scenario. The development of Digital X-ray, Post-mortem computed tomography, MRI and other medical imaging technologies provide a non-invasive/minimally invasive autopsy approach for the forensic examination popularly referred as Virtual Autopsy/Virtopsy. However, to be scientifically correct I would prefer to use the term "Digital autopsy" i.e. conducting autopsy with digital means. This procedure is investigator-independent, highly objective and being non-invasive, takes care of the religious issues. It may even be used to screen the dead bodies before cremation because digitally stored data can be used at any time later to provide patho-anatomic details and thus contributes to the concept of humanitarian forensics.

This write up is an attempt to showcase how we were able to place forensic radiology/digital autopsy services by taking tiny steps, overcoming various challenges faced, researches undertaken to understand its utility during this more than a decade long journey. Further it will delve deeper into the intricacies involved in placing these services, advantages and disadvantages of digital autopsy, legal issues involved, challenges ahead and try to address the apprehensions so that the younger generation can strive to place digital autopsy services at their respective place of work.

Keywords

Virtopsy, Digital autopsy, forensic radiology, conventional/traditional autopsy, CT scan

Introduction

Currently documentation of post-mortem findings is based on centuries old autopsy techniques and protocol which includes mostly dissection of the dead body and verbal description of the external and internal findings. Occasionally conventional 2-dimensional photographs are also taken depending upon the facilities available and as per requirement of the case [1]. Although in cases of alleged custodial deaths the National Human Rights Commission of India have laid down guidelines for conducting videography of the entire procedure in addition to conventional/traditional autopsy (TA) so that it can be reviewed afterwards for sorting out many complicated issues. These methods are highly subjective and sometimes even unable to fully elucidate the real picture although medicolegal/forensic autopsy is recognized as the gold standard for determining the cause and manner of death etc. The current practice of opening of the three major body cavities during post-mortem examination, makes the entire procedure highly invasive, destroys the entire 3-dimensional structure of the body and more often than not adds to the pain and agony of the relatives of the deceased. However, with the aid of various radiological techniques like digital X-rays, CT-scan, MRI and 3-D reconstruction techniques; post mortem pathological findings can be demonstrated easily and comprehensively to the lay person in the court room [2].

Conventionally the term 'Virtopsy' has been in vogue with the belief that autopsy is being done virtually where the human eyes are replaced by the virtual eyes of CT-scan and MRI [1,2]. It can be defined as an investigator independent, objective and non-invasive way of documentation and analysis of post-mortem findings with the help of CT, MRI and post-processing techniques like 3-D reconstruction of images, analogous to Keyhole surgery[3]. Therefore, to be scientifically correct, I would prefer to use the term "Digital autopsy (DA)" i.e. conducting autopsy with digital means since virtopsy connotes a different meaning. Systemic researches of Virtual autopsy were started in Switzerland and later spread to the other European Countries, Australia, Japan, and many other countries [4,5,6]. In a developing country like India, it is still a new concept and it is envisaged that application of digital autopsy will become increasingly prominent and recognized as the time progresses [1,7].

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There are some intrinsic difficulties and challenges in conducting a conventional/traditional autopsy that has been observed and reported from time to time. The first and foremost is its extensive invasiveness leading to substantial disfigurement of the body. This is such a big concern that many family members request for waving off the post-mortem examination of their deceased loved ones which at times is granted by the competent authorities respecting the emotions involved under legal provisions. However, there always remains a chance of misuse of this humanitarian act if no examination is done at all.

Initially there were many questions raised about its utility over the TA. So, we took 5-years study (2010-2015) with the objective to compare the findings of post-mortem computed tomography (PMCT) scan and TA in the victims of traumatic deaths and to analyse whether PMCT can be used to replace TA [8]. The conclusion of the study was that PMCT scan is promising in reporting injuries in traumatic deaths and can significantly complement the findings of TA. However, at present, it cannot be considered as a replacement for TA[8]. Although an experienced radiologist interpreted the images, the appearance of injuries after death was substantially different from that in life. Thus, it yielded a more objective judgment compared with that obtained by TA alone. [8,9]

Digital autopsy (DA) Procedure

To carry out DA, in addition to digital X-ray, a set of equipment is required, which consists of multi-section CT, MRI, 3-D optical surface scanner, heart-lung machine for post-mortem angiography, micro-CT, MR-microscopy, CT image guided biopsy system and artefact free body bag to prevent the contamination of equipments[3,4,10]. The complete set of equipments along with work station (computer for final processing of data) is called Virtobot[11].

In DA, external examination of body is done by taking the photographs of the entire body from different angles and with the help of 3-D optical surface scanner. These two-dimensional images are reprocessed to produce a coloured 3-dimensional view of the entire body[3]. Internal examination of the body which includes, examination of skeleton, soft tissue organs and blood vessels, is done with the help of multi-section CT-scan, MRI and minimally invasive angiography. Entire internal examination is done in a completely non- invasive way, without opening any of the body cavities. CT-scan gives minute details of the bony architecture of the body whereas MRI is very useful in soft tissue pathology. Post-mortem angiography can detect pathology of vascular system[6,10]. Even the minute injury to the blood vessel can be identified by angiography, in the form of leakage of dye from the injured vessel, which is impossible to detect by naked eyes alone. Samples for histological examination are obtained by the CT-image guided biopsy probes. Micro-radiological techniques, which include micro-CT and micro-MRI, produce high resolution images[5]. Finally, all the data obtained are merged and processed to produce 3-dimensional images; thus, creating a 3-dimensional visual document to illustrate post-mortem findings more efficiently.

Now here comes the issue of finances which goes to the tune of 150-200 million rupees, if one wants to have a complete solution. So, to begin with, we first pursued to place digital X-ray unit at our mortuary which took almost 3 years. But with perseverance once we overcame hiccups of the management of these at mortuary by having dedicated radiology technician and getting various clearances from Atomic Energy Research Board etc and support of other logistics by radiodiagnosis department and AIIMS administration along with Digital X-ray having flat panel detector and later lateral detectors; things started moving swiftly after 2017. In 2018, ICMR under financial grant of CARE (Centre for advanced research and excellence), provided CT scan and other logistics which took another 3 years to place these services. Now many researches are being undertaken in different areas where we are using CT scan and Digital X-ray routinely and trying to use these radiological aids more and more in our practice so that we could learn and evolve further. Of course, we have to place PM angiography, MRI and many more to have full-fledged services in due course of time.

Advantages of Digital autopsy:

DA is a non-invasive procedure akin to no incision/keyhole surgery, keeping the disfiguration of the corpse to minimum possible extent. DA takes relatively less time compared to TA as it is a rapid automated procedure with considerably less manual handling. Documentation of post-mortem findings is done in a completely objective manner, free of subjective bias which may occur in a written post-mortem report. As all the data obtained are in a digital format, so these can be stored for several years even after the cremation or burial of the body. Also data can be transmitted over internet to any part of the world for subsequent/expert/re-opinion. In DA, there is more precise and 3-dimensional portrayal of injuries such as stab wounds and firearm wounds, which is easy to understand even for a non-medical person e.g. lawyers and judges, instead of explaining to them written description of injuries and showing gory and horrific photographs of autopsy. Easy and more accurate detection of air and fluid inside the body cavities, fractures, foreign bodies, soft tissue trauma, injury to blood vessels is done in DA. There is less risk of infection due to less manual handling, so it is particularly suitable for infected and decomposed bodies. Therefore in DA there is uniform & clear recording in reporting which is Investigator/ Dr-independent. It avoids non-messy reconstruction during court proceedings

and elucidates 3-dimensional portray of injuries which has better evidentiary value and easy demonstration during court proceedings. Dead Body will be quickly returned to families in cases of Organ retrieval which is another humanitarian aspect/social forensics and will reduce the emotional trauma and stress to the aggrieved relatives. It may even be used to screen the dead bodies before cremation because digitally stored data can be used at any time later to provide patho-anatomic details and thus further contributes to the concept of humanitarian forensics.

Disadvantages of Digital autopsy:

As is very clear, DA is an extremely expensive technique. Cost of a CT-Scan machine range from 15-20 million Indian rupees and that of an MRI machine around 150 million Indian rupees. In developing countries like India where even a living person cannot afford such sophisticated technology, why would government invest such a huge amount of money to put a dead man under expensive scanner, is the usual argument put by various authorities. However, considering the current scenario with dignified management of dead, gradually the mindset of authorities are also changing. In DA one cannot detect colour of organs & colour changes, which give important information about status of inflammation and age of injuries etc. It can neither differentiate between antemortem & postmortem injuries nor it can detect post-mortem artifacts. The biggest question mark regarding this technology is its acceptability in the court of law, particularly in country like India where judicial changes occur very slowly. But times are changing fast and specially Covid pandemic had provided us the opportunity to use these for benefit of civil society to great extent. Sec. 45 of the IEA which deals with the Expert opinion related to these interpretations of any investigations including CT, MRI is admissible as report, subjected to cross- examination. Also Sec. 65-B of the IT Act relates to admissibility of electronic records as evidence in a Court of law which can easily be used to convince the honourable courts.

Although not sufficient data is available from comparative studies till date to prove its superiority over TA in all the cases. However, we had conducted 5 years study with encouraging results where it can be used in certain specific situations and now many more studies are going on and time is not far when we will have all these data for robust analysis. Few case reports where DA was found clearly superior to TA have been gathered from literature & personal communication, are being cited here for better understanding of the readers. (Figure 1-3)

Conclusion

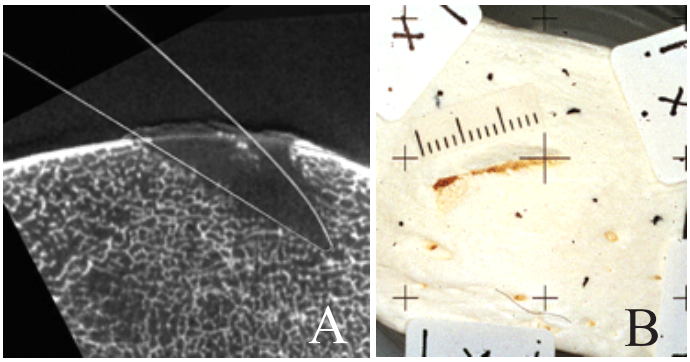

Figure 1 (a & b): Forensic micro-CT in a case of sharp-force injury. (1a) Photograph shows a bone defect that was to be investigated and compared with a knife that was suspected to have caused the injury. (1b) On a micro-CT scan obtained orthogonal to the bone lesion, the knife's dimensions are superimposed, allowing inclusion of the knife in the group of possible injury-causing instruments.

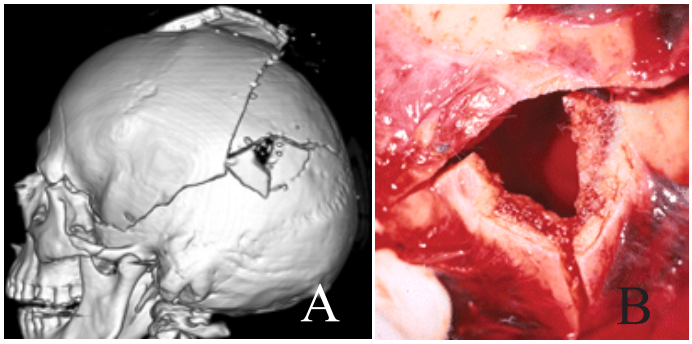

Figure 2 (a & b): (2a) Left posterior oblique 3D VR CT image shows the exit wound and a cone-shaped defect that enlarges from internal to external. The formed fracture lines can also help determine the order in which the wounds occurred. From the entrance wound, large fracture lines course along the skull, the result of increased pressure within the water-filled (incompressible) skull caused by the projectile. The short fracture lines from the exit wound stop at the previously formed entrance wound fractures (Puppe's rule). (2 b) , allowing inclusion of the knife in the group of possible injury-causing instruments.

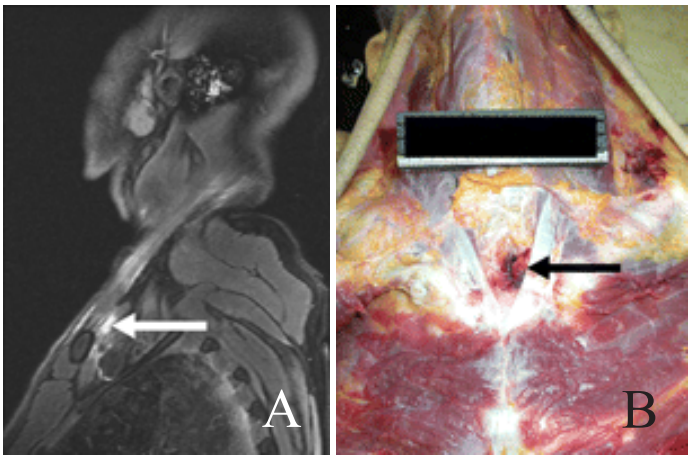

Figure 3 (a & b): Vital signs in a case of suicide by hanging. (3a) Sagittal T2-weighted MR image shows areas of hyperintensity (arrow) around the sternoclavicular insertions of the sternocleidomastoid muscle. (3b) Autopsy photograph reveals areas of bleeding (arrow) around the insertions of the sternocleidomastoid muscle, findings that indicate ongoing circulation at the onset of strangulation.

Although it's been few decades since the concept of DA originated, this technique has evolved very slowly. When compared to techniques such as DNA profiling, which has become ubiquitous, DA is confined to relatively few centres in the world & in India now we can say that beginning has been made by our centre. Although debatable, in my opinion DA has the potential to partially or under certain circumstances fully replace the TA, with the advancement of scientific knowledge and facilities available as has been learnt during the Covid pandemic. Of course, it requires persistent efforts and support of various stakeholders and concerned authorities to place these types of services under the department where there is always resource crunch as well as paucity of funds since forensic medicine department is least prioritised by health/hospital authorities. At AIIMS New Delhi, however we were fortunate enough to garner the support from all concerned so that we are now in a position to conduct DA to great extent. However, unless more and more scientific data are available from various researches and until facilities for CT-scan and MRI become widespread, DA may remain a concept confined to few centres instead of becoming a reality, particularly in our country.

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REVIEW ARTICLE

Artificial Intelligence: its role in autopsy practice

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Introduction

Artificial intelligence (AI) is the most trending technology in today's world to achieve many desired objectives and when it is combined with the Machine learning, it becomes an even more effective tool for creating intelligent systems.[1,2] In medical field also, there is use of the AI and machine learning for diagnostic purpose and for treatment, including in the field of Forensic Medicine, example virtual autopsy and virtobot etc.[3-6]

To describe AI, we can define it as the science and engineering of making intelligent machines. It was first defined by John McCarthy in 1956; though the possibility of machines to simulate human behaviour or machines which can actually think was mentioned by Alan Turing in 1950. The synonyms used are computational intelligence, synthetic intelligence or computational rationality.[7] After the development and advancement of the computer system, there is tremendous improvement in the AI which reduced the human effort manifold; today, we can solve from simple calculations to many difficult and hazardous task by use of AI enabled machines in a fraction of a second and that too in a very precise accuracy, which otherwise would have taken a longer time to perform.

On the other hand, Arthur Samuel was first to define the term "machine learning" in 1959, who was an American, pioneer in the field of computer gaming and artificial intelligence. One can define Machine learning as "Field of study that gives computers the capability to learn without being explicitly programmed."[8] Basically it is the process of training up a machine to perform in different situation by using its AI independently without requiring any separate coding for executing the objective.

In other words, the artificial intelligence of a machine is based on the command that is put in to its system, so that it can decide of its own in certain situations how to act. Basically, these are some combinations of if-else statements which guide the machine to act precisely in situations it is programmed for.

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AI in medical field

AI is being used in various diagnostic as well as therapeutic procedures and also used in predicting the outcome. Even by using the narrative-based machine learning classifier system in verbal autopsy, it is possible to come out with the automated Cause of death classification. By using the AI and machine learning, now it is possible to perform various robotic surgeries with more precision.

The primary objective of use of AI in health care sector is to analyze correlations of prevention or treatment techniques and patient outcomes. AI in health care is used not only in the diagnosis processes, there is wide use of it in the development of treatment protocol, development of new drug, personalized medicine, and patient monitoring system and patient care system. A large volume of data from the electronic health records can be used for analysis to achieve the disease prevention and diagnosis through AI algorithms. There are many medical institutions who already have developed AI algorithms for smooth functioning of various departments. Similarly, the technology giants like IBM, Google etc., are into developing AI algorithms for healthcare. Using the AI software to support operational initiatives, healthcare establishments can reduce their operational cost as well as improve patient satisfaction.[9]

AI can also be used in Telehealth sector, where, by use of different sensors in human subjects, the health status of an individual can be monitored remotely and in case of any alarming situations, healthcare system can be alerted by the machine trained for the same. Similarly, as the life expectancy is increasing now a days, such alarming system can be very effective in monitoring elderly persons for their health status where the other family members may not be available.[9]

In near future, another level of AI may be seen in the form of Brain-computer Interfaces (BCI), which is of help when having problem in movement, speaking or the cases of spinal cord injury. The BCIs with use of AI will help such persons in their movement and communication by decoding their neural activates.[9-10]

AI in forensic medicine

Like the other field of medical science, there is wide use of IA in the field of Forensic Medicine, for diagnostic purpose or analysis of the data to predict an outcome. Forensic medicine

specialists now a days, use many software capable of AI in laboratory related matters and also for diagnostic purpose. The image analyzing tools are a boost to this field, where one can get the more precise result in a very short period of time.

With development in the field of Virtual Autopsy, there is opening up of a new horizon in the field of autopsy and AI in being used in different steps of virtopsy, in the form of image analysis, taking sample by using Virtobots and many more.

Researchers are formulating means to predict / diagnose cases based on the basis of macroscopic appearance (using digital photography), the microscopic appearance (examined by microscope in digital pathology), medical imaging appearance (e.g., seen by CT, MRI, ultrasonography, etc.); and molecular phenotypes (e.g., by NMR-based metabolomics).[3]

However, in India, there are a very few working in the field of AI or other modern gadgets in the field of autopsy. Except AIIMS, New Delhi and NEIGRIHMS, Shillong, we are basically dependent upon the conventional autopsy. Autopsy is one of the most important tools to evaluate or find out the factors leading to death of a person; many a time it becomes the only piece of evidence, to asses someone's death.[11-13] The whole process of medico-legal autopsy is to find out the cause of death, mode of death, manner of death, recording and evaluation of injuries and also the time since death (TSD); many a time, the time since death carries a very important role to play in solving a death incident.

However, we are reluctant to use the modern scientific advancements in the field; still we are confined to the age-old techniques for determination of cause of death, time since death or other related issues.

In this regard, one small advancement may be mentioned here. For determination of the TSD, one mostly relies upon the different postmortem changes that occur in different parts of the body at different time period and most of the time this is a subjective evaluation and there is always scope for error as it is based on the observation by the respective observers.

At department of Forensic Medicine, NEIGRIHMS, Shillong, a project was taken up in this regard to establish the TSD by an observer independent technique where the changes in the colour temperature in the cornea after death was assessed by using the SLR camera and then recording the red, blue and green (RBG) values through a RGB software. During the study it was observed that, it is possible to determine the TSD with a mean error of 21 minutes.[14] The drawback of the study was that, for recording the RBG values, one SLR camera with constant aperture and focal length was used, with a dedicated flash for taking the picture and then is to be transferred to the RBG software to get the value, so any change in the SLR camera or the flash, the RBG values may also change. Similarly, one has to transfer the picture of the cornea to the software installed in a laptop, so it becomes a little cumbersome for the already overburdened Forensic autopsy surgeon. Moreover, in the study, the environmental variables like temperature, humidity etc. have not been taken into consideration, so there may be limitation for using the equation derived from the study for estimating the TSD only in this environment.

So, this department is in the process of developing a system which will be independent of these factors and also more precise. A multicentric collaboration may be helpful in this regard.

Conclusions

There is ever increasing use of AI in the health care system like the other fields. However, though the AI is improving healthcare sector significantly in the form of medical imaging, automated clinical decision-making, diagnosis, prognosis, and many more; in fact it has revolutionized several fields of medicine. However, it has its own limitations and AI cannot replace a healing hand of a physician. As AI is being used more and more in the healthcare system at the same time, many in the field are not properly aware about the system. Many raised their concern regarding the ethical issues related to AI such as data privacy, automation of jobs, and representation biases. It is also presumed that, implementation of AI into the patient care in the form of nursing care and getting advice through patients call lines may reduce their satisfaction or the patient may not feel comfortable. However, in practice, AI is to supplement the conventional patient care system, it cannot replace the human effort and requirement; as for example, we can mention robotic surgery, which is actually controlled by the human hands only with the aid of machine. So, it is not proper to blame the AI without considering its beneficial effects.

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REVIEW ARTICLE

An Overview of Thermal Injuries : A Medicolegal Perspective

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Abstract
Burn injuries are not infrequent in India. These may be of variable degrees and their extent may also range from a small localized patch of scorching of skin to burning of bones even to the extent of their turning into ashes. Various factors may influence these changes, so to analyse and interpret them, detail and minute examination of body, study of specific patterns of burns, their extent and depth in the various parts of body, behaviour of fire and fuel, origin and continuance of fire, nature of heat and its transmission and examination of scene of incidence are essentially required to reconstruct and determine the cause and manner of death with scientific clues. Need for such examination has been discussed in this paper.

Keywords
Thermal injuries; Medico-legal perspective.

Introduction

Burns are the injuries caused due to dry heat and scald due to wet heat. The severity of the thermal injury depends mainly upon intensity of heat, duration of exposure of tissues to heat, the part of the body and the surface area of the body affected, the ability of the body to conduct away the excess heat, nature of the heat source namely - flames, contact with hot object, radiant heat and wet heat.

More is the temperature of the heat source, less is the duration required for exposure of the body to cause certain degree of burn and vice versa. The minimum temperature required to cause burn of the body is about 44ºC with exposure of body for about 5 to 6 hours, with 60ºC , 3 seconds exposure and with 70ºC , 1 second exposure is sufficient.[1]

The susceptibility of the skin to burning and the severity of the resulting burn depend on skin thickness and other characteristics. Thickness of skin is grossly variable in different parts of body which plays a significant role in causing different severity of the burns. Skin of the palms & soles are thickest while those of flexure surface of arms & forearms are thinnest.

Skin burns as well as the extent of burn to humans are never distributed evenly. Areas of the body pressed against the supporting surface or covered by clothing are often burned less than unclothed skin area especially the tight fitting clothes. However, tight articles such as belts, shoes, socks and undergarment may protect the underlying skin by excluding air. With the use of kerosene or gasoline like fuel medium, there may be variable degree of burns like patchy charring of the tissue with at places more burnt while at some other places less burnt. Burns may range from localized superficial burn of the skin to the calcinations of bones. If the area is burned more severe it could be interpreted that the fire has burned there for a longer period whereas in some other area, burn is very superficial and to a smaller area, the exposure to fire was for a very short period; either the fire was extinct from that area or the fire could start late in that area. It is also possible to suggest that there has been use of some flammable liquid in more extensively burned area.

After the skin is burnt out, body fat is exposed then the body starts burning more. Human Fat burns at 250ºC but wick effect may cause burning of fat at a temperature as low as 24ºC , if adipocere tissue starts burning, there may be smoldering for prolonged period & even bones may be burnt. Clothes act as a wick, through the porous area of that fat mixes with the clothes which then converted into vapor and subsequently burn out with rising flames and more destruction of body. Liquefied fatty tissues leak out and maintain the fire for longer time.[2] Clothes burn when temperature reaches 225ºC.[3]

Fire related deaths are of great medico-legal importance and require complete evaluation of circumstances leading to fire and fire deaths with all medical facts and circumstances of the case to finally conclude that death was accidental, homicidal or suicidal in nature. Most often the questions required to be answered are :- Was the person alive before the fire started or during the fire? Whether the burns were the cause of death, the sole cause of death or the contributory cause of death ? Or some other causes also contributed as cause of death? What was the cause of origin of fire and continuance of the fire? Whether the fire was set intentionally to commit crime or conceal the crime?

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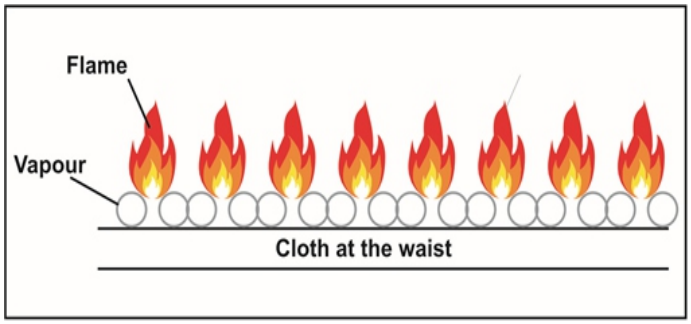
For clear understanding of fire related deaths, knowledge of the fuel and fire behavior are very essential. Fire is mainly of two types :-(i) Flaming Fire (ii) Glowing Fire. The flame from its origin always rises upwards unless it meets to an obstacle where it gets deflected and causes burns in the upper portion of the body. This can be seen in females wearing multiple layers of clothes in the waist which are if soaked with kerosene oil like fuel and then lit, oil turns into vapors and these vapors burn as flames. Diagrammatic view is being presented in the annexed photograph No. 01.



Photograph 1

The flame is seen originating little higher up from the clothes but continues till oil is available and causes burns. The parts beneath the clothes are usually spared or less burnt as seen in the waist area of various burnt dead bodies. Only after the complete consumption of oil from the selected area, the clothes may start burning in that area then causes burns in the covered area. This can be better understood with the example that an earthen lamp containing oil and a cotton wick, does not burn and remains cool till oil is available. Only the tip of the cotton wick continues to produce heat and gives flame till oil is available. By that time earthen lamp becomes warm during burning of the cotton wick. In the similar way the burns are also caused to the clothed area. But after the cotton wick is not getting oil, the flame also extinguishes. The cotton fabrics which contain cellulose ignite easily, produce flames and cause burns while in other types of fabrics e.g., nylon, polyester and wool etc. fire caused is of glowing type and only the part which is in direct contact with heat is burned.

The characteristic burns present on the dead body e.g. spared waist line, burned upper abdomen, burn patches in the lower part of the breasts, undersurface of chin, lower part of ears, outer surface of lower lip, mucosal surface of upper lip, tip of nose, margins of the hair lines of scalp etc. are the examples of sustaining burns in semi standing or standing posture as the flame courses in upward direction causing burns in the upper portion of the body. Photographs showing the burn patterns are annexed herewith as photographs 2-4.

Photograph 2

Photograph 3

Photograph 4

Hair and skin are burned due to flames. While cooking, burns are usually caused to the front of the body rather than the back with burns to the hands resulting from attempts to beat the flames out and burning of the undersurface of the chin, and upper chest and face. Pouring of kerosene oil over the head resulting into burns there has been frequently observed in suicidal cases. It has also been observed that with self immolation using an accelerant, the burns frequently are usually extensive with sparing of skin folds at the axillae and perineum.[4,5] They are often more pronounced over the front of the body. In cases of burns using fire accelerants usually feet and lower legs are not burned or less burned when the body was in upright position. Soles are usually spared in such position of the body.

Temperature higher than 150º C can reach in building fires within 5 to 10 minutes.[6] In close confined area like an aircraft cabin fatal temperature of about 250º C occurs within 5 to 6 minutes. and if the door is open, the sudden entry of oxygen may cause bursting of flame and flash over with the temperature reaching above 650ºC.[7] Temperature in the burning car can be about 1100ºC if fuel is available. In the chemical burns temperature may be much more even several thousand degree centigrade. Radiating heat in a high-temperature fire up to 980 ºC in an enclosed space can spontaneously ignite furniture.[8] Burn injuries are still a very prominent cause of death. In adults, burns over 40 percent and in children over 20 percent of body surface area are considered fatal. However, infants, children and elderly persons are more prone to death even with less percentage of burns.

In case of no burning or very little postmortem burning, absence of burns and/or soot deposits at the angle of eyes may be found. This sign is called as Crow's feet sign and considered as a feature of ante-mortem burn. Other mechanisms of its causation have been put forward like squinting of the eyes as a reflex response to smoke irritation and another mechanism i.e. shrinkage of skin due to heat may result in smoothing of the wrinkles of the face which is left without soot at the base of skin giving picture of crow's feet.[9] But further to that one more mechanism is worth noting that the conscious victim reacts to burn injuries very severely which may be expressed as powerful protective reflexes in the form of contractions of facial muscles and muscles of eyes producing wrinkling effects around eyes, nose and forehead. These contractions of facial muscles are also the reflection of expression of pain. Such wrinkling are caused due to alternate elevations and depressions of the tissues. The elevated parts get exposed to fire and burnt and the depressed parts are hidden and thus spared, giving picture of alternate burnt and healthy areas which are placed nearly at equal distances, equating to the width of muscle fibers around eyes, proximal part of nose and forehead. Skin tissues may be tightened, hardened, shrunken, leathery and consolidated due to prolonged exposure to high temperature.

It is interesting to note that more deep burns inflicted in face may cause obliteration of identification, neck region and perineal region may be for the purpose of concealing the signs of strangulation / throttling and sexual crimes respectively also. Prolonged smoldering of fire due to burning of adipose tissues may cause more severe damage, of the body parts. Under the direct contact of the fire, the loss of body mass is more pronounced than under radiant heat because the organic material of the body acts as a fuel whereas the radiant heat causes loss of body mass due to loss of tissues fluid. Contact with hot object like hot domestic appliances, cigarette match sticks, burning coal etc may cause localized burning of tissues. This burn will often, correspond to the size and shape of the hot object with a sharp delineating edge.[10]

Lawrence & Bull (1976) studied the relationship of time of exposure & temperature of the water to produce (a) discomfort (b) burn of partial thickness of skin and (c) burn of full thickness of skin and they found the average bath temperature is 40.5 0C and average shower temperature is 400C of water.[11] Murray (1988) found that hot water above 600C produces instant discomfort and a scald after 5 seconds.[12] The moist heat easily penetrates to the deeper tissues than the dry heat. Steam has approximately 4000 times more heat carrying capacity than dry air.[13, 14]

Scald is like a first degree dry burn and usually there is no charring of body tissue and burning of hair. The scalds correspond to the limited area of the body which came in the contact of the fluid with a sharp demarcating edge from the non contact area but if there is a splash or flow of the hot liquid is there, in that case, injury is more severe at the tissue of initial contact and in the lower part the fluid may trickle/ flow down, the fluid may cool and there may be less damage or no damage of the tissue will be seen. If the same quantity of hot liquid/water is applied into the larger surface area of the body, cooling of the liquid/water will be faster and thus at a localized area, injury may be proportionately less also. Thus damage to the tissue depends upon the intensity of heat, duration of contact, the amount of hot liquid present in the tissue, the area of contact and the intercepting materials like clothes etc. If the body part is immersed in the hot liquid like boiling water, the body part in contact will show scald of usually uniform severity and there will be sharp delineating edge at the margins of the contact area. Inflicted scalds in children are usually to the buttocks, perineum or limbs due to immersion in hot water.[15,16]

The traditional signs of ante-mortem nature of burns e.g., line of redness (red flare) at the junction of burnt and healthy skin, blister formation, carbon soots in the respiratory/ gastrointestinal tract and cherry red discoloration of blood due to excess of carbon monoxide converting into carboxy-

haemoglobin in the blood are not the absolute signs of ante-mortem nature of burns. Pattern of burns on the face and other parts of body indicating expressive act of life, postures of body and findings on the scene of incidence, signifying movements of body, if present, can be possible only when the victim is alive during burn and also he/she was conscious and in active state of life. This can be explained in another paper.

More emphasis has been given on the percentage of burns in practically all text books of Forensic Medicine. The depth of burns in the form of degree of burns has also been emphasized very much but the patterns of the burns have not got much importance in most of them. Although the percentage of burns is required to calculate the fluid and electrolytes needed for treatment and also to indicate the severity of burn whether total burned surface area of the body is sufficient to cause death or not? But it should not be forgotten that burns of lesser percentages can also cause death if they are deep involving the vital tissues of the body. Similarly, burns are described in degrees which reflect skin burns in 1st to 3rd degree while for subcutaneous tissue, muscles and bones of the body 4th, 5th, & 6th degree respectively.

Skin is a very thin tissue in comparison to subcutaneous tissue, muscles and bones. The present way of describing degree of burn is lacking in the sense that to what extent and what depth the tissues have been burned are not known by such description. Moreover, whether there are only partially drying effect due to water vaporization, loss of fluid from the tissue, burning of tissue, cooking of tissue, blackening & charring of tissue, crumpling of tissues, fracture & fragmentations of bones that too in multiple small pieces which may easily convert into ashes without or with little pressure cannot be differentiated. Such a vast difference in the depth and intensity of burn of the individual tissue require prolonged exposure to intense heat and is a proof that there has been intent of causing severe damage or death of a victim and accordingly attract the law of the land. Hence, a more precise tissue-wise anatomical description of the areas burned is essential to correlate the intent of crime is needed which will be further highlighted in a separate paper.

It is also worth noting that the estimation of time elapsed since death from the dead body is grossly misleading in burn dead bodies because none of the parameters indicating time elapsed since death is reliable as they do not follow the changes as seen in other dead bodies. Changes in eyes, cooling of dead body, primary flaccidity of muscles, rigor mortis, secondary relaxation of muscles, postmortem lividity, autolysis, putrefactive changes, adipocere changes, mummifications, and changes in chemistry of body fluids & tissues, enzymes, proteins, metabolites, condition & amount of food in the stomach and entomological changes are greatly affected and altered. A separate paper is needed to present this study.

Examination of scene of incidence in burn cases indicating different postures of the body, different movements of the body, use of accelerant for causing burns etc and their effects at the scene of incidence may result into meaningful conclusions, so the investigation and reconstruction of the body and the spot need to be presented in burnt cases in a separate paper.

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REVIEW ARTICLE

Autopsy approach in diagnosis of Mucormycosis

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Abstract
Management of systemic fungal infection has always been a challenging task for medical practitioners. There has been an exponential increase in the number of fungal infections during the COVID-19 pandemic. In India, cases of invasive mucormycosis are being encountered in large numbers. Injudicious use of steroids has been considered as one of the reasons for the rise in mucormycosis cases. Mucormycosis is a difficult diagnosis in its early stages. Most of the times the patients present in advanced disease conditions. There has been considerable mortality in such cases. Forensic pathologists may encounter such cases in their autopsy practice, particularly during COVID-19 pandemic. This article discusses the etiopathogenesis, autopsy features and post-mortem diagnostic approach in cases of mucormycosis.

Keywords
Autopsy; COVID-19; Invasive fungal infection; Mucormycosis; Mucorales

Introduction

Management of COVID-19 pandemic has been a daunting task for healthcare professionals. Medical fraternity is continuously being laid with different challenges during therapeutic management of these cases. Enormity of number of cases amidst crunch of resources is one of the forefront challenges faced by healthcare professionals. Additionally, there have been remarkable surge in number of associated secondary fungal infections. In context of opportunistic infections associated with COVID-19, pulmonary aspergillosis (CAPA) has received much recognition globally. However, in Indian scenario, invasive mucormycosis has remained the most common culprit among the invasive fungal infections.[1] Mucormycosis has been associated with significant critical complications and mortality. Though prevalence of mucormycosis varies globally, in India it is approximately 0.14 cases per 1000 population which is alarmingly eighty times more than in developed countries.[2] The development of mucormycosis has been attributed to the use of glucocorticoids and hence judicious use of glucocorticoids is recommended. Use of glucocorticoids in mild COVID-19 cases (without hypoxemia) is not advocated.[3]

Mucormycosis: Etiopathology

Mucormycosis (used to called zygomycosis) is a rare but dangerous fungal infection. It is caused by a group of molds called mucormycetes.[4] The different fungal species attributed with mucormycosis include Rhizopus species, Mucor species, Rhizomucor species, Syncephalastrum species, Cunninghamellabertholletiae, Apophysomyces species, and Lichtheimia (formerly Absidia) species.[5]

Route of entry of pathogen is either through inhalation or disrupted skin/mucosa. Mucormycosis is an angioinvasive fungal infection which can manifest as cutaneous, pulmonary, gastrointestinal, rhinocerebral,and disseminated subtypes. Uncommon subtypes include endocarditis, osteomyelitis, nephritis and peritonitis. Disseminated mucormycosis has the highest mortality rate (96% to 100%), followed by gastrointestinal (85%) and pulmonary disease (76%).[5]

It is more commonly observed in immunocompromised individuals such as poorly controlled diabetics, cancer patients, organ/stemcell transplant recipents, neutrepenic, patient on long term and careless corticosteroid therapy, illicit intravenous drug users, etc. Neonatal gastrointestinal mucormycosis has been reported in prematurity and low birth weight child. Immunocompetent individuals can also get infected if spores are directly inoculated through breach in the skin such as surgical wounds, burns, etc.[6]

Mucormycosis: A difficult diagnosis

Clinical diagnosis of mucormycosis can be challenging in earlier stages. With advancement of disease, there are specific clinical features which can aid in the diagnosis.[7] Mucormycosis can be fatal infection, hence early diagnosis and prompt treatment is essential. It mandates high degree of suspicion, particularly in persons with the risk factors. Patient usually presents with fever not responding to broad spectrum antibiotics and non-productive cough. Haemoptysis and dyspnoea are less common. Patient can also present with cutaneous necrotic lesions which have to be differentiated from other fungal infections. The other varied spectrum of clinical

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presentations include headache, stuffy nose or brown nasal discharge, toothache, loosening of teeth. Sinus pain, periorbital swelling, diplopia, proptosis, palatine ulcer or cranial nerve palsy are warning signs.[8] Diagnosis based on clinical features alone is often difficult and hence, it has to be supported with other diagnostic modalities. In cases of pulmonary involvement, CT scan may show nodular lesions. Tissue biopsy is carried out using Grocottmethenamine-silver (GMS) or periodic acid-Schiff (PAS) stains for better visualisation.[9]

Post-mortem diagnosis of mucormycosis has also been reported. It is found to be more frequent than antemortem diagnosis in some studies as diagnosis based on clinical presentation can be challenging.[7,10] Petrikkos G et al., reported only 25% cases gastrointestinal mucormycosis to be diagnosed clinically in their study.[10] Also Halvorson et al., in their case series reported that only one case out of four cases had antemortem diagnosis.[7] Autopsy diagnosis is mostly based on gross and histopathological examination. In the majority of the autopsy cases of mucormycosis, features of thrombosis and tissue necrosis have been reported. It has been postulated to be due proliferation of fungal hyphae causing angioinvasion.[7]

Gross autopsy findings

Autopsy findings may vary with the subtype of mucormycosis; rhinocerebral pulmonary, cutaneous, gastrointestinal and disseminated mucormycosis. Post mortem findings along with mechanism of its causation are discussed below.

Rhinocerebral mucormycosis is a most common entity among all types of mucormycosis. The infection spreads from the mucosa of the nose/nasopharynx to the soft tissues around it. The invading fungus may further invade the palate inferiorly, to the sphenoid sinus posteriorly and the cavernous sinus laterally. In advanced cases, it spreads to the orbits and then to the brain via the orbital apex or cribriform plate.[11]

Rhinocerebralmucormycosis shows features of fulminant rhinosinusitis with hemorrhagic necrotic lesions in the brain, mostly over the base of frontal lobes.[12] Acute to subacute ischaemic infarct can also be seen in the brain.[13] Mycotic aneurysm are also rarely reported.[14]

Gross pathological features in lungs may range from petechial haemorrhages to well circumscribed necrotic lesions. Classical targetoid Bull's eye lesions due to vasocentric necrosis in the lungs are also reported. Sometimes pale, wedge shaped cavitory infarcts with scattered petetial hemorrhges are also noticed.[7,15,16] Hemorrhagic necrotic lesions in a person with immunocompromised status should raise the suspicion of invasive fungal infection. Aspergillosis also manifest in the form of similar necrotic nodular lesions due to its angioinvasive property. Chamilos et al.[17] reported that chances of multiple nodules and pleural effusion are more common in mucor than other invasive fungal infections.

Cutaneous, gastrointestinal and disseminated mucormycosis are other varients of mucormycosis. Cutaneous lesions are reported as as circumscribed necrotic lesion with erythematous halo.[13] Necrotic eschar, ulceration, fasciitis along with suppurative inflammation and infarction can also be seen.[12] Gastrointestinal mucormycosis is difficult to diagnosis antemortem due to non-specific clinical features.[1] Stomach is the most common site of involvement followed by colon, ileum in gastrointestinal mucormycosis.[12] Multiple dark, nodular, targetoid mucosal lesions along with petechial haemorrhages over peritoneum are reported in such cases.[7] In neonates, necrotising enterocolitis, gangrene, perforation and peritonitis can be noted.[12] In rare instances, there is also involvement of heat, kidney and bone. Halvorson et al.[7], in their case series reported involvement of pulmonary, renal, cerebral, GIT, intrabominal soft tissue and hepatic involvement. Liver, kidneys can also show necrotic circumscribed nodular lesions.[13]

Disseminated mucormycosis is a rare entity. It indicates involvement of two or more non-contiguous system with mucormycetes. Manifestations are often non-specific hence diagnosis can become even harder. It can manifest following any form of mucormycosis and it is commonly reported in immunocompromised patient. Lungs and brain are commonly involved in disseminated mucormycosis.[18-20] It can also rarely manifest in the patient without any immunocomprised condition. It can be due to direct inoculation of mucormycetes in the injured areas. In such cases, cutaneous skin lesion or bony lesion can give clue towards disseminated form of mucormycosis.[21]

Histopathological examination

Supected lesions are subjected to histopathological examination for confirmation based on pathological findings. Histological examination also differentiates between mucorales and non-mucorales. Mucorales have broad, pleomorphic, ribbon-like, and pauciseptate hyphae with variable-angle branching, ranging from 45 to 90 whereas, Aspergillus has septate and narrow hyphae with acute angle branching.[22,23] Another differential diagnosis of mucor is candida, in which pseudohyphae and small yeast forms are seen on histology. In addition, multiple yellow-white nodules may be seen at autopsy in case of candidiasis. Angioinvasive features are uncommon in comparison to mucor.[7]

Tissue Culture

Apart from gross and histopathological examination, tissue culture can aid in diagnosis of mucor at autopsy. It is useful for genus and species identification. However, there is possibility of false negative as in case of uniform tissue distribution and

during the process of sectioning, there are chances of disruption of pauciseptate hyphae of mucor, rendering it unable to grow properly in culture medium.[6,24]

Other investigations

Similar to clinical diagnosis, rapid autopsy diagnosis can also be achieved by direct microscopic visualisation of affected tissue using KOH. Fluorescent brighteners such as Blankophor and Calcofluor White, can enhance visualisation.[6] Tissue culture has relatively low sensitivity and can be false negative. In such scenarios, immunohistochemistry is useful for species differentiation. Antigen based diagnostic test is available for aspergillosis but is not currently available for mucor.[25] Molecular methods are gold standard for identification of fungal strains. rDNA ITS region is most widely used barcode for phylogenitics and identification. Different PCR based techniques are being used for detection in the tissues.[26] Researchers are exploring detection of circulating mucor DNA in blood and urine. This non-invasive approach is useful in clinical diagnosis of cases with bleeding tendencies.[27-29]

Conclusion

The diagnosis of mucormycosis at autopsy depends on typical gross findings such as characteristic targetoid mucosal lesions, hemorrhagic necrotic infarcts and organ specific tissue necrosis as well as its confirmation by microscopical examination and DNA identification of mucorale species from the affected tissues. Diagnosis based on tissue culture is not advocated. During COVID-19 outbreak, mucormycosis should be suspected and investigated at autopsy in cases of death of a patient showing signs of atypical infection.

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REVIEW ARTICLE

Foetal autopsy: Case series based review

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Abstract
The discrepancies in the prenatal diagnostic techniques for anomalies and foetal outcome has necessitated foetal autopsy. There are certain pathological conditions which may go undetected in prenatal ultrasound or which may require further exploration which is feasible only with a meticulous autopsy. It helps review antenatal clinical care and provides a learning opportunity from unfortunate events which can furnish valuable feedback for the grieving parents.

Keywords
Foetal autopsy; Pathological autopsy; Post-mortem examination

Introduction

Pathological autopsy becomes more acceptable to the near and dear ones of the deceased, if it helps determine the cause of death of their child. Post-mortem examination in such cases helps to improve the standard of precaution, care and management in all future cases of similar conditions. Even as anatomically the child may be regarded as a miniature adult, however procedure and practices for foetal autopsy is markedly different from adult autopsy.[1,2] This may be attributed to the plethora of congenital anomalies, several of which don't allow survival beyond childhood.

Objectives for conducting series of foetal autopsy

1. To ascertain the cause and manner of death
2. To confirm or contradict a clinical diagnosis.
3. For medical education, research, epidemiological and statistical analysis.
4. Identification of rare anomalies which can be missed by antenatal investigations.
5. Collecting new data on existent diseases or anomalies.
6. Identifies inheritable or contagious diseases.
7. Helps the family to cope with such unexpected deaths and prepare themselves for future pregnancies.
8. Helps in defending the doctor in case of negligence case.[1,3,4]

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Prerequisites

1. All relevant documents like inquest papers, parent consent forms, medical records should be obtained prior to commencement of autopsy.
2. A reference chart for measuring the normal weight and length of foetus/new-born and weight and dimensions of foetal/new-born organs should be kept in hand.
3. Equipment like a dissecting board and dissecting microscope, masking tape, pins and tacks, scissors, syringes, needles, gauze, weighing scale, ruler, flexible measuring tape, scalpel handle with blades, knife, forceps with and without teeth, and probe with blunt end should be arranged before commencement of autopsy.
4. Fix the foetus on the dissecting table to provide a good surgical field (Figure 1).
5. A whole body roentgenographic examination of body is advisable prior to autopsy.
6. Photographs of the foetus perpendicular to the complete body and close up shots of external features and malformations should be taken. The foetus and foetal organs should be placed on a white sheet of paper, labelled, bearing details of the case like an autopsy number and date.[1,4,5]

External examination:

1. Note the weight of the foetus (Figure 2)
2. The length of the foetus is measured, from head to feet, with the help of an osteometric board.
3. The following measurements should be taken with the help of a string or using a pliable measuring tape-
   a. Head circumference (HC) – Normally, CH = HC.
   b. chest circumference (CC)
   c. abdominal circumference (AC)
   d. crown-rump (CR) length- (CR=approximately 2/3 CH)

e. crown-heel (CH) length
f. foot length (FL)
g. distance between the two inner canthus and distance between the two outer canthus
h. distance between the pupils
i. fissure length

4. Presence of vernix caseosa and its colour should be noted.
5. To test for presence of meconium, a cotton swab is inserted into the nostrils or auditory canal. Green staining of the cotton swab is indicative of presence of meconium.
6. Make a note on rigor mortis, degree of maceration, oedema in skin (by pressing over front of the lower limb, feet or back and looking for pitting). Dehydration can be assessed by pinching the skin. Needle marks, catheters, skin lesions, injuries, or masses should be listed, describing the site, number and measurements.
7. A cephalon-caudal approach is followed for external examination.

- Scalp & scalp hair – colour, texture and pattern should be noted. Defects in the scalp are a feature of trisomy 13.
- Skull- Describe the presence of any gross lesion or mass, palpate to check if cranial bones are overlapping, palpate the anterior and posterior fontanelles to check if they are sunken (dehydration) or tense (raised intracranial tension), look for extra fontanelles or defects, widely open or premature fusion of sutures, injuries like cephalhematoma or subaponeurotic haemorrhage.
- Eyes- Assess size, shape, position, inner canthal distance. Measure the interpupillary distance, and the size of the pupils. Check for jaundice in the sclera; pallor, cyanosis or petechiae in the conjunctiva.
- Ears- Position of ears should be assessed. If they are normally positioned, one should be able to draw an imaginary straight line from the corner of the eyes, through the mid upper half of the helix up to the occipital notch.
- Nose- Look for choanal atresia by passing a blunt end probe through the nares.
- Measure the philtrum (a long smooth philtrum is present in foetal alcohol syndrome)
- Oral cavity- Lips and palate are examined for any defect or cleft. The tongue and gingival surface are assessed for colour and dehydration.
- Lower jaw- Inspect the lower jaw for abnormally small or absent jaw
- Examine the neck for any injury or mass
- Chest and abdomen- Assess the symmetry and position of nipples, umbilical cord length and site of insertion. Skeletal dysplasia, anhydramnios pulmonary hypoplasia, pneumothorax or diaphragmatic hernia all may present as abnormally shaped chest. Gastroschisis, omphalocele, ascites, organomegaly, gaseous distension of the bowel, intestinal obstruction, and tumour should be noted.
- Extremities- Note the number of digits, cyanosis in finger nail beds, laxity of the joints (grade of maceration).
- External genitalia – Inspect the gender of the foetus along with the development and patency of the orifices. There may be renal or adrenal anomalies presenting as malformed or ambiguous genitalia. Neural tube defects, masses and abnormal tufts of hair may be noted around the lumbar area.
- Placenta- Examine the surface (foetal and maternal) of the placenta. Note the dimension and weight of the placenta. Examine the umbilical cord at its insertion site. Measure its total length and diameter, the number of umbilical vessels and its patency.[1,3,4,6-8]

Table 1: Different types of incisions

Type of incision	Given in cases of:
I shaped incision (Fig)	In routine autopsy cases
Y shaped incision	Preferable for neck dissection
Inverted Y-shaped incision	To study the umbilical vessels or urinary bladder

Figure 1: Foetus is fixed with a tape to the dissecting surface and a photograph is taken, with the camera held perpendicular to the body

Figure 2: Prior to commencement of examination, the foetus is weighed

Figure 3: An I shaped incision has been given, with subsequent removal of skin flap over the anterior aspect in a case of unknown foetus. This allows better exposure of internal organs. However, the same should not be practised in routine cases for cosmetic reasons.

Figure 4: All organs dissected out individually from the organ blocks

Internal Examination:

Position of body- A roll of cotton (for small foetuses) or a dissecting block (for bigger babies or child) is placed below the shoulders so that, the shoulders are elevated, the neck extended and the head is falling back. Different types of incision can be given based on the area of interest and for an extensive study.

Abdominal cavity

Assess the position of the diaphragm by counting the ribs or intercostal space corresponding to it. Check for diaphragmatic hernia, pneumothorax, ascites or blood. The abdominal organs can be removed by Lettules method or Rokitanski method (Figure 4). All organs are examined for any abnormality pertaining to position, colour, size, consistency. The major vessels, aorta and IVC are dissected in situ. The number, position, torsion and patency of umbilical vessels are noted. The urinary tract should be examined for signs of haemorrhage, infarction or obstruction. Malformations of internal genitalia- uterus, ovaries, fallopian tubes in female foetus and testes in male foetus should be examined.

Figure 5: Section showing occluded larynx in a case of chronic airway obstruction syndrome (CHAOS)

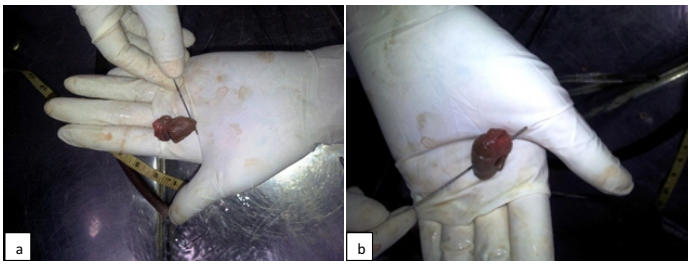

Figure 6: A case of Tetrology of Fallot. Position of the probe demonstrates- a) ventricular septal defect b) aorta overlying the defect

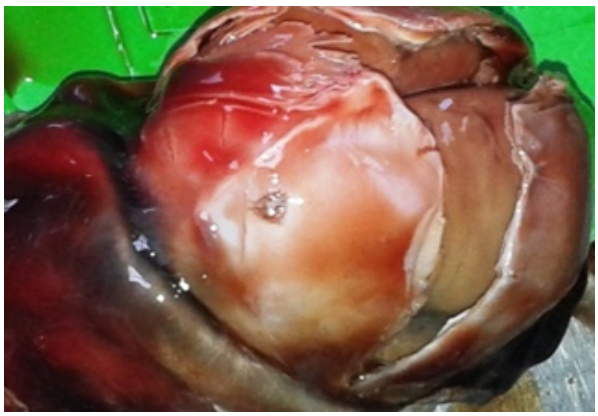

Figure 7: Calvaria is cut along the suture lines

Figure 8: Foetus with anencephaly and spina bifida

Figure 9: A case of umbilical stricture. Arrow is pointing towards stricture. Post constriction dilation of umbilical cord is also noted

Thoracic cavity

Examination of thoracic cavity begins by assessing the nutrition from subcutaneous fat thickness. Any abnormality of shape of chest like bell-shaped chest should be noted. A special note is made with regards to the thymus which is sensitive to chronic stress as in IUGR babies. The thoracic cavity should be inspected for pneumothorax, plural effusion, haemothorax and presence of any abnormal growth or lesion. It is important to preserve the connections between organs of different systems as most congenital anomalies present as multiorgan pathologies, fistulas or anomalous vessels. The oesophagus, larynx and trachea are examined for patency by passing a blunt probe through them (Figure 5). The surface of the lung is examined for petechiae. The lungs are then dissected out from the rest of the block, weighed and measured. A section of lung can be sent for microbiological culture.

The heart is dissected out together with great vessels after removing the pericardium. The position of the aorta and the pulmonary trunks in relation to each other should be noted. Patency of ductus arteriosus should be examined (Figure 6). The heart is best examined by opening in the direction of the flow of blood as in adult autopsy.

Cranial cavity

Types of incision:

1. Incision extending from behind one ear traversing over the top of the head and ending behind the opposite ear.
2. Question-mark incision- in cases where brainstem needs to be examined in detail

The fontanel sizes should be measured. The skull is opened either along the sutures (Figure 7) or by making an oval opening in the anterior fontanel which is extended by a scissors anteriorly and posteriorly as two parallel cuts. These cuts extend laterally in a curvilinear manner. Thus, two hinge shaped flaps of skull bone are created. Inspect for presence of any haemorrhage or defects in the falx and tentorium. The brain is removed by bending the head of the foetus backwards, supporting the brain with one hand. After inspecting and dissecting the cranial nerves and pituitary stalk, the brain is removed by cutting the spinal cord close to the foramen magnum. The brain is inspected grossly, weighed, fixed in formalin and sectioned as in case of routine autopsy (Figure 8).

Placenta

The following features should be noted:

- Surface- foetal and maternal side
- Weight
- Dimension
- Membranes
- Parenchyma
- Umbilical cord and vessels

The placental weight should be correlated with the gestational age and weight of the foetus.

Measure the length of the umbilical cord using a measuring tape. A short cord may result in evisceration and a long cord may cause foetal distress and demise from cord around the neck. The number of coils of the umbilical cord should be

noted (normal coiling- 1 coil every 5 cm). Foetal death and IUGR is seen in cases of excessive coiling of umbilical cord (Figure 9). Absence or decreased amount of Wharton's jelly should be noted. A single umbilical artery is associated with foetal deaths and congenital anomalies. Check for presence of thrombus, plaque, stricture or discoloration of vessels. The cord may be inserted at the centre or in margins called battledore placenta or into membranes. [1-4,9]

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CASE REPORT

A death due to wild tuber ingestion with literature review

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Abstract

The spectacular or famous glory lily is the national flower of Zimbabwe, Africa, and the state flower of Tamil Nadu, India. It is a herbaceous climber having tuberous roots and leaf-tip tendrils. The plant is elementary to cultivate in a warm conservatory, and it grows into a climber from an underground tuber. All plant parts are toxic, especially tubers, containing the poisonous alkaloid colchicine. Plant parts or extracts are used in rural areas by native practitioners for common ailments. In India and Africa, recently, there has been a resurgence in attention in extracting antimicrobial and medicinally valuable compounds to the level of growing the plant as the crop. The prevalence of this plant poisoning is relatively scarce. All the plant parts, mainly its tuber, are considered to be highly toxic parts. We report the case of a young female, a 36-year-old, who consumed the boiled tubers of Gloriosa superba mixed with edible tuber along with her husband as their routine food in the afternoon after agricultural work. This manuscript also outlines the clinicopathological aspects of Glory Lily poisoning. This case report highlights the accidental or unintentional usage of Gloriosa or its extracts resulting in potentially fatal poisoning.

Keywords

Colchicine; Gloriosa; Toxicology; Tuber

Introduction

Among the various types of plants, food plants get the earliest interest in humanity as shown by their search for their nutrient qualities.[1] Tuber plants find a significant place in the routine dietary habits or even as the staple food of marginal farmers, particularly in the food cover of the tribal population.[2] Gloriosa superba belongs to the family of Colchicaceae, also famous for being known as glory lily, flame lily, superb lily, and creeping lily. It is a branched, herbaceous climber that grows up to the height of 5 meters and had exotic flowers. They grow in low jungles and are seen commonly in India, Malaysia, Burma, Sri Lanka, Australia, the Pacific Islands, and Africa.[3] It is widely known in local language as Kal-Lavi and Khadyanag in Marathi[4] and Karthigaipoo in Tamil languages.[5,6] Gloriosa superba has gained significance in modern Medicine in recent years and is indicated gifted drug for the manufacture of colchicine on a profitable scale.[7]

The tubers of Gloriosa superba (Figure 1a) have been yield to contain several alkaloids, of which gloriosine and colchicine are the most vital ones. Dioscorea oppositifolia (Figure 1b) belongs to the family Dioscoreaceae, known as with vernacular name in Tamil as Kavalakodi, which also has climber habit, commonly consumed as a staple food by the tribal population of the Kolli hills residing near the eastern ghats of Tamil Nadu state.[8] The tuber used traditionally to treat bruises and sprains, joint pains, colic, hemorrhoids, chronic ulcers, cancer, leprosy, impotence, inducing labor pains, and abortion.[9-11] Acute intoxication related to the ingestion of tubers of Gloriosa superba is similar to the clinical features of colchicine poisoning.[12] We report an unusual fatal case of accidental tuber poisoning by husband and wife mistakenly consumed as their routine diet.

Case Report

A thirty-six-year-old female and her husband consumed boiled tuber as their staple food in the afternoon after agricultural work. Her husband died on the farm within a few hours of a wild tuber's consumption. He was brought dead to government hospital. Autopsy showed semi digested tubers and evidence of colchicine on toxicology analysis. The woman suffered from vomiting and diarrhea. Relatives took her to a nearby government Hospital without any delay referred her to a tertiary care hospital after one day. The patient had tachycardia (heart rate: 146 beats per minute), tachypnea (respiratory rate: 42/minute), and her blood pressure was 90/60 mm Hg. The arterial blood gas analysis revealed mild hypoxemia and metabolic and respiratory acidosis (pH: 7.31, pO2: 90 mm Hg, pCO2: 22.5mm Hg, HCO3: 10.9 mmol/l). The patient was confused and disoriented with the Glasgow coma scale of

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12/15(E3V4M5). She received gastric lavage and oxygen therapy. Blood investigations showed Hb level 12.8 gm%, higher levels of creatinine kinase (CK) total (712 IU/L), creatinine kinase myocardial band (CKMB: 59 IU/L), aspartate aminotransferase (AST; 200 IU/L), alkaline phosphatase (ALP; 591 IU/L), urea (47mg/dl), creatinine (1.35mg/dl). She died on the third day post-incident due to deterioration in her health. History revealed that she had consumed about 2 to 3 tubers. The attendants brought wild tubers for identification, and we identified them as Gloriosa superba.

The deceased was moderately built, with a body length of 148 cm and 55 kgs. Postmortem lividity was present on the dependent parts of the body. Eyes closed, tongue inside, and teeth were 16/16. There was no evidence of external injuries. On internal examination, the brain showed features of cerebral edema. Lungs showed congestion and edema. (Figure 2a) The stomach contains about 200 ml of brown-colored mucoid fluid without any peculiar odor, and mucosa was hemorrhagic (Figure 2b). All abdominal organs, including the liver, spleen, pancreas, and kidneys (Figure 3), were congested. Histopathology of lungs showed aspirated food material in bronchioles and inflammatory infiltration (Figure 4a & 4b). It also showed intra-alveolar hemorrhages and pulmonary edema (Figure 5a). The liver showed steatosis, central venous congestion, and nonspecific lymphoid infiltrate in the portal tract (Figure 5b). Kidney showed evidence of acute tubular necrosis. Toxicology qualitative analysis showed evidence of colchicine in blood, liver and kidney. The cause of death was aspiration pneumonitis and intra-alveolar hemorrhages following wild tuber consumption and manner of death was accidental.

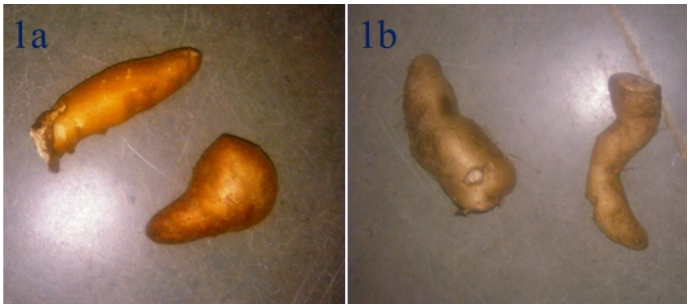

Figure 1a. Photograph of Gloriosa superba (Wild tuber). **Figure 1b.** Dioscorea Oppositifolia (Edible tuber) both consumed by the deceased during lunch.

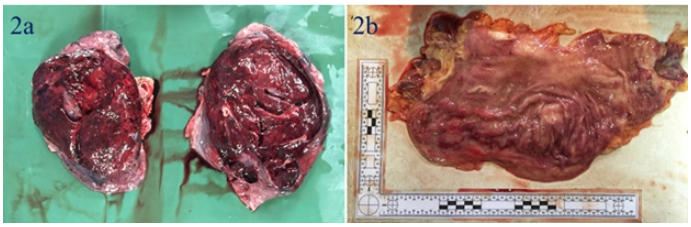

Figure 2a. Photograph of lung showing congestion. **Figure 2b.** Photograph of stomach showing brown fluid and hemorrhages on mucosal surface.

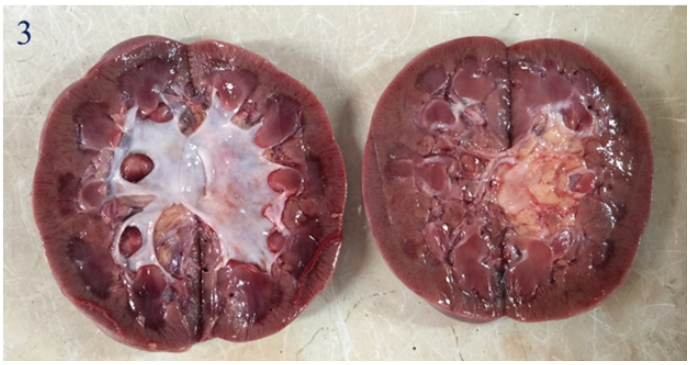

Figure 3: Photograph of kidney showing mild congestion

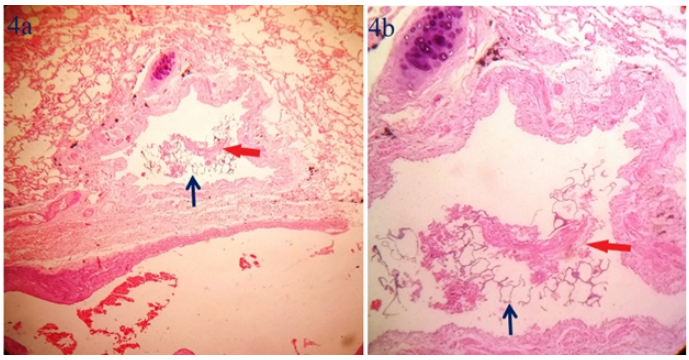

Figure 4a (H & E 4X) & 4b (H & E 10X). Photomicrographs from the lung showing edema, with bronchioles showing evidence of aspiration of food material (blue arrow) and inflammatory infiltration (red arrow).

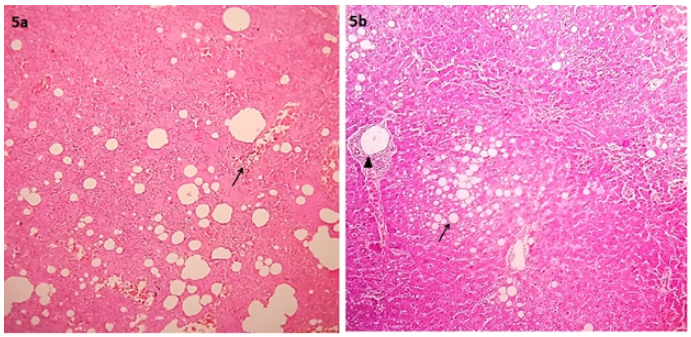

Figure 5a. (H & E 10X). Photomicrograph from lung showing intra alveolar hemorrhage and edema. **Figure 5b.** (H & E 10X). Photomicrograph from liver showing steatosis with nonspecific lymphoid infiltrate in the portal tract.

Discussion

Herbal medications are gaining popularity, even in developed countries. However, the patients sometimes suffer fatalities as there are no quantitative or qualitative standards for most. The Tamil Nadu government promotes Gloriosa's cultivation as subsidy schemes, and hundreds of acres are grown as a cash crop. All the plant parts are poisonous because of the full colchicine's content and the colchicine extracted from seeds.[6] Colchicine alkaloid is the primary active ingredient that handles the toxicity from Gloriosa superba. It also contains gloriosine,

desmethyl colchicine, N-formyldesacetyl colchicine, beta-lumicolchicine, superbine, chelidonic acid, and salicylic acid. The lethal dose of colchicine in human beings is about 0.8 mg/kg.[13] The alkaloid has a much tapered therapeutic index and, therefore, a minute overdose results in acute poisoning.[14] It has an anti-mitotic action that stops mitosis in metaphase. Body cells with a high turnover and metabolic rate, like the intestinal epithelial cells, bone marrow cells, hair follicles, etc., are susceptible.[15,16] The lethal dose is about 60 mg in adults and a fatal period is about 12 - 72 hrs.[10] Colchicine is extracted from the plant parts in boiling water.[17]

Colchicine is rapidly absorbed from the gastrointestinal tract and undergoes a significant first-pass metabolism in the liver. The metabolites go through enterohepatic circulation and then excreted in feces, resulting in the intestine's broad exposure to the toxic effects. Renal clearance accounts for about 10–20% of colchicine excretion through kidneys.[18] Colchicine inhibits microtubules polymerization and its formation in the cell division phase. Therefore, the rapidly dividing cells of the mucosa of intestinal epithelium are severely affected. It causes severe gastroenteritis, electrolyte imbalance, metabolic acidosis, multiple organ damage, and shock. Other features are pancytopenia, rhabdomyolysis, hypocalcemia, and acute respiratory distress syndrome (ARDS).[10] Severe vomiting and diarrhea cause hypotension due to fluid loss.[19,20] This patient also had nausea, vomiting, and watery diarrhea at the time of admission and has similar colchicine toxicity clinical features. In this case, we found evidence of intra-alveolar hemorrhages, pulmonary edema, central venous congestion in liver and acute tubular necrosis.

Colchicine causes ascending polyneuropathy and paralysis of intercostal muscles.[21] Gooneratne et al.[22] reported that the central and peripheral nervous system's progressive paralysis and could have toxic encephalopathy. It causes cardiotoxicity with ST-segment elevation on the ECG. It can cause renal impairment and thrombocytopenia.[9] Generalized massive alopecia is also observed as a complication of acute poisoning. There are no qualitative and quantitative standardizations for the native plant products used for the common ailments. These native preparations may contain such types of poison. Awareness of hazards of consumption of these unregulated medicines.[8] It is rare case of wild tuber poisoning and features of colchicine. The limitation of this case report is that we have only qualitative toxicological analysis report of colchicine and not a quantitative toxicological analysis.

Conclusion

Suicidal ingestions are not uncommon wherever this plant cultivates and grows well. In this report deceased consumed poisonous tuber accidentally. Our case can provide social awareness among people who consume varieties of tubers routinely as their staple food.

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INVITED CORRESPONDENCE: MEMOIRS OF A FORENSIC EXPERT

Forensic Medicine New Horizons: A Teacher's View point

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Introduction

Teaching as a profession from time immemorial has been considered as one of the most noble professions that satisfies one emotionally and spiritually. Teachers find topmost respect in all societies & major religions of the world like Hinduism, Islam and Christianity. The metaphysical satisfaction associated with teaching cannot be explained in words. As a professional who has served this noble field for more than 40 years, I would like to share my experiences in this august forum. Teaching students over these years has been an exciting, enthralling and challenging journey full of many new learning experiences.

My journey

I would like to start this journey from way back in early eighties when I completed my post-graduation in AIIMS Delhi and landed up with a teaching job at Government Medical College Srinagar. Ever since my role as a teacher not only made me work in the department at different faculty positions but I was also lucky enough to head the department for more than two decades. Early and late eighties saw students learning through dogmatic processes, handed to them by their peers. Taking advice of seniors and working hard through the routines were the best aspects of student learning. Bright intelligent students felt the insatiable need for knowledge that could possibly be overcome by late sessions in library or visits to outside states for knowledge.

There was no concept of internet or digital knowledge then. This resulted in honing skills of knowledge gathering through sweat and toil. I could really find the satisfaction of this hard-earned knowledge on faces of deserving students. Many new innovations stamped their mark on nineties. These included the introduction of newer gadgets like projectors, mannequins, audio visual aids in teaching process. I vividly remember those times when my chalk & board method of teaching & face to face discussions with students got changed to slide presentations and subsequent taking down of notes by students. A summarized knowledge was thus presented to the students that they found easy to assimilate and reproduce.

Twenty first century saw major strides being made in expansion of internet and introduction of digital gadgets that could augment a student's knowledge. Desktops, Laptops, Data Banks, Routers, PDF, Smartphones, pen drives and may other devices have found acceptance with students. This was positive in many ways but the desire to toil and work to get information and knowledge was sullen and extinguished by it. Library visits, offline discussions, peer advise all found a back seat. A simple click of a button could give them tons of information which was unrivalled by any of above.

Present scenario

Online teachings instead of face-to-face discussions are preferred now. The modern epidemics like covid19 disaster has supplemented and strengthened the necessity of online education. As a teacher I feel that such advances may be good for overall development of a student but the basic student-teacher face to face interaction can never be replaced by any modern technology.

Long way to go

What needs to be changed is the attitude of a teacher towards education. The focus of a teacher should be overall development of a student rather than imparting textbook knowledge only. Invigorating students mind with innovative thoughts that could lay foundation of newer technologies should be the new dictum of teachers.

New Medical education system

It is satisfying to note that recent revisions made by National Medical Commission regarding up-gradation of medical education. It is equally satisfying to find the emphasis laid by the commission of, teacher training. The CISP modules for teacher training vis a vis Competency based Medical Education [CBME] is a welcome step in modernizing the medical education in India. This will help in moving a student from a classroom to multiple other fields increasing his/her mental capacity to invent rather than ingrain in future. This along with updating the laboratory infrastructure, converting old lecture halls in to smart classes, using internet for direct teacher-student interaction is a blessing for modern student education. Focusing on core competencies in a subject and evolving student teaching around is very beneficial. Synchronizing Concepts like Self-directed learning [SDL], attitude ethics and communications [AETCOM] with other routine methods is a welcome development. This not only focuses on mental development of a student but also benefits him/her morally and ethically.

New Horizon

Using technology with education is also necessary in modern teaching. Using highly sophisticated satellites dedicated to education sector has brought education to doorsteps of distantly located villages and towns. Now a village-based student has same access to knowledge as a metropolitan dweller. Finding data pads, personal digital devices and other sophisticated devices in hands of student is not an uncommon sight nowadays. It is heartening to see teaching methods being diversified and upgraded over period of time. It is essential that we build up on resources that we already possess and incorporate more and more advances in our teaching process. This will help us in coming at par with modern nations of the world.

My personal view

Because we are involved in training the medical students who will be the future doctors & finally involved in treating the patients, the mixed type of teaching should be adapted. Some of the theoretical part can be taught online while practical portion which is very important in medical curriculum can be taught in Clinics, Laboratories, Museums, Dissection halls & autopsy rooms etc.; It is pertinent to mention that even UGC allows 40% online teaching now. It is very good to follow & adapt new technologies of the west but how they can be applied in our country where resources are limited especially in rural sectors is a matter of concern.

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INVITED CORRESPONDENCE: MEMOIRS OF A FORENSIC EXPERT

Fun learning of Forensic Medicine & Toxicology – An experience

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Introduction

Medical education has changed in the past few decades and has moved from a teacher centric one to a student centric system. The medical graduate is expected to think flexibly and critically in order to solve problems in different situations. There is an exponential growth in the availability of teaching-learning resources for medical students. Many innovative learning tools have been devised and tested. The incorporation of gamification into medical education has been used as a powerful adjunct. Encouraging learning, entertaining people and having a nice time can be used as effective tools in training young doctors.[1] Gamification is the application of principles of gaming i.e., fun elements to teaching-learning activities. Using a game for teaching elements related to a subject is referred to as game-based learning. Serious games are those often used for behavior training and other non-entertainment purposes.[2] Research in medical education has reiterated beyond doubt that gamification and social media can be used to foster student learning through increase in participation in learning activities and enhancing their sense of belonging to the department.[3] The concept of active learning, where the learner has to be more engaged in the process, requires a variety of tools for success. Both facilitators and adult learners will continue to try, create, improve upon (or reject) newer tools and techniques, especially during this present time of blended learning.[4] Educationists have stressed on the fact that creating educational tools by the learner enhances learning abilities. Learning outside the confines of a traditional classroom, through the use of innovative and newer tools, is an excellent situation for active learning.[5]

Humanities in medical education is gaining popularity as a very effective method of making learning happen. Body painting, as an effective tool, has been well researched and used in learning anatomy.[6] This can be used for teaching-learning of Forensic medicine too. During an era in which role play is recognized as an effective tool for inducing active learning of the subject and also skills of the affective domain in general. Theatre of the oppressed, developed by Augusto Boal[7] in the 1970s, has been used very effectively for bringing about a change in the identification, understanding of and responding to conflict and struggle situations. This learning method provides the learner with opportunities and means to migrate from being a spectator to a "Spect-Actor", thereby actively learning through involvement.[8]

Learning with fun - experience in Forensic Medicine and Toxicology

Many innovative fun methods of teaching-learning, some unique in themselves, have been tried over a period of twenty years in the Department of Forensic Medicine and Toxicology at the Himalayan Institute of Medical Sciences, Dehradun. Many of these methods are being continued till date as they were found to be feasible and are effective in increasing student participation, triggering high order thinking, enhancing learning of the subject, and fostering student-teacher relationship.

Student Research Projects- Over the past ten years our department has been involving undergraduate medical students in research projects. The interested students are assigned research topics in pairs. A sensitization session on basic research methodology is held and the student researchers write research proposals which are sent for ethical clearance. These short-term research projects, mostly on topics from Forensic Medicine and Toxicology, are supervised by willing and previously sensitized faculty members from various departments. On completion of the research, these projects are bound and judged by both internal and external subject experts. A prize distribution ceremony is organized annually for awarding the best projects and certificates to all the participants.

Every year the department churns out about thirty original research projects which are proudly archived in the department. The student researchers are encouraged to convert their work into academic scholarship and each year a sizable number of research projects get published in reputed journals. Thus, in addition to academic achievement, undergraduate medical students who get exposed to research methodology and its various components develop enhanced interest in the subject and understanding of its importance. The involved faculty members too felt that the whole exercise is immensely satisfying, as evidenced through a program evaluation conducted by the department (Figure 1).

Museum Model Making- The undergraduate students who are not engaged in scientific research are divided into small groups for making museum models in Forensic Medicine and Toxicology. After extensive brainstorming, the students come up with ideas for making their models. The department facilitators ensure that models are made of durable material like plaster of Paris, clay, fabric, wood or metal. An average of

thirty models is submitted each year. These are judged by internal and external faculty and awarded in an annual function. Many of these models are selected for display in the department museum, thereby gradually converting our museum into a student made one. The department now boasts of possessing many teaching-learning museum aids that are not available commercially. The students, in turn, learn through a fun activity that helps them exhibit their creativity (Figure 2).

Figure 1: Original research projects developed by students

Figure 2: Museum model making by students

Figure 3: Quiz boards

Figure 4: Moot court setup

Quiz Boards- This innovative idea was conceived a few years ago and designed by undergraduate students as a museum model. This electrically controlled board contains illuminated questions and their answers. The participant can fill his roll number and attempt the questions, usually twenty per board, any time convenient to him. Right and wrong answers are shown instantly by colored lights and the final result is displayed on completion. The results of the quiz test can be ported to a computer and compiled on excel sheet. The questions and their answers can be changed by the administrator for each test. This method of assessment has become popular with the students as it dispels the innate apprehension that accompanies assessment sessions (Figure 3).

Moot Court- Hesitation of medical professionals in attending courts of law as expert witness can be attributed to the fact that they have not been adequately exposed to nor have enough knowledge of court procedures. The requirement of a moot court for imparting knowledge of legal procedures through experiential learning has been well recognized and moot courts have been set up in many institutions.

Many innovative modules can be designed for teaching undergraduate medical students by making use of a moot court. A meticulously planned role play can be thought of when there is constraint of time. However, a module where students take up various roles after in-depth study of a real or hypothetical case will be more fulfilling. The various documents and other exhibits required for this module need to be carefully prepared and pre-validated. The students should be given enough time to prepare and the facilitators must preferably design checklists for keeping the proceedings focused. At the Himalayan Institute of Medical Sciences, we have combined moot court sessions with ideas from the “Theatre of the Oppressed”, where students from the spectator group can pitch in with their inputs at any time during the performance. This small fun-filled addition to the traditional moot court module has helped in increased participation, encouraged self-directed learning and amplified

the students' critical analysis capabilities (Figure 4).

Toxi-photographer- Students will be assigned the task of clicking photographs of plants and other agents of toxicological importance in and around the campus with their mobile phones. They will study the photographed specimen in relation to its identifying features, mechanism of action, fatal dose, fatal period, signs and symptoms off poisoning, treatment, postmortem findings and medicolegal aspects. They will then collaborate with other students who have photographed agents from the same group as per the toxicological classification taught earlier. After extensive group discussion, one student from each group will present the compiled group work in the presence of invited faculty members, who will judge on the basis of subject knowledge, compilation of work, presentation style, photographic appeal and relevance. This method of learning of toxicology can be very useful in the organization of self-directed learning sessions. The students not only indulge in extensive self-study, but also love working in groups for sharing knowledge and exhibiting creativity.

Creating Crossword Puzzles- Solving crossword puzzles have been tried in many subjects of various fields as a learning tool that has been clearly demonstrated as a booster of retention. However, we have taken this a step further, where the learners create crossword puzzles in groups, which are solved by a peer group. It is well understood that creating crossword puzzles is a challenging task and requires the creator to study the topic thoroughly, be able to explain the key concepts clearly and employ high order thinking in order to bring in objectivity in designing a flawless crossword puzzle. This learning method requires shorter time as a considerable part of the work is done outside the classroom. However, involvement of faculty members is greater as this activity requires clarity of instruction, constant supervision and validation of each crossword puzzle before submission for solving by peer groups. A study conducted in the department has shown that both learners and facilitators felt that this activity enhanced creativity and confidence while the students worked in groups and can be implemented as a feasible learning tool.

Topic gurus- This is a fun activity where small groups of students are assigned topics at the beginning of the semester. Prior to teaching-learning of the topic, the student group prepares a PowerPoint presentation for the teacher, using their creativity to make the topic understandable and simple. They are given the freedom to use various resources, pictures and even video clips to generate interest. The teacher can use parts of this presentation for actually teaching the topic and acknowledging the group. The topic gurus will be the first responders for addressing doubts of students during discussion of the respective topics. The students learn various techniques of breaking complex matter into simpler and understandable elements by using their own creativity. The teachers too understand the learners' perspective of the topic and can moderate discussions better and in a more focused manner.

Student summary- At the end of discussions on a particular topic, a student will summarize. This student can be one who has been assigned the task sufficiently before discussions on the topic started. He can also be a member of the Topic Guru group for that topic and has prepared the summary in a creative style. The teacher can also consider adding the summary slides to his presentation. This activity will help the carriage of take-home messages in a more learner friendly format.

Comic strips- Student groups make small comic strips to explain complex terms used in Forensic Medicine & Toxicology. The students get an opportunity to exhibit their artistic skills or make use of the many free comic making applications available over the internet. Comic strips with empty dialogue bubbles can be used for teaching the affective domain and communication skills effectively.

Reflections and narratives- Critical reflection writing is a very effective tool for enhancing learning. It helps analyse a particular experience with respect to self and the situation and prepare the medical graduate to perform better each time.[9] Narratives help in etching human values into the medical graduate. Narrative medicine offers fresh opportunities for respectful, empathetic, nourishing medical care.[10] Medical graduates can make use of reflection writing and narratives following their visit to the mortuary and viewing medicolegal autopsies. Listening to narratives of relatives of the deceased will make the student understand that there are many helpless situations that do not have clear answers or explanations and will prompt him to be more empathetic, respectful, truthful, responsible and humble. Fun learning methods are not limited to those described above as many more new tools can be innovated and tried.

Points to consider for making fun methods powerful

Motivation: The method or tool must be both intrinsically and extrinsically motivating for the learner and must arouse and maintain curiosity during the entire process.

Active engagement: The tool should be such that the students are actively engaged and actual experiential learning should happen. It should be one that encourages participation of all types of learners.

Educationally rewarding: The very intention of introducing fun learning techniques is to make the entire activity educationally rewarding. This means that the new method will help the learner in acquiring knowledge and skills better than by the use of traditional methods.

Healthy competition: Often competition drives learning. It has

to be clearly decided whether the proposed tool promotes healthy competition and may need to be modified or discarded.

Feedback: The tool should be so designed that learning can be assessed and effective feedback can be given.

Discovery: Learners must feel that they have discovered something new and that the activity was worthwhile in their context.

Bonding and belonging: Amplification of bonding between the students and faculty members and amongst themselves is the hallmark of these learning tools. The participants must be facilitated to develop a sense of belonging for the department and the subject in general.

Sense of achievement: The involved faculty members and the students must derive a sense of satisfaction and achievement through working together.

Feasibility and sustenance: In order to implement the designed fun tool without calling it off in between, its feasibility needs to be meticulously analyzed. Only those tools which can be smoothly used the very first time and leave their mark as good educational fun tools must be kept in the toolbox for repeated use.

Evaluation: As most of these fun learning methods may behave differently in different situations, it is always pertinent to go for a program evaluation following the intervention. This will help in deciding whether the tool can be implemented as such, modified to situational needs or discarded.

Other important points to be considered are financial issues, time and willing manpower required for designing and conducting these teaching-learning methods. A general culture of permission is particularly important for smooth implementation. Not all teaching-learning tools can be adopted on a long-term basis. The medical educator will need to constantly review his toolbox for improvement and replacement of tools. This form of pedagogy is becoming so popular and necessary that many educators are advocating architectural changes for designing classrooms that can support fun learning techniques. Although time, money and manpower often hold back implementation of innovative fun learning methods, one single step in this area may open doors to a newer and much more rewarding realm of teaching-learning of Forensic Medicine and Toxicology.

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INVITED CORRESPONDENCE: MEMOIRS OF A FORENSIC EXPERT

Ways to Strengthen Forensic Medicine and Toxicology in India and Increase Faculty Position: A Path Forward

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Introduction

This write-up intends to highlight the measures to be taken to uplift the speciality of Forensic Medicine and Toxicology (FMT) in the Indian setup, which in turn may prove effective to proportionately increase the faculty strength required at medical colleges. This is based on my interactions with medical officers, Police, Judiciary and other related officers.

Past scenario and the crisis developed

The field of FMT has been facing a persistent crisis from the reduction in the number of faculty required at medical colleges to few takers. About three decades ago, there were a handful of qualified experts to handle medicolegal cases and the majority of such cases were handled by non-forensic doctors. Even the undergraduate teaching in the subject of FMT was handled by medical teachers of other paraclinical branches. With changing times, many universities introduced the postgraduate course in the subject of FMT leading to an increase in the number of forensic experts. Medical Council of India recognized and insisted to appoint qualified forensic experts in medical colleges. This created a huge demand for forensic faculty which was not properly utilized by the forensic specialists. The repercussion of which was a decrease in the faculty position, which went even to the extent of plans being made to phase out the subject from the undergraduate curriculum. However, with sincere efforts made by the senior faculties in the field of FMT, the subject remained as a part of undergraduate curriculum.

Current scenario and exploration of newer avenues

The current job profile of the Forensic Medicine experts in most of the institutions is restricted to teaching undergraduate medical students, postgraduate training and autopsy work. Conduction of postmortem examination is again limited to government medical colleges and few private medical colleges which have government approval to conduct them. The upliftment of the subject requires the forensic fraternity to explore newer avenues to prevent the subject from being static and stunted.

Beyond undergraduate and postgraduate teaching to the medical students, forensic experts can involve themselves in teaching the subject to students of allied health science courses such as Forensic Science, Criminology etc. They can be a part of training institutes that are involved in teaching recruits and conducting refresher courses for personnel of the investigating agencies and one can also be involved in educating law students. Regular training sessions and contact programmes can be planned in collaboration with the health and family welfare department to train the medical officers working in the peripheral set-up. This is beneficial to equip the primary care doctors to handle forensic cases effectively.

The Forensic Medicine departments can initiate certificate / short term courses on various topics such as Forensic Odontology, Forensic Nursing, Forensic Anthropology, Forensic Science, Forensic Radiology, Forensic Ballistics, Medical Law & Ethics, Medical Record Maintenance, Handling medico-legal cases etc. Such courses can be offered to undergraduate, postgraduate students and even healthcare professionals of various streams of medicine, which in turn are helpful in capacity building and can generate revenue for the parent institution.

Since most of the mortuaries across India appoint unskilled workers as support staff, autopsy technician courses and embalming training courses can be designed which would be beneficial to strengthen the field of Forensic Pathology. Creating awareness among the general public regarding the procedure of embalming can increase the number of people opting for the procedure which can yield monetary benefit. Setting up a fully functional Forensic Histopathology and Forensic Toxicology and Genetics laboratories under the aegis of the Department of Forensic Medicine will go a long way in strengthening the subject.

Many institutions across the country have established Clinical Forensic Medicine Unit in the hospital casualties, which is a welcome change since this can help in restoring the faculty strength in the subject of FMT. In addition to handling the medicolegal cases in the casualty, setting up of Poison Control Centre comprising of both poison information wing and analytical toxicology laboratory has a potential to compel the organizations to increase the number of faculty recruited to the department of FMT. The department of Forensic Medicine can work in conjunction with other clinical departments in setting up Child Abuse Response Units, Organ Donation Banks, Medico-Legal Grievance Redressal Cells, thus making the department a vital part of the hospital set up.

Virtual autopsy is already in the inception phase in India, hence

working on establishing such a centre in one's institutions can prove lucrative. The Government of India has taken measures to improve the criminal justice system in India by establishing National Forensic Science University. Signing a Memorandum of Understanding (MoU) with such institutions would facilitate and promote studies and research, which could serve as an instrument to achieve excellence in the field of FMT. Signing an MoU with international forensic institutions can further strengthen the speciality. This would facilitate undergraduate and postgraduate research in the field of FMT thus proving beneficial to strengthen the subject.

Future and developmental needs

Since the future of the subject is partly dependent on the number of students opting for this speciality, it is our duty to kindle the interest of our students in the subject of FMT. This could be attempted by encouraging both undergraduate and postgraduate students to take up short term research projects pertaining to the field of FMT, which could be funded by the institution or even one can guide the students to apply for financial assistance from the funding agencies. This can boost the morale of the students and also help in inculcating research culture amongst them. Since academic advancement in the present day is dependent on one's research and publications, these measures can help one achieve professional growth.

Organizing conferences and workshops on topics that are relevant to even non-forensic doctors would go a long way in improving the face value of the subject. The need of the hour is to make our work more appealing so that it can inspire the budding doctors to take up this speciality.

To restore the faculty strength, there is a need to establish the department of FMT as an integral and irreplaceable part of the organization. This is possible only when the forensic fraternity is ready to take up newer responsibilities and envisage them beyond teaching and autopsy work. Success is usually met when one moves out of the comfort zone and embraces newer opportunities. As the saying goes change doesn't happen overnight. What is needed is constant effort and perseverance. Especially if you have a well-developed sense of justice, you have a scientific mind and want to help law authorities create a more balanced society. You also get to work with interesting cases and examine all types of evidences in a meticulous manner.

Let us strive to get the subject of FORENSIC MEDICINE AND TOXICOLOGY its due recognition. Wishing you all the best in your future endeavor.

“Arise, awake and do not stop until the goal is reached."

Swamy Vivekananda

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INVITED CORRESPONDENCE: MEMOIRS OF A FORENSIC EXPERT

Forensic experts stand for the truth and speak for the dead

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The Case

On a Sunday morning, I woke up late as we had a party the previous evening. From my bed, positioned so I could see the Ganga, about two-hundred meters ahead, I watched the waters playing against the shore, the sun's rays breaking on the surface, and a boat with three men being rowed to the bank. Although it was early March, I felt a cool breeze streaming in through my window. Refreshed, I stood up and noticed that two persons from the boat had walked up to our place and sat on the ground across the road. Spring flowers were in bloom in the garden surrounding our building. Our quarter was located away from the town, where Govt planned to construct a medical college hospital in the future. Although we had a police station a little further away to the east, the place felt lonely and insecure. The two men turned and eyed my flat. Alone because my wife was posted in another medical college in Darbhanga, I made tea and ate toast with butter. Every so often, I looked through the window, and I saw those two men observing my flat.

By 8.30 a.m., I was ready to go to my pathological lab located near Sadar Hospital. Outside my building, hurrying out, I passed the two men. After opening the garage and bringing out my scooter, when I turned around to start it, the two men were standing in front of my two-wheeler, blocking my path. “What do you want?” I asked. One of them, a middle-aged man wearing a kurta-pyjama and white skull cap, said, “Last Tuesday, you conducted a post mortem. You have written that he was murdered.” “I don't remember,” I said. “Every day, I conduct so many post mortems.” The fellow brought out a paper from his pocket. To my shock, it was the original post-mortem report written by me about the case of a twenty-five-year-old Muslim man who had died of stab wounds. In the column of opinion, apart from other things, I had written that the manner of death was homicidal.

My office staff or the constable who was supposed to carry the report to the police station must have given the report to these men. “How did you get this report?” I asked. The man in the skull cap told me that the officer in charge of the police station had given it to him to get it corrected. He joined his hands. “Sir, please correct the report. We will do whatever you want.” I wondered if he or his friends knew the meaning of “homicidal.” “Did anyone else tell you that the doctor has written 'murder'?” I asked. “No,” he said. I jumped at the answer. “You see, the police officer is making up stories to extract money from you.” They looked confused. Taking advantage of the situation, I started my scooter and sped away.

Years passed and I was transferred to Patna. One day, a lawyer from Munger, a district adjoining Bhagalpur, came to my residence in Patna and asked me if I would attend the summon of a case in which his senior was engaged from the defence side. I told him that I had not received any summon, but in case I did, I would go to court. I received the summon and attended the court. In the summon, only the name of the accused and S.T. No. (Session Trial number) is mentioned, so I couldn't figure out the case details. But the post-mortem report handed to me by the prosecution lawyer reminded me about the case, and I recalled the two men coming by boat sitting across from my flat in Bhagalpur for several hours and the disquieting interaction near my garage.

After the judge finished with bail matters, the case was called, and I presented my evidence. On external examination, I had found that the victim had two stab wounds, one in the left iliac fossa and the other on the lateral side of the left thigh in the upper region anteriorly. Both were identical externally, 1” x ¼”. The left lower extremity was grossly swollen, especially the thigh. On dissection, I noticed that the injury in iliac fossa had penetrated the abdominal cavity, the loop of the small intestine and had also punctured the posterior abdominal wall slightly, but there was no bleeding in the abdomen, which, except for at the margin of cut tissue, was almost bloodless. On dissecting the track of stab wound of left thigh, it was found to have punctured the upper part of thigh medially almost horizontally to a depth of about 6” below the inguinal ligament. It had pierced the femoral blood vessels, including the femoral artery. More than 2 litres of blood and blood clot was present in the tissue. Other than that, I detected nothing abnormal. There was no smell of alcohol either in the stomach or in the opening of the chest wall, or on cutting lungs.

On cross-examination, I responded that those were unlikely areas for suicidal stabs, especially the injury on the outer side of left thigh by a right-handed individual that too with a horizontal track. Even if we assumed that the victim had somehow managed to stab himself in the thigh like that, resultant bleeding, fall of blood pressure would have incapacitated him from stabbing himself again. But supposing he stabbed himself first in the abdomen and found that nothing happened, as there was no internal bleeding, the second stab was expected in some

more vital area like cutting of wrist or neck, or stab in chest instead of a nonvital area like thigh. No blood in the abdomen indicated he was stabbed in the thigh first and then in the abdomen. Moreover, there was no finding to support that he was drunk, as alleged in the Inquest report. Considering all the facts, the injuries were homicidal. Curious about the case, I talked with the prosecution lawyer outside the court, who asked a young man standing nearby to narrate what had happened. The young fellow told me that the victim was married to his elder sister for a fortnight just before his murder. On that fateful day, the victim's elder brother, a drunkard and ruffian, came home drunk and started throwing a tantrum. The younger brother, a newly married man, told his elder brother to behave decently. Angry, the elder brother said, "Oh, so now you have a voice. I'll silence it forever!" He stabbed his younger brother twice. He died within minutes. Later, the family took both the brothers to a hospital, where the victim was declared dead, and the elder brother was admitted for treatment of stab wounds made by family members.

The real story

The family told the doctor, police, and villagers that the younger brother celebrating his marriage had come home drunk, so the elder brother scolded him. In a rage, the younger brother stabbed him. However, when his younger brother saw blood, he came to his senses and screamed that he had no right to live after killing his elder brother and stabbed himself, which caused his death. The victim's brother-in-law told me that his sister, the victim's wife, was present in the house and had seen the killing of her husband and had also heard the father and others talking about the case. She knew that the post-mortem report said "murder", which is why the police were not willing to close the case. However, the police had closed the case ultimately. In fact, the elder brother married the widow, and the family believed the issue was behind them. Unfortunately, the new husband was not able to win the affection of the younger brother's wife. When she returned to her mother's place after a couple of years, she narrated the story and the conclusion reached by the doctor that the victim was murdered. She refused to go back to her marital home. Her family filed a petition in Patna High Court, which ordered the reinvestigation of the case, leading to the arrest and prosecution of the elder brother.

Sense of relief

While going out of the court campus, I met the same persons who had rowed to my flat at Bhagalpur. one of whom even now was wearing Pyjama, Kurta, with a white skull cap standing. He said, "Sir, you trapped us after all" I said, "No, I only stand for truth and speak for the dead" Sometime later when I went to Bhagalpur to attend another court summon, the public prosecutor told me that the accused was sentenced to ten years of rigorous imprisonment based on the wife's evidence and supported by my post-mortem report.

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INVITED CORRESPONDENCE: MEMOIRS OF A FORENSIC EXPERT

Journey of a forensic medicine expert

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Introduction

I and my other colleagues must be feeling privileged to be a forensic expert, but society and others do not know how much effort we had put in to achieve this goal, as it is a tedious job. There are two different related fields, i.e., Forensic medicine and Forensic science having the same motive, overlapping at multiple places but managed by two different sets of experts. It is important to realize that most of the criminal cases are solved only due to the inputs that are put in by the forensic experts. Forensic scientists give the police and the investigative agencies the evidence that is required to prove a certain point in the eyes of the law.

To understand what Forensic Medicine is, one needs to watch people waiting outside a hospital morgue. There will be policemen, magistrates and sometimes curious onlookers. Only a few realize the hardship and importance of work that a police surgeon is delegated. The morgues are usually relegated at the rear end of the hospital, and experts are constantly trying to find clues by examining the cadaver to learn the cause of death.

Those who have entered the field either by choice or because of interest, and have opted to work for the government, have earned the respect of the police and the judiciary by working with them in unravelling mysteries and ensuring justice to the aggrieved person.

Role of a Forensic medicine expert

A forensic medicine expert is not only asked to conduct autopsies but is also involved in clinical cases, in the form of management at causality, giving an opinion for drunkenness, age estimation, sexual assault, impotency, insanity and many more types of cases. So, it is wrong to say that forensic medicine expert is a doctor working only for dead bodies.

With the increasing awareness among public and law enforcement agencies, demand for this specialty is increasing. Any case of unnatural death requires an autopsy. In future, the number of accidents may come down but they will continue to happen and we need experts to perform autopsies. Only a few states in India have been permitted to conduct medico-legal autopsies in private medical colleges.

Forensic field and its applications play a vital role for mankind, not only by giving answers to the theory of mysteries but also plays a vital role in conferring justice to the aggrieved one. It is a vast word having a bundle of information adhered within it. Some say it is a synonym for “legal or related to courts” only, but it is not.

A person, who has achieved or is perusing the courses in the form of degree, diploma or DNB examination to become a forensic medicine expert, need to work much more than normal office hours. He may have to do shift duties or on call duties. He may have to work round the clock or also on Sundays and other gazette holidays.

After obtaining degrees, conducting plenty of medico-legal work including autopsies and attending several courts, one gets experienced. Any day in the career is giving you some form of teaching. At some stage, you have to give your opinion and re-opinion over the sensitive cases. Although no case is sensitive for us, it has been made sensitive by society or the media and presented to us in such a manner. In all these, one has to use only the scientific knowledge, without losing his cool. Since most of the autopsy reports can be challenged, leading the expert's opinion gets re-opined by other experts. So, we need to take care and take every effort, to think as per, best of our knowledge before giving any opinion.

You may have to work for higher investigating agencies like CBI, NHRC, etc. Sometimes you may have to appear in front of the media. Never give any opinion when the case is sub-judice and the opinion has already been given by your colleague. Try to give only your scientific knowledge. So, appearance in front of media should be in a guarded way.

We are also sometimes called forensic pathologists, as we provide vital expertise in suspected cases of homicides. Forensic pathologists specialize in performing post mortems for medical and legal purposes, to understand the cause and manner of death. In some countries, they also follow a case in crime scene, before giving evidence in criminal court. Although technically anyone with MBBS degree can perform an autopsy, a qualified surgeon's skill would enhance the quality of work.

Alongside, forensic pathologists share duties with their colleagues across cellular pathology, writing reports to share their findings and teaching trainees in their profession. While most of our work focuses on suspicious deaths, they are sometimes called on to interpret the injuries of live victims to assist criminal cases. They will also conduct autopsies in cases

of unexplained death.

As a forensic pathologist, your time will be split between mortuaries, hospitals, the courts, and, sometimes, crime scenes, which will require regular travel. You will mostly be working independently, with the support of police, judicial, laboratory, and mortuary staff or your colleagues. You will be in contact with other pathologists, as well as people in the criminal justice system, such as police and lawyers.

Senior forensic medicine experts routinely also act as a teacher. In a medical college, he has to impart training to undergraduate and postgraduate students. His additional job of giving training to paramedical staff, resident doctors, police officials and judiciary from time to time cannot be ignored. Our various sister branches or courses are there we have to impart training to their students also. They share their experiences and teach them about medical ethics. Sometimes we are also involved in the making of various types of curriculums for different courses, assessing other institutes, accrediting other institutes and universities for various types of courses.

As an expert, you need to provide scientific evidence for use in the court of law to support justice. A forensic medicine expert's meticulous documentation of injuries on the cadaver can help overturn a case.

What skills will I need?

Good communication skills – you'll need to prepare comprehensive technical reports on your findings but testify on them in court to a lay audience.

A flexible approach to working – the working life of a forensic pathologist is more unconventional as compared with other specialties. Every day will be different and travel may be required. The ability to cope under pressure – your working environment will be inherently linked with stressful life events, and you'll need to be prepared for the challenge of being cross-examined in Crown Court. One has to maintain balance in his all type of duties, i.e., teaching, clinical, medico-legal and court duties.

To keep our knowledge afresh, and all other newer developing techniques in the field, one has, to attend conferences, training programs, symposia and other lectures, for which we may have to travel for long distances. In all, we feel happy to work and give our best to mankind with our ability to work to deadlines. We try our best and we will do our best whether the condition favor us or not.

Tips for budding forensic experts:

- Be polite. Keep yourself cool. Do not lose your temper.
- Do not be stressed at any time while working.
- If any undue pressure comes, try to avoid it.
- Use only scientific knowledge to conclude any case.
- Dress modestly.
- Do not be over-enthusiastic.
- Do not criticize your colleagues.
- Avoid using adjectives to avoid exaggerations in your evidence in courts.
- Never miss any attendance in the court without any valid reason and that too without informing the court of law.
- Always conduct the postmortem or any other medico-legal work by yourself and do not depend/ rely upon the history given by the investigating officer or findings of others.
- Never give an opinion on the cases of others, until and unless asked by competent authorities.
- One should develop good communication skill
- Try to be flexible, depending upon the situation, but never with your findings or report.
- Respect your seniors and colleagues.
- Never discuss the case outside the court of law with anyone.
- Always be well prepared about the case, while going to court. You can discuss the case with your colleagues.

Apart from this, there are plenty of other tips, which we can share with our young forensic medicine experts experienced over longtime. Best of luck and wishing them their bright and stress less future.

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INVITED CORRESPONDENCE: MEMOIRS OF A FORENSIC EXPERT

My experience of a few interesting cases

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I am mentioning three interesting cases which may be helpful for budding forensic experts. All these unpublished cases were presented in various IAFM conferences.

Case 1: Determination of position of assailant in manual strangulation.

Gordon and Shapiro in their book "Forensic Medicine: A guide to principles" stated that shape of the fingernail markings helps to determine position of assailant in throttling. This statement may be true in some cases but I found out not in all cases.

I have shown through my presentation that fingernail abrasions adjacent to nail markings is important and not the shape of fingernail markings. The abraded area on the medial side of the fingernail marking over neck denotes that the assailant was standing in front of the victim. This area gets abraded because of the slipping of skin underneath the nails when pressure being applied. This paper was presented in 1972, Goa conference. Whenever I thought I would be presenting such a paper in front of such august members gave jitters to me.

At last, the day arrived and my pulse was racing like a wild horse when the chairman of this scientific session said that the paper was open for discussion. I was a novice in the field who completed P.G. just eight months before. For about 10 seconds no questions and then suddenly Prof. Heeresh Chandra called Dr. Preetam Patnani. Dr. Patnani asked me three questions which I answered, then he asked me to demonstrate over his neck and started coming towards me. Then suddenly his boss – Dr. C.A. Franklin told him "He is right, Sit down". He obediently followed. Further no questions asked. That day during dinner many colleagues congratulated me and later rewarded with member of executive member of IAFM.

My advice to the budding experts is not follow blindly whatever someone or whoever might say, examine each case meticulously and strict to your findings.

Case 2: "Time since death 280 years??"

In the campus of a new medical college while digging for a football field workers found some pieces of broken bones, one and half feet below the surface. After examining I concluded that they belonged to two female bodies. One was aged 11-13 years and the other >22 years. In that area, we occasionally found few copper articles and unearthed big earthen pots. Those found were shown to archeology department and they said that they belonged to Aurangzeb period. I enquired with elders of the neighboring villages and few descendants of the village. According to them, this site was a thriving village during the regime of Aurangzeb. Once, plague swept that area and majority of people there succumbed to it. The remaining few deserted village leaving some bodies in the open without burying. Over the years, the deserted village became dust and some buried, after that it became a barren land till the new medical college constructed. From this history, I concluded that the bones belonged to those who died in the plague. I wanted to confirm by C-14 test and approached Central Forensic Science Lab in Hyderabad. The officials there told me in the absence of bone marrow the test cannot be performed. All that time I had a nagging doubt how the parts of bones did not become dust over so many years. All the facts point out that somehow, they got preserved when other parts disintegrated.

Case 3: "Strangulation and survival for few hours"

On a fine day, a young women's body was found in open fields outside the town with a towel around her neck. Postmortem was done in the government hospital and hyoid bone was sent to me to know the fractured hyoid was antemortem or postmortem. At that time, I was Honorary Medicolegal expert and consultant appointed by the Karnataka govt., with jurisdiction over two districts. I submitted the bone for histopathological examination and concluded that fracture was antemortem. Another striking feature that, the fracture resulted for about five hours before her death. After few days, the investigating officer came to me, to clarify his doubts. One of them was, the time since death given by medical officer and the eyewitness were not coinciding. He continued and told the car drove away and he did not see the car number as it was night. The assailant might have thought that she was dead and actually she lost consciousness and dumped the body in open fields.

I told the investigating officer that she survived for about five hours after strangulation attempt and then died and thus to add five hours prior to time since death and see whether eyewitness time is coinciding.

Acknowledgement: I would like to take this opportunity to thank the thank the members of IAFM who supported me to be governing council (executive committee) of IAFM for about 16 years in various capacities. Thanks, are also due to them and members of SIMLA for honoring me with "Life Time Achievement Award"

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INVITED CORRESPONDENCE: MEMOIRS OF A FORENSIC EXPERT

Learn to Love and Practice with Love

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Recipient of the IAFM Fellowship in 2008

I took up MBBS course as a nominee of Government of Manipur and thus immediately after completion of the course I reported to the Government and was appointed as Medical Officer of TB Control Centre, Imphal on Ad-hoc basis for a term of six months. Neither advertisement for regular post of Medical Officer nor extension order for Ad-hoc service was there even after completion of the six months of the service. That time there was an advertisement for the post of Demonstrator (now Tutor) for the department of Forensic Medicine of my parent Institute i.e., RIMS, Imphal from where I had undergone my MBBS training. During my undergraduate days, Forensic Medicine was taught by Anatomist of RIMS and the District Medical Officer of Government of Manipur and therefore, I could not learn much about the subject. My family was in dire straits then and the heavy responsibility of providing necessities for my family fell on my inadequate shoulders. So, when the advertisement for the post of Demonstrator of Forensic Medicine came out, I applied without any delay and appeared the interview and got selected. Then I joined the service of RIMS, Imphal as Demonstrator of Forensic Medicine on 9th October 1980 thinking that it was truly the biggest blessing God gave me.

Learn to love Forensic Medicine as a subject

With the sole goal of learning Forensic Medicine, I was determined to follow Sir B.V. Subrahmanyam's teaching and guidance. Sir had joined the department as Professor & Head few months before me. He was a true guru, whom I requested to impart his teaching in Forensic Medicine. From Sir, I received first hand training about the examination of Medico-legal cases including autopsy and enjoyed the journey. He used to dissect the bodies by himself during autopsies and motivated us to follow the same. Sir bestowed trusted upon us to take classes and also conduct Medico-legal autopsies. I started studying Forensic Medicine as a fresh student and performed the duties allotted to me. I did not feel reluctant asking for help from Sir whenever I needed. Time went by for me learning about Forensic Medicine. After completing two- and half-year service in the department, I had developed a genuine interest in "her" and took the decision of joining postgraduate course in Forensic Medicine. I appeared entrance examination at Calcutta Medical College and got a seat to undergo MD course under Sir J. B. Mukherjee, who was Professor & Head of Upgraded department of Forensic Medicine, Calcutta Medical College, Kolkata as well as Principal of the College.

Those two years in the Upgraded department of Forensic Medicine, Calcutta Medical College, Kolkata was my honeymoon period with Forensic Medicine. During those two years Sir J. B. Mukherjee provided us (Myself, Dr. Rabindranath Karmakar, Dr. T. K. Bose & Dr. Indrajit Ray) opportunity to participate in taking undergraduate classes, examination of medico-legal cases including skeleton remains, crime scene examinations, drafting the reports and presentation of the cases and face cross examination by himself and other faculty members. Those were the good and hard times. The level of learning and tasks involved in the course was naturally high. We received both firm and hard treatment from Sir during that period and his teaching style worked for me as I really started loving my subject i.e., Forensic Medicine (earlier called Forensic & State Medicine).

After completing my PG course, I came back to RIMS, Imphal and handled different medico-legal cases independently as Ex-Officio Assistant Police Surgeon and then as Ex-Officio Police Surgeon of Government of Manipur.

Learn to love as Forensic expert

While handling medico-legal cases, we used to face many stress & strains particularly in Firearm injury cases with the allegation of "fake encounter after torture" or "allegation of fake encounter after sexual assault" and in cases of deaths of newly married women with the allegation of "suspension after killing just to present as a case of Hanging" etc. Sometimes we had to face very volatile situations arising between two armed parties (Police /Army & Underground /Revolutionaries). In such a high-stake job, personal values and principles and commitment to the roles and ethics delivered me success and upliftment of my dignity.

Whenever Courts need me, with great pleasure I used to reach the particular court on the particular day, time and place. It is a good practice to reach the court on time, and better if he/she reaches the court a little early before the designated time. During those days, the time mentioned was 10 am. It was a practice for me to reach court at 10 am or 5 minutes earlier. I sometimes found that the gates were found yet to be opened, or I was the first person to enter in the court complex. It felt good too when the Presiding Officers, Parties in the case and then Lawyers came after me. Reaching the courts on time or earlier became a practice for me in all summons. The Presiding Officers appreciated my gesture and asked all the concerned to

be in the court on time particularly when they summoned me.

The confidence and the experience that I carried and shared with the courts and the concerned officials were all due to the teachings and blessings of my Gurus. Way back in 1983, I started attending court for giving evidence. This was when I was undergoing the PG training at CMC, Kolkata. As a young person with little exposure to the profession, it was usual that I felt nervousness. My Gurus told me that the best medicine to avoid nervousness is “to remember that we are there to assist the court with our Professional knowledge”. During that early period of my life with Forensic Medicine the then Public Prosecutor helped me understanding questions and relevant systems through simplification. Whenever I attended court he had shown me my report prepared at the time of examination of the case and asked me to read and revise. This practice helped me refresh my memory and build confidence.

Remembering the principle

“Doctor is neither for the prosecution nor for defence but for the truth” if one conducts the examination personally & carefully with clean heart and mind and then prepare the report carefully recording all the positive findings and important negative findings (if any) and answer to the questions based on the report after listening the questions carefully, Courts appreciate such discipline and the value of our profession is increased.

Learn to love the profession

Stating the facts only, not opinions, unless asked for, will impress the court. When asked to give an opinion, one must give his/her opinion based only on scientific findings which were recorded in the report. The moments, I gave my opinion as “based on the facts & findings stated above, I opined that …….” I always felt proud of my profession. That moment I felt that my left hand is on the shoulder of my love i.e., Forensic Medicine and declaring that we will be together till my soul leaves my body. Our profession does not have any room for phrases such as "I think", "I imagine”. These phrases reflect the lack of care and commitment of the person in this profession.

I am thankful to all my Gurus, who instilled in me the priceless, everlasting principles and values. It is indeed my honour to reiterate these golden principles & values for future generations in the field: Doctor is neither for the prosecution nor for defence but for the truth. Avoid rough, rude or inhuman behavior with the relatives and parties. Listen and collect maximum information from different sources. Find out the possible questions which may come from different individuals after the examination and save them in own memory centre before entering in the examination room. Keep open the eyes, nose & ears but not the mouth. Remember the “Lockard's Principle of Exchange”. Remember that “No crime can be committed without leaving a clue”. Search the answers of the possible questions which were stored in memory centre by meticulous and thorough examination. Personally & carefully examine / dissect the body and collect & preserve trace evidences properly. Remember that “what is done today is to be judged tomorrow” and thus the report of the examination must be prepared carefully recording all the positive findings and important negative findings (if any). While writing the report one must remember that it should be a word picture and should help the reader to visualize what has been seen at autopsy/examination and how the conclusions have been arrived at. The opinion of a doctor may not be accepted as “GOSPEL TRUTH”. In other words, the opinion of an expert must be based on the facts and findings only.

Practice with Love

One should love their profession. He/she must be modest, sober, patience, prompt while in the profession. He/she must practice it with devotion to uphold the value of the profession in the society. It is necessary to perform the duty sincerely with clean heart and mind so that he/she can boldly say that “if it is white, it will be recorded as white, if it is black it will be recorded as black and opinion will be based on the finding only”. I hold these values closely. Doctor cannot do a miracle. We are human and we may err in our judgment. Err in judgment is not a crime in law. However, to maintain good rapport in the society one should love & respect his/her profession and perform his/her duty sincerely and carefully.

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INVITED CORRESPONDENCE: MEMOIRS OF A FORENSIC EXPERT

Remembering Mentors

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At the fag of my carrier when I am preparing to hang my pen, mic and knife, I want to remember and pay homage to two of my mentors.

Dr. R.M. Jhala

Most of the present generation FMT (Forensic Medicine and Toxicology) experts may not be aware of his name. In fact, he worked and earned his name and fame even before the birth of our association that is IAFM. I may refresh your memories. There happened a very famous and talked about case in erstwhile Bombay- the Prem Ahuja Murder case. (K.M. Nanavati v/s State of Maharashtra) On this case few movies have also been made; 'Ye Raste hai Pyar ke' (1963), Achanak (1973), and recently 'Rustam' (2016). Also, the web series The Verdict. Dr. R.M. Jhala was working as police surgeon Bombay when this incident happened and he was the person who did the autopsy and gave the witness.

He was the first one after Modi, who came up with a book on Medical Jurisprudence. He was probably the first one among the forensic fraternity, if you want to say so, to come up with a book on disability assessment. He worked in Bombay. When states were restructured, he opted for Gujarat state and worked in Gujarat state services. After retirement he was settled in Baroda. It was Baroda where I first met him. As we know there was always scarcity of examiners in FMT, he would be appointed as internal examiners and I would join him as one of the co examiners. This process went on for my fortune for many times. He was a civilised person and had Victorian English at his command, also a learned man in Sanskrit as well. He would quote phrases in English as well as in Sanskrit during the sessions of viva and in between. During this period, I was young, raw and inexperienced while there was a person who was senior, experienced, royal and author. The age difference between two of us could be in the range of 25 to 30 years I interacted with him and learnt few lessons of life of a scientist, teacher and author as well. I learnt many phrases from him. I quote two of them. One, **'When question is short, answer is long'** and other one **'Listen the question, understand it, think over it and then answer'.** Since then, I am using these phrases in many of my classes and lectures on various forums**.**

I quote two instances of interaction which highlights his qualities as an author.

1) While going through the book I stuck at point where the word **"must be"** be written. From my knowledge I knew the phrase in forensic medicine-Seldom say never; seldom say always. So, I dared and asked about it to him in one of the meetings. He said, if I have written it, I must be having a reference. And to my surprise very next day he showed me the textbook of Medical Jurisprudence by none other than Alfred Swine Taylor.

   The point here was not only he did not feel offended when such a question was asked by a person who was about twenty years junior to him in all aspects of expertise in the subject. Also, his filing system was such that not only he retrieved the reference but did not forget to bring it and show to me very next day. This becomes very important in the context when other stalwarts (more than one on more than one occasions) of the subject very senior to me but reasonably junior to Dr Jhala had given me cold shoulder by saying you are too junior to ask me this question or avoided the question on one pretext and other and behaved in such a manner that I could not dare to discuss any scientific matter with any of those since then.

2) In his book at one place, he had quoted a Calcutta High Court judgement in relation to disposal of unclaimed viscera lying with the morgue[1]. This was very important for me as in my department also viscera bottled were piled up since many years and no scientific solution was in sight. I thought that this judgement would give me an authentic legal support to destroy the viscera after period of preservation quoted in the judgement. I wrote a letter to him. I did not get any reply for many days. I almost forgot the matter. And then one fine morning after about six months, I received an envelope from Dr Jhala, which contained one inland letter and one note. The inland letter was written by one Supreme Court lawyer and addressed to Dr. Jhala. It was in relation to my query about the quoted Calcutta High Judgement. The lawyer had written that he has searched the judgement within his resources but could not find it. Further, he said that I am afraid in next edition of the book we will have to remove the reference. The author did it in the next edition of the book[2].

This lawyer was the person who edited the case law part of the

book. It can very well retrospectively interpreted that my query was sent by Dr. Jhala to the concerned lawyer and as soon as he got the reply, he forwarded it to me. In this incident there were so many lessons for me about the authorship, literary honesty and plagiarism. This is more relevant in modern era of copy paste when textbooks on forensic medicine are mushrooming without authorship accountability.

Dr. C.A. Franklin

What a name! Christopher Alexander Franklin. Can name be more 'Royal' than this? I have not come across. I am lucky enough to meet and learn many things from Prof Franklin. With him also I met as a co examiner first in Surat and then many times in Surat as well as in Bombay. As there were no internal examiners during those days in Govt Medical College, Surat Dr. Franklin would act as an internal examiner. The technicalities of system of examination I learnt from him. He would fill up not only his technical forms but mine also about the examination. In the evenings we would be free and have ample time. I would accompany him after dinner for a walk and then he would narrate many of his experiences as police surgeon, Bombay. These instances on occasions would have his shortcomings also still he would not hesitate to narrate.

On one such occasion he told story of one of his contemporaries who would tell to him boosting that because of his evidence person was convicted. Then in a lighter vain Dr. Franklin asked him dear friend please also narrate one or two instances where due to your evidence an innocent person was acquitted. There were none. I learnt the lesson-as an expert I am not the witness of prosecution but of the Court. Here also I remind the audience that Dr Franklin was too senior by age and experience and rank and what not! It was Franklin's frankness.

When he invited me Mumbai as an examiner and learnt that I would be visiting Mumbai first time he wrote me a meticulously detailed letter how to reach to the Grant Medical College from airport onward. He introduced me to transparent ball point pen (during those days it was new) saying that this has an advantage that we know when the refill is going to be changed. He would keep one net plastic collapsible bag with him in his pocket. Once we were walking down the road, he saw something, purchased it and took out that bag from his pocket. That was the way tackling the vagaries of Mumbai life. I learnt from him to read newspapers from forensic point of view and cut the relevant news on the same evening otherwise it is likely that paper would be misplaced. I am following it since then. He had a fatherly affection on me. On many occasions he would give me photocopies of one article or other which has read.

Once it happened that I was working as co examiner in one of the medical colleges in Navi Mumbai. He asked me my place of stay (which was somewhere in Navi Mumbai) and my plan of return journey. When he learnt that I would be catching Shatabdi Express from Bombay Central at 5 A.M. He said it would be near impossible to do this from Navi Mumbai where I was staying. He took me to his home in Bandra reclamation for preceding night. At three o'clock in the night he woke me up with a cup of tea ready. When I was ready, he took me downstairs negotiated with taxiwala and booked a taxi for me to Bombay central. That was a tender loving care from a stalwart in Forensic Medicine and retd Police Surgeon, Bombay for a junior co examiner. It is no over emphasis when I say that there are many lessons in it for me and the grand aspect of personality of Prof Franklin. Dr. Prof C.A. Franklin was royalty changed into 'Simplicity Personified'.

I am indebted to both of these gentlemen. I salute them.

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INVITED CORRESPONDENCE: MEMOIRS OF A FORENSIC EXPERT

My Mentor

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Recipient of the IAFM Fellowship in 2018
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After M.B.B.S, I had many options for deciding about my future earlier. I was deciding about my future career. I was interested in doing something different from other lady doctors. So, I selected F.M.T as a lifetime career. I was the first fulltime lecturer in the F.M.T in the Medical College of Bombay Municipal Corporation. Later on, I realized that I was the first lady doctor to choose F.M.T as lifetime career. Most of the lay people are under the belief that doctors working in the department of F.M.T do only postmortem examination. They are not aware that equally important work for Forensic doctors is in Clinical Forensic Medicine.

It is said that 'The dead do tell tales.' We doctor in F.M.T really learn a lot by doing post-mortem examination. We always have respect for the dead bodies. In media the word 'शवविच्छेदन' is commonly used. Whenever possible, I used the word 'शवचिकित्सा' and tried to spread the word.

Shortage of staff was a common problem faced by my medical college in the past, when there was no availability of M.D.(FMT) or D.F.M.

Experience 1

I had an unforgettable day in my career when one morning we had to face 27 dead bodies. I had only one lecturer in the department. We managed the task and worked the whole day without any break. After having worked in F.M.T for 35 years, I was benefited in many ways for personality development. I learnt about keeping personal and professional life separate from each other. I learnt about time management and that helped me a lot when I obtained M.D. and LL. B degrees after marriage, while shouldering multitude of professional and domestic responsibilities.

Having seen many cases of accidental, suicidal, homicidal and unexpected deaths, deaths under unforeseen circumstances, I realized that, death can attack anyone, anywhere, anytime. So, I realized the value of life and being alive.

Experience 2

In one case a prostitute delivered a baby boy in our hospital. Prostitute usually do not like a son being born. They wanted a baby girl. Usually after normal delivery, the woman is discharged within 3-4 days. The day she was to be discharged she started shouting that the baby is not responding. The obstetrician suspected some foul play and the body was sent for autopsy. I found that there was congestion around the nose and mouth. There were hemorrhages on the upper and lower lip. The women later-on admitted that she had pressed a pillow on the nose and mouth of the baby.

Experience 3

While performing autopsy on the body of a young man it was seen that there were five wounds of bullet entry on the posterior aspect of the body on upper and lower part of the back. After opening the body, five bullets were found in the body. Out of those bullets, three were of one type and two were different in size, shape and weight. So, I could inform the investigating officer that they had come from two different fire-arms. Later on, I was informed that two persons were arrested.

Conclusion

Though life is journey between birth and death, no one should look at death as - the destination of journey of life. I thought of making my life 'A Journey of Joy'(आनंदयात्रा). I tried to use every moment of life in a nice way. I took interest in creative art, craft, music, cookery etc. I shared my joy with family, friends and society and all of them are my co-travelers in the 'Journey of Joy'. I wish the subject of F.M.T and I.A.F.M. bright future.

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