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Members of the Executive Committee of the IAFM attending the PAFMATCON 2016

Prof. Kalpesh Shah, President IAFM, being felicitated as the Chief Guest of the PAFMATCON 2016

Prof Kalpesh Shah, Chief Guest of the Occasion addressing the audience

Ex Editor JIAFM, Prof Mukesh Yadav, being felicitated by the Present Joint Editor Prof Manish Nigam with Prof Shiv Kocchar, E C member & Prof Aditya Sharma looking on

The JIAFM issue 2, being released during the Validectory Function

The President , General Secretary and the rest of the EC members of the IAFM, after the EC meet, held at GMCH, Chandigarh

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From Editor's Desk

JIAFM
A Quarterly Publication
Volume 38, Number 3, July September, 2016

Dear friends,

The **IIIrd issue of the Journal** of our Academy, the JIAFM is now in your hands. Due to certain technical problems, the most important being the delay in getting the corrected versions back from the authors - there was delay in bringing outthis issue. This delay has now been taken care of and from now on you will get the JIAFM online, regularly.

Last year, we had an important Act - **The Juvenile Justice (Care & Protection of Children) Act, 2015[JJA].** We thought that we should bring this Act to your knowledge as every medical and paramedical professional, as part of medical jurisprudence, must have sufficient knowledge of law in order to avoid conflicts against law during the practice of his/her profession. For this he/she has to be familiar with various Acts, rules & regulations of the land. JJA is primarily a law for the children in India. It was first enacted in 2000, followed by amendment in 2006 and now the new form of 2015, with lot of changes and inclusions. Main changes are: "**Judicial Waiver System,**" which allows that the juveniles, in certain heinous offences like rape and murder, be dealt with in the adult criminal justice system and to punish them as adults. This is for the first time in India's history that such a provision has been prescribed. The Act mandates setting up Juvenile Justice Boards and Child Welfare Committees in every district with at least one-woman member each. The Act introduces foster care in India. In adoption, disabled children and children of physically and financially incapable persons would be given priority. Parents giving up their child for adoption will get 3 months to reconsider and it also lays down the eligibility criteria for adoptive parents. The Act has been enacted with "the best interest of the children and their rehabilitation only" in the eyes of the law.

Jai Hind & Long Live IAFM!

Dr. Dasari Harish
Editor, JIAFM

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Editorial

Computerization of Medico-Legal Reports & Video-Conferencing for Giving Evidence: G M C H, Chandigarh, Experience

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Editor - Journal of Indian Academy of Forensic Medicine.
(2016 - 2019)

Abstract:

In Crl. Misc. No. M-19820 of 2011,[Rajpal @ Labh Singh & Anr. Vs State of Haryana] vide order dated 6th July 2011, Mr. Justice Rajesh Bindal, Honorable Justice, Punjab & Haryana High Court, decreed that all medico-legal work in the states of Punjab, Haryana and the UT Chandigarh shall be computer typed from 1st September 2011. In compliance of this order, the department of Forensic Medicine & Toxicology, GMCH, Chandigarh, indigenously developed fill-able Microsoft Word Templates of all the medico-legal performas, all the forms for forwarding various samples and specimens to different laboratories, subsequent opinion forms, etc. and started using them.

Since 01.09.2011, all the medico-legal work being done by the department was computer typed. The NIC Haryana developed the Med LEaPR software, based on the Medico-legal Manual of the Haryana state, in collaboration with the faculty of GMCH & PGIMER, Chandigarh; DHS Haryana and Chandigarh and Medical Officers from the three states. Since 7th January 2013, the department started using the MedLEaPR software for online preparation of the PMRs & MLRs.

Hon'ble Punjab & Haryana High court, under the orders of Justice Hemant Gupta [State Of Punjab vs Mohinder Singh on 16th April, 2013 CRM No.18934 of 2013]decided that video-conferencing be started in the states & UT for recording evidence. In compliance of these orders, video-conferencing was started in GMCH, Chandigarh from 25th May 2015, after undergoing a number of trial runs and fine-tuning the equipment and the process.

Key words: Computerization, Medico-legal, Word Templates, Med LE aPR, Software, NIC

Computerisation of Medicolegal work:

Way back in 2008, a Division Bench of the P & H High Court, noticing spelling mistakes in the medical evidence given by the Doctors, gave the following directions:[1]

"In view of the aforesaid, in order to ensure that medical evidence is placed on Court records in correct and clear terms and also that Presiding Officers of Courts do not take it lightly, we direct the Registrar (Judicial) to issue instructions to Secretaries (Health) and Director General/Directors (Health Services), and Presiding Officers of Courts in Punjab, Haryana and U.T. Chandigarh, that at the time of recording of evidence of Doctors, who are produced as expert witnesses, Courts shall ask them (Medical Doctors etc.) to submit medical reports on affidavit in clear terms with correct spelling."

In pursuance of above directions, the Registrar (Rules) issued a communication dated 28.08.2008 to the effect that requisite affidavits are required to be prepared by the Doctors, who appear as expert witnesses, as the original records always remain with them, which they can use/refer to, while preparing their affidavits.[2]

Again, in 2009, the Division Bench of Mr. Justice Satish Kumar Mittal and Mr. Justice M. Jeyapaul had directed the issuance of suitable instructions "to the doctors to prepare documents --- medico-legal reports, bed head sheets and post-mortem reports --- legibly and scrupulously, as those documents are exhibited to decide the fate of a case before the court of law". This was so because the court, the prosecution and the defence face problems in appreciating the various medico-legal reports during the trial as these are usually penned down in illegible handwriting.[1]

In 2011, Mr. Justice Rajesh Bindal decreed that all medico-legal work in the states of Punjab, Haryana and the UT Chandigarh shall be computer typed from 1st September 2011.[3] This was the genesis of computersation

of all medico-legal work in the states of Punjab, Haryana and the UT, Chandigarh.

The state of Punjab and UT, Chandigarh did not have any Medico-legal Manual, but Haryana had gazette notified its Manual recently.[4] The onus of developing a software for the said computerisation, hence, fell on the National Informatics Centre (NIC), Haryana. A software developing team was constituted by the P& H High Court on 13.10.2011. Various meetings were held with the doctors of Post Graduate Institute of Medical Education and Research (PGIMER), Government Multi Speciality Hospital (GMSH - 16), Government Medical College and Hospital (GMCH), Chandigarh; representatives from hospitals and medical colleges of Punjab & Haryana; and the NIC Punjab, Haryana and UT Chandigarh to develop a viable software for the said purpose and to whet the same. Trial runs were made for the software, problems that cropped up were discussed, solutions found; and finally, on 3r December, 2012, the Hon'ble P& H High Court ordered that all Medico-legal work in the states of Punjab, Haryana and UT Chandigarh would be henceforth done, using the "Med LEaPR" software.

Meanwhile, since 1st September 2011, the Department of Forensic Medicine & Toxicology, GMCH, Chandigarh, started computer typing all medicolegal work by using indigenously prepared "word templates" for all the performas needed - MLRs, PMRs, Age estimation, etc. From 1st September to 31st October 2011, the department issued hand written reports with a note in the end - "I.O. to collect computer typed copy of the same within 1 week". From 1st November onwards, the department completely did away with hand-written reports and did all the medicolegal work on computers only. The NIC software was brought in use by the department from 7th January 2013. Since then, the software alone is being used, however, whenever there is a connectivity problem, the templates were put to use.

Each doctor is given a VPN (Virtual Private Network) Pin and a password. Once, the doctors logs into the system for the first time, he changes the pin. In GMCH, the doctor is given another Pin and a Password to log in to the Internet provided by the institute. The said doctor uses the pins to log in to the net, the software, prepares the Report online. Once the report is finalized, he/ she is to "Freeze" the report. Once "freezed", no one, not even he himself, can make any alterations to the Report. He then takes the requisite prints of the same, gets signatures of the concerned people at the appropriate places and hands over the hard copies to the police, the various labs, if needed, and keeps a copy with the department. The soft copy is stored in the NIC server of the respective states/ UT.

The Head of the department is given two Pin numbers by the NIC - one for his personal use to fill in the reports of the cases done by him and one, as the administrator, to depute some other doctor to complete the medico-legal formalities and prepare subsequent opinion documents in those cases, where the doctor who prepared the original report had left the department.

The Med LEaPR software still has certain problems:

Foreign National's registration details are difficult to enter in the given format

In case of deceased from states like Bihar, UP, Rajasthan, etc, districts as mentioned by relatives do not match with districts given in drop-down box of the software.System gets automatically logged off sometimes, while noting injuries & all injuries noted till that time disapp ear and have to be re-written.

Injuries like ligature mark, burn injuries, etc cannot be marked using software and have to be marked manually on the blank diagram sheet - these will not reflect in copy of report on website of Med LEaPR and may raise unnecessary issues during evidence recording in the courts

Injury sheet has a dental chart on which details as provided in accompanying key cannot be marked & hence has no use at all.However, even with these problems, the three states of Punjab, Haryana and UT, Chandigarh, have been using this software successfully for the last 3 years.

Videoconferencing for Evidence in Courts:

On 16th April 2012, the Division Bench of Punjab & Haryana High Court, presided by Mr Justice Hemant Gupta & Mr. Justice Fateh Deep Singh decided that in furtherance to the concept of e-Courts, evidence recording for the doctors in various courts of Punjab, Haryana and UT, Chandigarh will be through videoconferencing.[2] In compliance to this, the concerned doctors of the PGIMER, GMSH 16 & GMCH, Chandigarh, met under the Chairpersonship of the DHS, UT, Chandigarh and unanimously agreed that:

- All the parties have no objection in principle for the Video Conferencing for evidence.

- Every institution has an IT Department and hence it would be more practical and less cumbersome if every institute is directed to have their own Video Conferencing Centre.
- A time slot between 11.00 AM to 1.00 PM on working days may be kept fixed for Video Conferencing.
- NIC should be directed to provide Digital Signatures & any other technical assistance which may be required from time to time.

A committee for the said purpose was constituted in the GMCH with the undersigned as the Chairperson on 16th October, 2014. Directions were received on 30. 03. 2015 from the Registrar General, (Computerisation) P & H High Court, to establish a videoconferencing facility for the purpose of giving evidence in courts in Punjab & Haryana through the Registrar Computerisation. Requisite equipment was sourced, put in place, tested, configured, retested, etc, till it was given a go ahead by the official from the NIC, Chandigarh, the Registrar's office (computerisation); who also helped in the whole process. Email ids & web addresses of various courts in all 3 target areas – Pb, Hry. & Chd. were given by Registrar's office. Video-conferencing was started in GMCH from 25th May 2015. SOPs were framed in May 2015, notified in August 2015, after successful running of the facility. Initially, the courts in the triciti es - Mohali, Panchkula and Chandigarh were not included as the target courts; they were included in October 2015.The following tables **(Table 1, 2 & 3)** give an overview of the videoconferencing in the 1st 6 months for various departments of the GMCH, month-wise and state-wise distribution of cases, respectively. Till date, it has been noticed that the courts in Haryana honour the videoconferencing more than either Punjab or Chandigarh. (Table 3) On an average, 3 - 4 summonses were being sent for videoconferencing to the various courts till July 2016, but of late, the number has increased two fold.

History:

In a path-breaking development, the Hon'ble Supreme Court, in April 2003,[5] allowed videoconferencing for the purpose of giving evidence in courts. It held that the recording of evidence by way of video conferencing might be done in cases where the attendance of the witness cannot be ensured without delay, expense and inconvenience. It was also held by the Apex court that recording of evidence by video conferencing was a 'procedure established by law' under Article 21 of the Constitution and did not violate the rights of the accused.

The judgment relates to a case in which a US based doctor had opined against operation of a cancer patient through video conferencing. Ignoring the advice, two Indian doctors operated on the lady, who later passed away. The patient's family went to court against the doctors. However, the US based doctor, Ernest Greenberg, refused to come to India, but expressed willingness to give evidence through video conferencing. But the Bombay high court did not allow the trial court to go ahead citing Section 273 Cr PC, which lays down the procedure for recording evidence.

The husband of the deceased and the Maharashtra government appealed against the High Court order in the Supreme Court. Speaking for the bench, Justice Variava said, "In cases where the attendance of a witness cannot be procured without an amount of delay, expense or inconvenience, the court could consider issuing a commission to record evidence by way of video conferencing."

"Normally a commission would involve recording of evidence at the place where the witness is. However, advancement in science and technology has now made it possible to record such evidence by way of video conferencing in the town/city where the court is," he said. Referring to the chances of witness abusing the trial judge during video conferencing, the apex court said, "As a matter of prudence, evidence by videoconferencing in open court should be accepted only if the witness is in a country which has an extradition treaty and under whose laws contempt of court and perjury are punishable."

The Hon'ble Court said that though Sec 273 Cr PC mandates that evidence shall be recorded in the presence of accused, video conferencing is not contrary to this procedure as the counsel of the accused will also be present for cross questioning. It has emphasized that advancements in science and technology are here to stay and if the Courts do not go with such advancement, then it is a retrogatory step..[6]

In video conferencing both persons are present in the presence of each other and the submissions of each counsel can be seen as though actually happening in your presence. Hence, it is clear that as long as the accused or the counsel are present when the evidence is being recorded by video conferencing that evidence is being recorded in the presence of the accused and hence would fully meet the requirement of Section 273 Cr PC. Hence, recording of such evidence would be as per the procedure established by the law.[7]

The Government of India has initiated a scheme National Medical Colleges Networking through which 41 medical colleges will be provided a fast broad band networking. The National Medical Colleges Networking (NMCN) will use the already present National Knowledge Networking (NKN) for the purposes of e-Education, e-Healthcare under NMCN. The participant medical colleges will be provided with latest I. T. equipments for video conferencing, tele-consultation, tele-followup, tele-monitoring, tele-CME etc. This will also be useful for tele-conferencing in the courts through video conferencing as it has brought huge benefits to the participating colleges. e-Court Mission Mode Project (MMP), launched in 2008, is being implemented by the Department of Justice throughout the country which envisages video conferencing at the level of district courts for the purposes of giving evidence through NMCN or NIC, son as to speed up the Justice process through e-Justice.[8]

Benefits of video-conferencing for court evidence:

Patients - Doctors will only be away for about 15 to 20 minutes as against 6 to 8 hours. Even for evidence in a local court in Chandigarh, which is only 6 Kms from GMCH, the average time taken for travel and evidence giving is of the tune of 2 to 3 hours. Doctors will therefore be available for the patients at all times, increasing the quality of health care**. [Table 4]**

Courts: - Many a times, because of professional commitments, doctors would not be in a position to attend courts, thereby increasing the pendency of cases. With video-conferencing, since the doctor has not to leave the institute and can be back in a very short time, case resolution would be faster.

Doctors: - They will be saved of the harassment of travelling to far places, wait for prolonged periods to give evidence. Many a times, they come to know of the Judges leave only after reaching the court. They can therefore be profitably employed for patient care.

Hospitals: - The ever present acute shortage of doctors can be somewhat resolved as the doctors will not be on forced leave. Pendency of the OPD, OT lists, etc can be reduced.

Health Care System: - In GMCH, we were able to save 490 man working days in an year. This appreciably improved the quality of health care being provided by the hospital. [Table 4]

State: - The government launched these projects in tune with the developments in technology and it would also reap benefits in the way of stemming financial drain through TA/ DA payments, improved health care delivery system, reduced fuel consumption, etc.

Society at large: - All the above benefits would make the society a better and a healthier place to live. With the corresponding less use of motorised vehicles, emission of fumes have decreased and 'carbon points/ credits' have also been gained for the society.

Conclusion:

The society and the government has to keep pace with the developments in Science and Technology, as already stated by the Hon'ble Supreme Court, way back in 1974. Keeping pace with such developments, the Government launched the e-Courts (MMP) in 2008. Many medical colleges in the country have been connected with either the NMCN or NKN networking through the NIC. The medical fraternity should make use of all these facilities and initiate the same in their respective areas. This will go a long way in making e-Governance a reality in our country.

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Table.1: Dept.- wise Distribution of cases for 7 months [July 2015 to Jan 2016]

S.No	Month	Department Wise Distribution							
		Orthopedics		General Surgery		Forensic Medicine		Other Deptts.	
		Summons received	V C done	Summons received	V C done	Summons received	V C done	Summons received	V C Done
1	July	53	39	38	8	10	3	6	1
2	August	50	32	40	14	18	6	8	1
3	September	84	66	64	17	17	9	8	3
4	October	68	43	56	17	11	4	9	1
5	November	52	28	45	25	12	4	15	6
6	December	38	22	34	14	18	7	12	3
7	January	30	21	41	18	29	11	9	5
Total		370	251 (68.0)	318	113 (35.5)	115	44 (38.2)	67	20 (29.9)

Table.2: Month wise distribution of Video-conferencing for Evidence in courts[12 months]

S. No.	Month	Summons Received	Video-conferencing Done	
			No.	%
1	July	107	33	30.8
2	Aug	115	41	35.7
3	Sept	167	43	25.8
4	Oct	143	43	30.0
5	Nov	124	53	42.7
6	Dec	101	39	38.6
7	Jan	106	52	49.1
8	Feb	128	71	55.5
9	March	130	64	49.2
10	April	115	49	42.6
11	May	133	46	34.6
12	June	52	17	32.7
Total		1421	551	39.1

Table. 3: State-wise distribution of Video-conferencing for Evidence in courts

S. No	Month	Punjab		Haryana		Chandigarh	
		Summons Received	Video conferencing done	Summons Received	Video conferencing done	Summons Received	Video conferencing done
1.	July	34	11	44	15	29	07
2.	Aug	35	13	47	24	33	04
3.	Sept	53	12	64	31	50	00
4.	Oct	39	13	57	27	47	03
5.	Nov	38	16	38	21	48	16
6.	Dec	38	14	33	17	30	08
7.	Jan	47	24	30	16	29	12
8.	Feb	59	30	36	21	33	20
9.	March	45	21	34	16	51	27
10.	April	37	21	28	11	50	17
11.	May	32	09	42	12	59	25
12.	June	18	08	16	01	18	08
	Total	475	192 [40.2%]	469	212 [45.2%]	477	147 [30.8%]

Table. 4: Working Days saved in 1 year

Month	Video Conferencing conducted	Approx. Time Saved in going to Courts (Punjab, Haryana, Chandigarh) and give evidence
July 2015 to June 2016	551	Avg. 8 hours per summons [as get 1day court duty] 551 x 8 hours = 4408 hours 490 working days [taking 1working day → 9 hrs]

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Original Research Paper

A Prospective Study on the Magnitude, Pattern and Cause of Female Deaths Due to Burn Injuries

[1]Biswadeep Paul, [2]Amarjyoti Patowary

Abstract

Deaths due to burn injuries assume even more importance when they involve females as they are more exposed to pyrogenic incidents compared to males, due to the length of time they devote to the kitchen and household chores. A woman may also be compelled to end her life at the altar of dowry by self-immolation, interpersonal and other domestic violence. To know the magnitude, pattern and cause of such deaths, we conducted an autopsy based study including a newer technique the 4th incision or the cosmetic incision, on 242 cases of female deaths due to burn injuries in the Mortuary of Department of Forensic Medicine & Toxicology, Gauhati Medical College & Hospital, Guwahati during the year 2014. Our studies revealed that majority of the females were Hindus (66.9%), highest in the age group 21 - 30 years (42.1%). Majority of the victims were married (74%), housewives (57.8%) and belonged to rural area (73.9%). Alleged accidental nature of burn injuries (81.8%) from kerosene lamp (41.7%), topped the list. Death following shock was the most common (53%). Based on the outcome from this study, preventive measures can be formulated for better management of the cases.

Key Words: Female deaths; Burn injuries; Autopsy; 4th incision; Preventive measures

Introduction:

Burns are defined as injuries produced by the application of dry heat such as flame, radiant heat or some heated solid substances like metal or glass to the surface of the body resulting in tissue destruction, multisystem involvement, ulcers, deformities and deaths.[1-3]

Deaths due to burn injuries are an enigma in themselves and female deaths assume significance manifold in the current scenario of female foeticides, dowry deaths and an already depleting fairer sex ratio in our country. Females are 3 times more exposed to burn incidents compared to males[4] and their delicate nature makes themr even more vulnerable.

According to NCRB data (2010), out of total unnatural deaths due to burn injuries, 66.6% were females as compared to 33.4% males and 8.8% of these female deaths were suicides committed by self- immolation and 1 in every 5 victims were housewives.

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It is the 3rd commonest means adopted for suicide after poisoning and hanging. In India 45 female deaths occur every day due to burn injuries.[4, 5]

The larger use of crude fuel, wood fire and ill maintained cooking apparatuses being used negligently by uneducated women folk have been instrumental in causing higher accidental fatalities.[6] The manner of dressing and dress materials also has proved detrimental in the pattern and outcome of burn injuries.

As the etiological factors of burn injuries vary considerably in our huge and diversely composed population, a careful analysis of the epidemiological features is the need of the hour before successful treatment modalities and sound prevention programme can be planned and implemented to prevent death and deformity following burns.

Aims & Objectives:

1. To study mode, manner & means of fatal burn injuries in female victims.
2. To analyze the pattern and trends prevalent in the society.
3. To compile epidemiological information, analyze the magnitude and impact of burn injury.
4. To establish consistency of facts and data.
5. To suggest remedial measures.

Materials and Methods:

The study was a prospective study undertaken in the Department of Forensic Medicine & Toxicology, Gauhati Medical College, which included all the cases of female deaths due to burn injuries that came to the Mortuary for autopsy during the study period of one year from 1st January 2014 to 31st December, 2014. Data of the cases regarding age, religion, marital status and cause of death with its manner etc. were recorded from police inquest, autopsy reports, laboratory investigations and interview of the attendants and eyewitnesses accompanying the dead body and detailed autopsy examination performed including a newer technique - 4th incision and subsequently analyzed.

Observation and Results:

During the study period, a total of 3,020 autopsies were carried out and burn injuries comprised 334 (11.1%) of the total cases, with 242 (72.5%) female and 92 (27.5%) male fatalities. **(Table 1)**

Discussion:

In our study, most of the incidents of burn injury deaths peaked towards winter months similar to the study of Memchoubi and Nabachandra.[7] Majority of the victims were between 21-30 years of age, which is consistent with findings of Buchade, et al and Gupta, et al.[8,9] Most of the female victims belonged to the Hindu community.[10,11]

A large chunk of victims belonged to rural areas similar to findings of Vaghela, et al.[12] Majority of the victims were housewives and were either matriculate or with lesser level of education. A higher percentage of incidents occurred inside the house especially inside kitchens which is consistent with the study of Das and Vaghela et al.[10,12] Majority of the women were wearing loose fitting cotton garments at the time of incident.[9,13]

Kerosene lamp happened to be the source of fire in maximum cases which is consistent with findings of Das.[10] Maximum victims were married similar to the findings of Vaghela, et al.[12] In this study most of injuries were accidental in nature, as seen in other previous studies.[8,10,12]

Family disputes, pertaining to dowry deaths including failure in love accounted for the highest number of cases of suicides and homicides in our study. In 2010, according to NCRB, a total of 8,391 and in 2011, 8,618 dowry deaths were reported across India and 121 cases were in Assam.[4] NCRB in 2011 revealed that a crime against a women is committed every 3 minutes, a dowry death occurs every 77 minutes and 1 case of cruelty committed by either the husband or relative of the victim.[5]

Most of the victims had burn injuries over 61-70% of total body surface area which was consistent with findings of Buchade, et al.[8] Shock was found to be the most common cause of death as also reported by Das.[10] Majority of the patients received hospital treatment as has been reported by Memchoubi and Nabachandra.[7]

Application of 4th incision (Cosmetic Incision):

In burn injury cases, bruises or concurrent injuries are not usually visualized especially over back of chest and abdomen and neck by conventional methods, as the surface is covered by burn or masked by coexisting wound infection. So, 4th incision technique was applied for the detection of such masked injuries.[14,15] In alleged suicides and homicides, 4th incision was applied and contusions in the deeper layers could be detected in 7 (23.3%) cases of our study. **(Fig. 1&2)**

Suggestions:

1. Education and broadening of the thought process of the society in general and individuals in particular with introduction and promotion of less inflammable fabrics and safer cooking appliances.
2. Proper information and guidance to the females regarding usage and maintenance of inflammable household appliances and articles.
3. Identification of populations at risk, description of structural determinants from existing data sources, fformulation and implementation of stringent laws by the Government against dowry demands and deaths, is the need of the hour.

Conclusion:

Female deaths due to burn injuries add to the loss of precious human resource which is preventable through implementation of more aggressive, cost effective and sustainable prevention programmes to prevent an already depleting female sex ratio in our country. Specialized burn unit centres, involvement of NGOs and last but not the least a self-restraint exercise on human greed will go a long way in solving the problem.

The interventions can hence be translated into action through application of the

5 Es namely Education, Engineering and Execution of Efficacious Emergency care. As Article 21of the Indian Constitution rightly declares "Mere existence is not the right to live, it is the right to live with dignity".

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Fig.1:Back of the Body of a Burn Victim

Fig. 2: Contusions Detected on the Same Victim after Applying Cosmetic Incision

Table 1:Analysis of the burn cases

S.No.	Heading	Highest			Lowest			Graph no.
		Sub-heading	No.	%	Sub-heading	No.	%	
1	Month	November	31	12.8	June	9	3.7	1
2	Age group	21-30yrs	102	42.1	71-80	0	0.0	2
3	Religion	Hindu	162	66.9	Christianity	7	3	3
4	Locality	Rural	179	73.9	Urban	63	26.1	4
5	Education	Matric	72	29.7	Postgraduate	20	8.2	5
6	Occupation	Housewife	140	57.8	Farmer	5	2	6
7	Incidence area	Kitchen	168	69.4	Corridor	2	0.8	7
8	Wearing garments	Cotton	80	33	Semisynthetic	17	7	8
9	Source of fire	Kerosenelamp	101	41.7	Pump stove	7	3	9
10	Married/pregnant	21-30/31-40yrs	84/4	-	11-20/41-50yrs	3/1	-	10
11	Nature of death	Accidental	198	81.8	Homicidal	3	1.2	11
12	Cause of suicide/ homicide	Family dispute	11	37	Poverty	1	3	12
13	% of TBSA	61-70%	84	34.7	0-20%	0	0.0	13
14	Mode of death	Shock	128	53	Suffocation, ARF	1	0.4	14
15	Treatment accessibility	Received treatment	205	84.7	Died on spot	11	4.5	15

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Original Research Paper

Age determination from Tri-radiate cartilage fusion - A radiological study in Mumbai region

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Abstract

The bones of human skeletons develop from separate ossification centers. From these centers ossification progresses till the bone is completely formed. These changes can be studied by means of X-rays and these changes are age related. It is therefore possible to determine the approximate age of an individual by radiological examination of bones till ossification is complete. This radiological study was carried out with the objective to assess the general skeletal maturity around Tri-Radiate cartilage, of subjects in Mumbai region. Total 99 cases of males between age group of 9 to 24 years and 62cases of females between age group of 9-24 years attending the outpatient department of this hospital were selected. Age confirmed from history and noting the birth dates from driving license, passport, rations card or voter's card. The cases were selected after ruling out the nutritional, developmental, and endocrinal abnormality which affects the skeletal growth. Data analysis was done in P4 computer using HPSS software. At the end conclusions were drawn which are compared with available results of various previous studies.

Key Words: Epiphyseal Fusion, Ossification Centers, X-Rays

Introduction:

Determination of the age of an individual from the appearance and the fusion of the ossification centers is a well accepted fact in the field of medical and legal professions. Epiphysis of bones unites during age periods which are remarkably constant for a particular epiphysis. The determination of age presents a task of considerable importance from the view-point of the administration of justice. It is not possible to enunciate a hard and fast rule for age determination from this union for the whole India because the various geographical areas of our country differ in climatic, dietetic and disease factors. The present study was carried out to study roentgenographically the fusion of Tri-radiate cartilage in subjects between age group of 9-24 years attending outpatient department of this hospital.

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Aims and Objectives:

- To assess the skeletal maturity of Tri-radiate cartilage for a known chronological age in subjects of Mumbai region.
- Do Comparative study of fusion of Tri-radiate cartilage with known standards.
- To evaluate sex related variation & its correlation with age.
- To know variation if any & exception of fusion of Tri-radiate cartilage.
- To evaluate the medico legal aspects of different ages.
- To suggest any additional radiological investigation to aid and to reduce range in determining age.

Material and Methods:

The study was carried out in Grant Medical College and Sir J. J. Group of Hospitals Mumbai which is a tertiary referral centre. The objective was to assess the general skeletal maturity of Tri-radiate cartilage in subjects in Mumbai region. Total 99 cases of males between age group of 9 to 24 years and 62cases of females between age group of 9-24 years attending the outpatient department of this hospital were selected. Age confirmed from history and noting the birth dates from driving license, passports ration card or voter's card. The cases were selected after ruling out the nutritional, developmental, and endocrinal

abnormality which affects the skeletal growth. X-rays of Tri-radiate cartilage, AP and lateral view were taken at department of radiology. Different phases of fusion were graded according to Dr. William Sangma et al and Mckern and Stewart's methods.[1,9] The 5 stages were as follows-

Stage 1 (F1): Non union – when the epiphyseal cartilage did not begin to decrease in thickness

Stage 2(F2): Commence of union – when the thickness of epiphyseal cartilage was found to be reduced appreciably (1/4th united)

Stage 3(F3): Incomplete union – when the epiphysis has begun to fuse with shaft and complete union was well underway (1/2 united)

Stage 4(F4): Complete union – when the epiphyseal cartilage was bony in architecture and its density indistinguishable from the epiphysis and diaphysis in its neighbourhood but an epiphyseal line called epiphyseal scar could still be distinguished. (3/4 united)

Stage 5(F5): Complete union – with absence of epiphyseal scar.

The appearance and fusion of Triradiate Cartilage was evaluated radiologically and the results were compared with the previous known standard studies

Observation and Results:

Table No. 1 shows F1 stage of fusion was seen in 1 case (100%) at 9 – 10 years age group. F2 stage of fusion was seen in 3 cases (23.1%) at 9 – 10 years age group, in 4 cases (30.8%) at 10 – 11 years age group, in 2 cases (15.4%) at 11 – 12 years age group, in 3 cases (23.1%) at 12 – 13 years age group and in 1 case (7.7%) at 13 – 14 years age group. F3 stage of fusion was seen in 1 cases (16.7%) at 10 - 11 years age group, in 1 cases (16.7%) at 11 - 12 years age group, in 3 cases (50%) at 13 – 14 years age group and in 1 case (16.7%) at 14 – 15 years age group . F4 stage of fusion was seen in 1 case (12.5%) at 13 - 14 years age group, in 3 cases (37.5%) at 14 – 15 years age group, in 4 cases (50%) at 15 – 16 years age group. Complete fusion (F5) was seen in 4 cases (5.6%) at 15 - 16 years age group, in 7 cases (9.9%) at 16 – 17 years age group, in 9 cases (12.7%) at 17 – 18 years age group, in 12 cases (16.9%) at 18 – 19 years age group and in 39 cases (54.9%) at 19 – 24 years age group.

Table No. 2 shows F1 stage of fusion was seen in 2 cases (20%) at 9 – 10 years age group, in 2 cases (20%) at 10 – 11 years age group, in 5 cases (50%) at 11 – 12 years age group and in 1 case (10%) at 12 – 13 years age group. F2 stage of fusion was seen in 2 cases (50%) at 12 – 13 years age group, in 1 case (25%) at 13 – 14 years age group and in 1 case (25%) at 14 – 15 years age group. F3 stage of fusion was seen in 2 cases (100%) at 14 - 15 years age group. F4 stage of fusion was seen in 1 case (33.33%) at 14 – 15 years age group and in 2 cases (66.66%) at 15 – 16 years age group. Complete fusion (F5) was seen in 4 cases (9.4%) at 15 - 16 years age group, in 6 cases (13.95%) at 16 – 17 years age group, in 3 cases (6.97%) at 17 – 18 years age group, in 6 cases (13.95%) at 17 – 18 years age group and in 24 cases (55.82%) at 19 – 24 years age group.

Discussion:

In present study males show Triradiate cartilage union at 16 - 17 years age group and earliest union occurred at 15-16 years. Females show Triradiate cartilage union at 16 - 17 years age group and earliest union occurred at 15-16 years. The present study findings are close to Galstaun study for males in Indians, Flackers study for males in Australians, Davies and Parsons study in England B. D. Chaurassia study for both males and females in Indians, Parikh, and Krishan Vij. Present study and Galstaun and Fkackers study show different results for females and in Pillai study there is difference for both males and females because they are performed in different regions and races (Table - 3). In present study majority of cases show complete union at 16 – 17 years for both males and females. These findings are in tandem with study carried out by B. D. Chaurassia and Parikh because both studies are done in India.

Conclusions:

From the present study it can be concluded, that- Epiphysis of Triradiate cartilage fused in most of the cases at 16 – 17 years for both males and females. Earliest union occurs at 15-16 years in both males and females.

It is not possible to enunciate a hard and fast rule for age determination from this union for the whole India because the various geographical areas of our country differ in climatic, dietetic and disease factors.

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Table 1: Incidence & extent of fusion of Triradiate cartilage in different age groups in males

Extent of fusion (stages)	9-10 cases (%)	10-11 cases (%)	11-12 cases (%)	12-13 cases (%)	13-14 cases (%)	14-15 cases (%)	15-16 cases (%)	16-17 cases (%)	17-18 cases (%)	18-19 cases (%)	19-24 cases (%)	Total Cases (%)
F1	1 (100)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1 (100)
F2	3 (23.1)	4 (30.8)	2 (15.4)	3 (23.1)	1 (7.7)	-----	-----	-----	-----	-----	-----	13 (100)
F3	-----	1 (16.7)	1 (16.7)	0 (0)	3 (50)	1 (16.7)	-----	-----	-----	-----	-----	6 (100)
F4	-----	-----	-----	-----	1 (12.5)	3 (37.5)	4 (50)	-----	-----	-----	-----	8 (100)
F5	-----	-----	-----	-----	-----	-----	4 (5.6)	7 (9.9)	9 (12.7)	12 (16.9)	39 (54.9)	71 (100)

Table – 2: Incidence & extent of fusion of Triradiate cartilage in different age groups in females

Extent of fusion (stages)	9-10 cases (%)	10-11 cases (%)	11-12 cases (%)	12-13 cases (%)	13-14 cases (%)	14-15 cases (%)	15-16 cases (%)	16-17 cases (%)	17-18 cases (%)	18-19 cases (%)	19-24 cases (%)	Total Cases (%)
F1	2 (20)	2 (20)	5 (50)	1 (10)	-----	-----	-----	-----	-----	-----	-----	10 (100)
F2	-----	-----	-----	2 (50)	1 (25)	1 (25)	-----	-----	-----	-----	-----	4 (100)
F3	-----	-----	-----	-----	-----	2 (100)	-----	-----	-----	-----	-----	2 (100)
F4	-----	-----	-----	-----	-----	1 (33.33)	2 (66.66)	-----	-----	-----	-----	3 (100)
F5	-----	-----	-----	-----	-----	-----	4 (9.4)	6 (13.95)	3 (6.97)	6 (13.95)	24 (55.82)	43 (100)

Table 3 Comparison of Time of Fusion (in Years)

Author	Year	Race	Sex			Earliest Union (Yrs)	
			Males	Females	Mixed	Male	Female
Davies& Parson	1927	English	-----	----	16	----	----
Flecker	1932	Australians	15	13		----	----
Galstaun	1937	Bengalies (Indians)	15-16	14		----	----
Chaurassia	1980	Indian	----	----	16-17	----	----
Parikh	1990	Indian	----	----	15-16	----	----
Krishnan Vij	2001	Indian	----	----	15-16	----	----
Pillai		Madrasis	----	----	11-14	----	----
Present study	2010	Mumbai (Indian)	16-17	16-17		Male-15-16	Female15-16

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Original Research Paper

Profile of victims of natural sexual offences in South Bangalore

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Abstract

Rape is a notoriously under-reported crime in India, because of its social stigma and the fact that in most of the cases, culprits are known to the victim. The examination of the survivors of alleged sexual offences is one of the most difficult tasks in Medical practice. Methodology: This study was carried out between January 2012 to June 2013 in the Department of Forensic Medicine at Kempegowda Institute of Medical Sciences Hospital & Research Centre, Bangalore, Karnataka. The cases registered under sections 375, 376 IPC and Protection of Children from Sexual Offences Act were included in the study. Results: Total 35 victims were examined during study period. Of these, 24 (68.5%) were in the age group of 15 years to 20 years; 26 (74.2%) cases were educated up to school level. Unmarried victims were the maximum, 34 (97.1%); in 17(48.5%) cases, the incident occurred between evening & midnight, and in 14 (40%) cases, it occurred in the accused's house. Among the 35 female victims, 17 (48.6%) presented with recent tears of hymen while 11 (31.4%) had old tears of hymen. The manner of offence in majority of the rape cases, 23 (58.9%) was of the consensual type, which was followed by 10 cases (25.6%) of forcible rape. Discussion: The present study shows that younger age females who are unmarried and school goers are more vulnerable to sexual assault. In the overwhelming majority of cases, the incident took place within the house of accused or the victim and in the night. Significant number of cases had consensual sexual activity and this was the probable reason for lesser general physical trauma.

Key Words: Sexual offence, victim, 375 IPC, POCSO Act

Introduction:

Violence affects the lives of millions of women worldwide, in all socio-economic and educational classes. Violence against women takes a dismaying variety of forms, from domestic abuse and rape to child marriages and female circumcision. Out of all the crimes against women, rape is most heinous one.

Rape is a notoriously under-reported crime in India, because of its social stigma and as the culprits in most of the cases are known to the victim. Center for Disease Control and Prevention reported that one in every five American women has suffered an attempted or completed rape by an intimate partner during her lifetime.[1] Similarly in India, of all the major crimes, the incidence of rape has registered a high growth in the last four years. Incidence of sexual offences and their contribution to proportion to crime was observed respectively to have increasing trend from 2010 (27,756 cases, 2.4 %) to 2013 (46,070 cases, 12.27 %).[2]

The outrage following the gang rape and murder of the paramedical student in Delhi in December 2012, led the Government of India to promulgate Criminal Law Amendment Act in 2013.[3] Protection of Children from Sexual Offences (POSCO) Act[4] provided legal protection to children below 18 years, and victims above 18 years will continue to be covered under S. 375 & 376 of the Indian Penal Code (IPC). [5]

The examination of the survivors of alleged sexual offences is one of the most difficult tasks in medical practice. Considering the danger of allowing true offenders to go unpunished as well as injustice of wrong convictions, the task of the examining physician becomes even more important. Against this background, the present study was conducted with an aim to find out the profile of sexual offences occurring in South Bangalore and to

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describe the characteristics of victims of sexual assaults.

Material and Methods:

This was a prospective descriptive study, carried out for a period from January 2012 to June 2013 in the Department of Forensic Medicine at Kempegowda Institute of Medical Sciences Hospital & Research Centre, Bangalore, Karnataka State, India. Study was started after approval from Institutional Ethical Committee.

The cases from South Bangalore, registered under sections 375, 376 IPC (inclusive of amendments) and Protection of Children from Sexual Offences Act (POCSO Act) were included in the study. From January 2012 to April 2013, the cases were registered under sections 375, 376 IPC and after April 2013, the cases were registered under 375, 376 IPC as per the amendment of the criminal law. To analyse impact of amendments in law, an attempt was made to study consensual sexual activities which were criminalised. Consensual type of sexual offence means sexual intercourse with the consent of a girl, who is aged more than 16 years and less than 18 years. Statutory rape is sexual intercourse with a girl less than 16 years even with her consent.[6] Male victims and autopsy cases having associated findings of sexual offences were excluded from study. Similarly, alleged sexual offence cases which later turned out to be false allegations were not included in study. Informed written consent has been taken from the victims.

A standardized proforma was filled in each case after detailed interviews with the investigating officials, victims/ alleged accused and the relatives/friends of the victims/ alleged accused. The information regarding the age, socio-economic background, level of education, occupation, marital status, menstrual history, history of sexual offence as disclosed by the victims. During examination, general details of the victims' health, mental state, etc.; general details of physical examination, examination of the genitalia, laboratory findings, and medico legal interpretation of the information, findings and injuries were recorded in proforma. Results were analysed using descriptive statistics using percentages. The comparison was made between these findings and conclusions were drawn after comparing and discussing with similar type of the work carried out by other authors.

Observation and Results:

A total of 35 victims were examined during study period. Maximum numbers of victims, 24 (68.5%), were in the age group of 15 years to 20 years. (**Table 1**) Maximum number of victims, 26 (74.2%), were educated up to school level. (**Table 2**) Students constituted maximum number of victims, 26 (74.2%) cases. (**Table 3**) Unmarried victims were maximum, 34 (97.1%) cases. (**Table 4**) In majority of cases, 17 (48.5%), the incident occurred between evening & mid night time, i.e. from 6.00PM to 12.00AM. (**Table 5**) Fourteen (40%) cases occurred in the accused's house, followed by 9 (25.7%) cases that occurred in other indoor places like lodge, friend's house, etc. (**Table 6**) Among the cases studied, 17 (48.6%), presented with recent tears of hymen, 11 (31.4%), presented with old tears of hymen. (**Table 7**) The manner of offence in majority of the rape cases i.e. 23 (58.9%) cases were of consensual type, which was followed by forcible rape, 10 cases (25.6%) (**Table 8**)

Discussion:

In present study, the age of victims ranged from 4 years to 36 years. The most affected age group was the15-20 yrs (68.5%), indicating that this was the most vulnerable age group. Similar were the observations of other studies done in India[7-10] and globally[11]; however it differs with the study done by Pauline Saint Martin, et al,[12] where 68.3% of the cases involved children under 15 years.

Regarding the socio demographic profile, 26 (74.2%) cases of victims were educated up to school. Similar were the observations of Tailor C,[8] who noted that 99% cases were educated; while it differs from the study done by Roychaudhury UB,[7] who observed that majority of cases i.e. 45% were illiterate. In our study, maximum number of victims i.e. 26 (74.2%) were students, followed by 3(8.5%) each who were homemakers and labourers. The findings are consistent with the study done by Santos JC, et al,[11] and differ from the study done by Tailor C,[8] in which 48.9% of victims were engaged in household work and 23.4% cases were students. In the present study, unmarried victims were maximum i.e. 35 (97%) cases, whereas only 1 victim (3%) was married. The findings in the study are consistent with other studies.[7,9,11]

Temporal consideration of findings showed that majority of cases, 26(74.2%) occurred between evening & night time, i.e. from 6.00PM to 6.00 AM. These figures are similar to those encountered in studies in Indian [13] and non-Indian community[14]. The reason attributed towards the highest incidents occurring at night are that during this period either the event takes place unnoticed or the victim cannot get help

from others[13] or due to social habits of the majority of victims and the fact that cover of darkness can give opportunities for assaults to take place[14]. In present study, it is observed that the highest number of cases i.e. 7 (17.5%) cases occurred in the month of December, followed by 6 (15%) cases occurred in November. Least number of cases i.e. 1 (2.5%) occurred in the month of June. These findings differs from the study done in Ireland by McDermott S et al[14] who observed the highest incidents in July and least incidents in December, and it also differs from the Indian study done by Roychowdhury UB et al,[7] and Sukul B et al[10] who observed the highest number of incidents in the summer months of April to August.

In the present study, majority of the sexual assault i.e. 14 (40%) cases occurred in the accused house. It is followed by 9 (25.7%) cases occurred in the other indoor places like lodge, friend's house. The findings of our study are consistent with the study done by McDermott S et al[14] in which 43% of cases occurred in the indoors but he has not categorized as victims'/ accused house. It differs from study by Roychowdhury UB et al[7] who observed in 77.5% of cases the incidence occurred outside, and, it also differs from the study done in Bangladesh[15] in which 36.95% of incidents occurred in victims' house. The occurrence of events mostly inside the house is attributed to the accused being able to trap the
victim easily inside a closed room.[13]

Profile of extra-genital injuries sustained by victim indicated that only 7 victims (19.4%) of sexual offence had external injuries. The findings of this study are consistent with other studies[9,16] and differs from the study by Al-Azad MAS et al[15] who reported extra genital injuries in 36.09% of cases. As regards to genital injuries, 80% of victims presented with rupture of hymen. 17 cases (48.6%) presented with recent tears of hymen, 11 cases (31.4%) presented with old tears of hymen and only 7 cases (20%) presented with intact hymen. 4 cases (11.4%) presented with genital injuries in the form of bruising of vulva. Findings of this study are consistent with the study done by Roychowdhury UB et al [7] who observed recent tears of hymen in majority of cases and differs from other studies[14,16,17] in which maximum number of victims presented with old tears of hymen.

In present study, the manner of offence in majority of the rape cases i.e. 22 (62.8%) cases were of consensual type, which is followed by 8 cases (22.8%) of forcible rape. The findings of our study are consistent with other study [8] who observed similar findings. Tailor et al [8] observed that in many cases there was history of runaway with the friend, colleague or known person, mostly consented or on abetment. In this study also, victims who had sexual consensual intercourse with their partners were covered under POSCO Act on complaints of their parents. Consensual sexual activity by victim suggests that alleged accused was amongst her acquaintance. When the assailant and the victim are acquaintances, traumatic lesions tend to be less frequent and less severe.[12]

In such cases flexible stance should be adopted to protect adolescents having consensual and safe sexual practices. Inspiration may be taken in this arena from the provisions of Swiss Law, where though the legal age of consent has been fixed at sixteen years, an exception has been carved out for cases where the age difference between the involved parties is three years or less. A similar position is reflected in Israel where, while sexual intercourse with a child below the age of fourteen years is considered to be statutory rape (i.e. consent is immaterial), if the child is between fourteen and sixteen years and the age gap between the two individuals is less than two years, consensual sexual intercourse is legal. The effect of such a nuanced stance is that while all sexual activity between adults and children is patently illegal, it ensures that children below the age of consent are not criminalized.[18]

In the present study, only 3 victims (8.5%) were examined within 24 hours of the incident. Majority of the victims 13 (37%) were examined between 48 hours to 72 hours, and, 3 victims (8.5%) were examined after 1 month. The findings of the study are consistent with the other studies.[9,10,16] Detection of spermatozoa and interpretation of injuries may be hampered due to delay in reporting and examination of cases. Delay in seeking help by the victims may be due to embarrassment or fear or mental stress suffered by the victim. This delay may explain the low percentage of general body trauma (19.4 % in this study) since a delayed examination obviously reveals fewer clinically significant lesions than an examination immediately following the assault.

This study had several limitations which included absence of data regarding women who have been sexually assaulted by a close acquaintance and are less inclined to lodge a formal complaint or seek medical assistance. Hence, study population is probably not representative of the victims of sexual assault in the general population. Less sample size may have less statistical impact of the results, but

might reflect the burden of the evil in the society and provide comparative data and impetus for further studies involving larger population strata.

Conclusions:

The present study shows that younger age females who are unmarried and school going; are more vulnerable to sexual assault. In the overwhelming majority of cases the incident took place within the house of accused or victim and in the night. Significant number of cases had consensual sexual activity and was probable reason for lesser general physical trauma and warrants a need for further nuanced stance for adolescents. There is need for further studies with bigger sample size so that the result obtained may be used to strategise actions for protection of sexual offence victims.

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Table 1: Age wise distribution of victims of Sexual offences

Age (yrs)	Victims (number)	Percentage
0-10	03	8.5
11-15	03	8.5
15-20	24	68.5
21-30	04	11.4
30+	01	2.8
Total	35	100

Table 2: Literacy wise Distribution of Victims

Education	Number	Percentage
Illiterate	02	5.7
School(10+2)	26	74.2
Graduate	07	20
Postgraduate	00	00.0
Total	35	100

Table 3: Distribution of Victims based on their occupation

Occupation	Number	Percentage
Student	26	74.2
Home maker	03	8.5
Labourer	03	8.5
Employed	02	5.7
Unemployed	01	2.8
Total	35	100

Table 4: Distribution of victims as per marital status

Marital status	Number	Percentage
Unmarried	34	97.1
Married	01	2.8
Total	35	100

Table 5: Distribution of Cases According to Time of Incident

Time of incidence	Number	Percentage
12.00am to 6.00am	09	25.7
6.oo am to 12.00pm	04	11.4
12.00 pm to 6.00pm	05	14.2
6.00pm to 12.00am	17	48.5
Total	35	100

Table 6: Distribution of cases according to place of incident

Place of incidence	Number	Percentage
Victims' house	07	20
Accused house	14	40
Other indoor (lodge, friend's house)	09	25.7
Outdoor	05	14.2
Total	35	100

Table 7: Genital findings in female victims of sexual offence

Genitals findings	Injuries	No. of cases	%age
Hymen	Intact	07	20.0
	Recent tears	17	47.22
	Old tears	11	31.4
Vulva	Bruise	04	11.4
Vagina	Laceration	00	-
Anal mucosa	Torn	00	-

Table 8: Distribution of natural sexual offence (rape) cases based on the manner of offence

Manner	Number	Percentage
Statutory (less than 16 yrs)	04	11.4
Forcible	08	22.8
Threatened	01	2.8
Consensual (more than 16 yrs and less than 18 yrs)	22	62.8
Total	35	100

Original Research Paper

Deaths due to Organophosphorus Poisoning - A Retrospective Study.

[1] Siddaramanna T C, [2] Dileep Kumar R, [3] Rudramurthy S

Abstract

Poisoning is one of the commonest method employed for committing suicide, especially in developing countries like India. In this retrospective study, a total of 139 organophosphorus poisoning cases autopsied at district hospital, Tumkur, Karnataka, were analyzed during the period from January 2013 to December 2014. Male predominance was noted accounting for 74.8% of total cases compared to females.25.18% cases. Most common age group involved was 21-30 years (44 cases) followed by 31- 40 years (34 cases). Suicide was the commonest manner of death in majority of cases. People involved in agriculture related occupation must be educated regarding the usage of insecticides. Healthcare facilities should be upgraded to reduce the mortality due to poisoning.

Key Words: Poison, Organophosphorus, Autopsy, Suicide

Introduction:

Poisoning is one of the commonest methods employed for committing suicide. Indiscriminate use of insecticides to get high yield in agriculture has led to the increase in the poisoning incidence. Because of their easy availability, low cost, lethal nature; insecticides are widely used as means for committing suicide. Organophosphate poisoning is the most common poisoning in India followed by aluminum phosphide.[1] There is considerable variation in pattern of insecticide poisoning from region to region with organophosphorus poisoning being more common in south and central India. Since 1995, it has been found that the incidence of aluminum phosphide poisoning is increasing in North India.[2,3] The present study was conducted with the objectives to know the common age group involved, to know the reason for consumption and the manner of death due to organophosphorus poisoning.

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Material and Methods:

In this retrospective study a total of 139 cases of organophosphorus poisoning autopsied at the district hospital, Tumkur, Karnataka were analyzed during the two-year span [January 2013-December 2014]. The study was conducted based on the data obtained from the autopsy reports, hospital treatment records, chemical analysis reports and police inquest papers.

Results:

In the present study, out of 139 autopsied cases of organophosphorus poisoning, 104 cases (74.8%) were male and 35 cases (25.2%) were female. Male to female ratio was 2.97:1. Most commonly involved age group was 21-30 years (31.6% of total cases), of which 34 cases were male and 10 cases were female. This was followed by the age group of 31-40 years (24.4% of total cases), of which 25 cases were male and 9 cases were female. **[Table – 1]** The commonest manner of death due to poisoning was suicidal - 118 cases (84.9%), followed by accidental consumption or exposure during agricultural usage -17 cases (12.2%), and alleged homicide- 4 cases (2.9%).

In the present study, health related issues (like chronic abdominal pain) was the most common motive for consuming poisonous substance (46 cases – 33.1%), followed by family related issues like domestic conflicts/violence, suspicion, etc (38 cases – 27.3%), financial problems (17 cases – 12.2%), failure in exams (16 cases - 11.5%), etc. **[Table – 2]**.

Discussion:

The present study was conducted with the objectives to know the common age group involved, to know the reason for consumption and the manner of death due to organophosphorus poisoning. In the present study of 139 autopsied cases of organophosphorus poisoning, males outnumbered females. Similar results with male preponderance was found in the studies done by Nigam, M et al [4] and Padmanabha TS et al.[5] In our study out of 139 cases, 15 victims have consumed alcohol along with organophosphorus compound.

In our study majority of victims belonged to the age group of 21-30 years, which is similar to the study done by Nigam M et al[4] where 32.5 % of cases were of the age group of 21-30 years. Similar results were also found in studies done by Padmanabha TS et al [5] (41.1%) and Joshi SC et al [6] (43.8%).

In the present study health related issues were the most common motive for poisoning (33.1%), followed by family issues (27.3%), financial reasons (12.2%), educational (16 cases), etc., whereas in study done by Chakrabarty P et al [7], more than one third (36.7%) of deaths were due to domestic conflict / violence / marital disharmony / quarrel etc.

The commonest manner of death due to poisoning was suicidal, (84.9%), followed by accidental consumption or exposure during agricultural usage, (12.2%), and alleged homicide (2.9%).

Conclusion:

Organophosphorus poisoning is common in rural areas compared to urban region. Rapid industrialization, massive use of pesticides in agriculture, low cost, easy availability has increased the incidence of poisoning. In the present study, males outnumbered females, suicide was the most common manner of death. Establishment of Poison Information Centers especially in poison prone areas is required. People involved in agriculture related occupation must be educated regarding the usage of insecticides in order to avoid accidental exposure like wearing protective masks while spraying, washing hands and body after the work etc. Healthcare facilities should be upgraded to reduce the mortality due to poisoning.

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Table no – 1: Age wise distribution of poisoning cases.

Age group (Years)	Male	Female
< 10	01	00
11-20	05	05
21-30	34	10
31-40	25	09
41-50	22	06
51-60	10	02
61-70	07	02
71-80	00	01
Total	104	35

Table no – 2: Distribution of cases according to reason for consumption.

Motive	Number	Percentage (%)
Health issues	46	33.09
Family issues	38	27.33
Financial	17	12.23
Educational	16	11.51
Dowry related	07	5.03
Unascertained	15	10.79
Total	139	

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Original Research Paper

Age estimation from proximal end of Fibular epiphysis in Adolescent Boys: A Radiological study

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Abstract

Evaluation of age of an individual using various methods is required for medico legal purposes in both civil and criminal matters. There is no statistical data to establish variation in epiphyseal fusion in population in population of central India. This significant oversight can lead to exclusion of persons of interest in a forensic investigation.

Epiphyseal fusion of the proximal end fibula in 82 individuals was analyzed on radiological basis to assess the range of variation of epiphyseal fusion at each age. In the study the X ray films of the participants were divided into three groups on the basis of degree of fusion. Firstly, those which were showing No Epiphyseal Fusion (N), secondly those showing Partial Union (PC), and thirdly those showing Complete Fusion (C). Observations made were compared with the previous radiological studies.

By comparing the available literature about ossification of long bones, fusion was delayed one to three years in this study with population of Central India than those parts of south India and population of Bengal and is nearly similar to those in population of Madhya Pradesh, and Rajasthan, Karnataka.

Key Words: Epiphyseal Union, Proximal end of fibula ray, Age estimation, Central India.

Introduction:

Epiphysis of the bones unites during age periods which are remarkably constant for a particular epiphysis [1]. Epiphysis of the bones unites at the particular age and this is helpful in age determination. In law the crime and punishment is entirely based on criminal responsibility and this in turn depend on the age of a person [2]. Age is helpful in identification of an individual which in turn is helpful in both civil and criminal cases according to Sangma William Bilkey ch. et al [3].It has been also stated that the study of epiphyseal union of bones is considered a reasonable scientific and accepted method for age determination by the law courts all over the world [4]. India is a vast country with diversity in social customs, multiple religions, dietary habits and variations in climatic conditions.

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In Modi's textbook it is quoted that owing to variation in climatic, dietetic, hereditary and other factors affecting the people of the different states of India, it cannot be reasonably expected to formulate a uniform standard for the determination of the age of the union of epiphyses for the whole of India [5]. Human growth is continuous process which goes through, first a developmental stage and second, the maintenance of status. In the developmental stage, changes in skeletal and dental morphology occur in an age–age predictive sequence [7]. Reddy KSN stated that (2009) the bones of human skeleton develop from a number of ossification centers.

At 11 to 12th week of intrauterine life, there are 806 centers of ossification, at birth there are about 450.The adult human skeleton carries only 206 bones [8]. Mehta Homi S (1963) observed that it has been approved by research in our country that the epiphysio-diaphysial union in Indian occurs about a year or two in advance of the age at which that occurs in Europeans[9]. Jit and Balbir Singh revealed that Precocity of epiphyseal union has been attributed to racial and climatic factors. Works in different regions of India-North (Punjab, Delhi and UP), East (Bengal) and South (Chennai) have given different ages of fusion of the epiphysis. Further, workers in the same region have also given different ages of fusion of the epiphysis of the same bone and in the same

sex. This difference could possibly be due to in adequate material or recording of incorrect ages of the participants [10]. It was, therefore, decided to reinvestigate the problem in the central part of India by radiological examination, taking care that adequate material was examined and only those participants investigated whose ages has been recorded with reasonable degree of accuracy.

Aims and Objectives

This study has been confined to the radiological evaluation of the proximal end of fibula with the following aims and objectives:

1) To estimate age from epiphyseal fusion of proximal end of fibula in all Participants.
2) To asses age specific difference in epiphyseal fusion all participants.
3) To assess and evaluate the difference in the epiphyseal fusion in Central part of the India with other part of India on the basis of previous studies.

Material and Methods:

The present study was carried out in Department of Forensic Medicine MGIMS Sewagram Wardha. A total of 82 participated in this study **(Table No.1).** The participants included students of schools, College from district. The participants were from 13-20 years of age group. Approval taken from institutional ethical committee MGIMS, Wardha and informed consent was taken from all participants prior to each investigation.

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

The X ray films were taken and films were developed with the help of experienced technicians. The part taken for X ray was Knee for distal end of Fibula. For the study the X ray films were divided into three groups for each epiphysis –

Skeletal maturity was evaluated according to the Jits and Kulkarnis[10]. classification

1. Those showing No epiphyseal union (NF)
2. Those showing partial union (PF)
3. Those showing complete union (CF)

Result and Observation:

Proximal end of Fibula **(Table No. 1,2)**

Proximal end of Fibula shows partial fusion in 12(14.63%) cases in 14-15years age group. 8(9.76%) cases in 15-16 years age group. 9(10.98%) and 1(1.22%) case in 16-17years and 17-18years age group respectively. Complete fusion in 2(2.44%), 7(8.54%) & 13(15.83%) cases in 15- 16years,16-17years & 17-18years age group respectively. Shows complete fusion in all 22(26.83%) cases between 18-20 yrs of age group**.(Figure No.1, 2)**

Discussion:

The proximal end of fibula (TableNo.2)

The observations of present study correspond to data given by Davies and Parson (1927) [11] in the population of England, Saxena and Vyas (1969) [12] in the population Madhya Pradesh. Observations also coincide with findings of Bokaria et al (2009) [13] in the population of Rajasthan, Kausar and Varghese (2011) [14] in the population of Karnataka. Observation of present study also matches finding of Flecker (1932) [15] in the population of Australia. Paterson (1929) [16] and Stevenson (1924) [17] in the population of US.

Study of Pillai (1936) [18] in the population of Madras, Galstaun (1937) [19] in the population of Bengali, Basu and Basu (1938) [20] in the population of Hindu in Bangal. Does not match with the observation of present study, rather their observations shows early fusion by about 1-3 years in proximal end of Fibula.

Conclusions:

The ossification at Proximal end of fibula at the Knee joint is completed in all instances (100%) at the age groups of 18-20 years.

By comparing the available literature about ossification of long bones and fusion was delayed one to three years in this study with population of Central India than those parts of south India and population of Bengal. By comparing the available literature the age of skeletal maturity in this region are nearly similar to those in population of Madhya Pradesh, and Rajasthan, Karnataka.

As this study is done in Central India region the application of standards of this study may be considered ideal for application in the region of Central India. Population in Central India is mixed type comprising of various religions and castes. The opinion about age should always be given in the range. From this study, range of 1-2 years of margin of error can be concluded. For estimation of age relevant joints should be radiologically examined for different centres and opinion should be arrived considering the status of multiple centers.

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Figure 1.

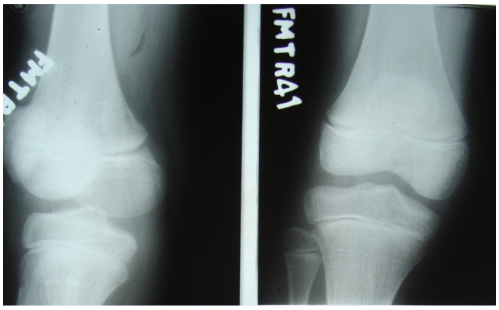

Figure 2.

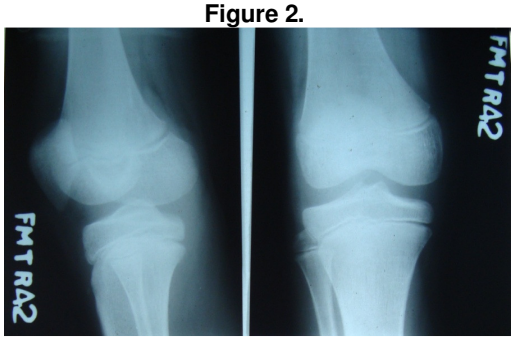

Figure 3. AP view of knee joint shows Complete Fusion proximal end of fibula

Table-1: Proximal End of Fibula in Adolescent

CBME GROUP (n=4)		CONTROL GROUP (n=4)	
Candidate	Score (out of 20)	Candidate	Score(Out of 20)
A	15.5	E	13.5
B	15	F	13
C	12.5	G	6.5
D	12.5	H	6.5
Mean Score(± SD)	13.8(± 1.6)	Mean Score	9.8((± 3.9)

Table 2: Comparison of age of fusion in Proximal Epiphyseal end of Fibula in adolescent boys

Age in yrs	13	14	15	16	17	18	19	Total
NF	9.76%(8)	0.00%(0)	0.00%(0)	0.00%(0)	0.00%(0)	0.00%(0)	0.00%(0)	9.76%(8)
PF	0.00%(0)	14.63%(12)	9.76%(8)	12.20%(10)	1.22%(1)	0.00%(0)	0.00%(0)	36.58%(30)
CF	0.00%(0)	0.00%(0)	2.44%(2)	7.32%(6)	15.83%(13)	12.20%(10)	14.63%(12)	53.65%(44)
Total	9.76%(8)	14.63%(12)	12.20%(10)	19.51%(16)	17.07%(14)	12.20%(10)	14.63%(12)	**100%**(82)
ϰ2-value	134.30							
p-value	0.000,S,p<0.05							

Original Research Paper

Estimation of Age from Human Dentine

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Abstract

Aim - Aspartic acid racemization has been found to be an accurate measure of age at death for recent forensic material. The aim of our study was to estimate the aspartic acid enantiomers ratio using HPLC-UV technique and Marfeys reagent as a derivatising agent from dentine samples of premolar teeth **Material & method** - Fifty individuals participated in this study in age groups of 11- 60 yrs. Their teeth were processed for isolation of dentine, extraction of amino acid and analysis of aspartic acid enantiomers using HPLC and calculation of ratio of racemization. **Result -** The ratio of aspartic acid enantiomers showed increasing trend towards age of an individual. **Conclusion** - The ratio of D/L aspartic acid was synchronized with age of an individual and it is appropriate method for age estimation.

Key Words: Dentine, Aspartic acid, HPLC, Marfeys reagent, Age

Introduction:

Age estimation in forensic science is all about identification of unknown human remains, establishing key evidences in criminal offences, solving the mystery of missing person and assistance in mass disaster or natural calamity. Estimation of age is one of the most challenging areas for archaeologists, forensic anthropologist and Forensic Medicine people, especially identification after death of an individual.

If we take Forensic investigation as a four legged animal, then each leg of this animal represents different members of the system involved, from series of investigation to outcome of the verdict. Police / Magistrate initiate the movement of this investigation, with the help of Doctors and available scientific technology, so that the investigation reaches the destination through court procedure (Judiciary). If we want the animal (investigation) to run fast then each of these four legs (members of the system) have to be of equal size (in terms of advancement) and should work in close coordination with each other. Present situation is quite bizarre, where scientific technology has been growing fast while other members like doctors, police and judiciary are unable to cope up with this advanceument and hence our Forensic investigation is limping.

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Although science has been advancing fast and there are several methods of age estimation which have been identified, or are in process of identification, but still the Forensic investigation is substandard.

However there are several methods of age estimation like morphological, radiological, but the majority of age estimation technique are often biased antiquated; frequently result in a large margin of error as they affected by lifestyle, health and nutrition of the individual. Amidst pressing need for the development of the methods for age estimation, this study of age estimation by racemization of aspartic acid in dentine is more consistent between individuals. [1-3].Amino acid raemization is a process by which there is an inter-conversion of amino acid which are the building blocks of proteins from one chiral from (levo-from)to mixture of levo and dextro forms following protein degradation, whose rates are influenced by various factors such as temp, humidity and PH. [4]

Racemization of aspartic acid in dentine protein during the human lifetime progress with age and it have fast racemization in body temperature. [5] Present study is carried out for estimation of aspartic acid racemization ratio with reference to age utilizing dentine samples from premolar teeth to estimate the aspartic acid enantiomers ratio using HPLC-UV technique and Marfeys reagent as a derivatising agent.

Material & Methods

Permission from the Institutional Ethics Committee was obtained before proceeding in this study. Preliminary data including name, age, sex and socioeconomic status, were noted in a specially designed proforma for this study. 50

samples were taken which consisted of premolar teeth extracted from individuals coming to oral surgery department in Sri Aurobindo College of Dental Science, for tooth extraction, as advised by the oral surgeon. Informed written consent was taken at the time of extraction for the use of the tooth in the study. As a pre-requisite, the individuals were asked to deposit age proof in the form of birth certificate, mark-sheet of $10^{th}/12^{th}$, passport or any other documentary proof. They were clinically examined for oral hygiene and the teeth having dental carries were excluded from the study. Thus 50 age matched extracted tooth samples from the individuals, having age between 11 - 60yrs were taken. The extracted premolar tooth was processed as per the protocol mentioned below

Step 1 : Teeth Cutting – Isolation of dentin

Extracted tooth was placed in a 50 mL beaker and 6 M hydrochloric acid was added to it until it submerged in the solution, then it was ultrasonicated for five minutes. Then HCl was decanted and replaced with HPLC water and again sonicated for five minutes. Then HPLC water was also decanted and replaced twice with fresh HPLC water. Same sonication procedure was performed for another five minutes, each time after washing with HPLC water. Ethanol was used as the third solvent to rinse the tooth and it was again ultrasonciated for five minutes. Following this, a final step of submersion in ethyl acetate was performed without sonication. The tooth was removed and dried. Then a thin layer of the crown from tooth was removed taking special care of concavities and the enamel was removed. The dentin was excised by immediate pulverization as the tip hollowed the interior of the dentin core. Diamond drill was used to yield an instant powder of the dentin, which requires no further grinding. [6]

Step 2 : Demineralization

Extracted dentin was soaked in 0.6N HCL and placed for continuous agitation for 2 hr at 4^0C.

Step 3 : Hydrolysis

10 ml of 6 M HCl was poured into a glass vial containing the dentin which was then sealed and placed in the oven for 6 hours at 90 ℃. Then the vial was removed from the oven and allowed to cool to room temperature. The solution was then transferred to a 25 mL, round bottom flask and evaporated using a Rotovap until the resulting product turns in to a yellow solid. Five mL of HPLC water was then added to the round bottom flask to dissolve the amino acids.

Step 4 : Thin layer chromatography of amino acids extracted from dentine

The presence of amino acids, extracted from hydrolyzed dentine sample was confirmed with thin layer chromatography using silica TLC plates, butanol: acetic acid: water (3:1:1) solvent system and ninhydrin spray reagent.

Step 5 :Derivatization using FDAA (1-Fluoro-2,4-dinitrophenyl-5-L-alanine amide - Marfeys reagent) – Following three solutions are prepared separately

1) 50mM of D& L Aspartic acid (standard) was weighed and placed in 10 ml of measuring cylinder. Few drops of 0.1 M HCL was added to dissolve amino acids and make up the volume to 10 ml using HPLC water.
2) 1gm of extracted and processed dentine was weighed and dissolved into 1ml of HPLC water.
3) 1 gm of FDAA (Marfeys Reagent)was added to an umber colored bottle and 10 ml of acetone was added to it.

All the prepared solutions were shaken well before derivatisation. Then diastomers of FDAA were prepared with amino acid -

- 100µl of standard (D & L) Aspartic acid and dentine sample were taken.
- 200µl of FDAA was added to it
- It was shaken well and 80 µl of freshly prepared sodium bi carbonate (1M) was added to it
- It was again shaken and kept for 4-6 hrs at 75- 90 ^{0}c
- During this, the yellow color of solution will change to red / orange color.
- The reaction was stopped by addition of 20 µl of 2MHCl and dilute two fold directly with the mobile phase using TEA-Acetonitrile buffer.

Step 6 : HPLC Analysis

Here we are using the linear gradient method, where two mobile phases A and B are used, with linear gradient from100 to 0% in A & 0 to 100% in B. they are made to run for 40 min, at a flow-rate of 1.0 mL/min in 25^0C. Here Solvent A is 50 mMtriethylamine phosphate buffer (pH 3.5) and acetonitrile in ratio of 90:10and solvent B is the same buffer with the ratio of buffer &acetonitile being 60:40. The absorbance of the eluted fraction monitored at 340 nm and

Sample absorbance is determined in this wavelength with a variable wavelength detector. Separation is achieved by gradient elution with a 1.0 mL/min flow of triethylamine – phosphate buffer (0.05M, pH 3.0) and acetonitrile as shown in **Table 1.**

Statistical analysis

Here we had applied descriptive statistics, estimating the Median value for each age range and used scatter chart to depict the relationship between age and D/L ratio. Then after linear regression, equation was applied.

Result

The age groups selected for our study fall in the range between 11-60 yrs. Result clearly suggest that D/L ratio shows increasing trend towards increasing age. The deviation observed in some cases may be due to certain factors which effect the transformation from L to D form such as temperature, pH etc.

The minimum value of the D/L ratio increases with age range from 11 yrs to 60 yrs continuously, similarly the maximum value of D/L ratio also increases with age range from 11 yrs to 45 yrs except for the age range between 16-20 yrs, may be because of just 2 samples in this age group. Similarly the maximum value after the age of 46 yrs is not in increasing order again may be due less number of samples, along with other factors. The median of the D/L ratio increases with age range from 11 yrs to 45 yrs but after the 46 yrs the median value is not in increasing order. The HPLC chromatogram showing the peaks of D and L aspartic acid is shown in the **Figure 1.**

Discussion

Though various types of teeth were used for dentine extraction, we used premolars tooth as they are single rooted teeth with a relatively small volume with dentine, thus sampling of the dentine is easier than for other teeth. Dentine represents the most suitable material among the mineralized tissues, as it is relatively protected from exogenous damage and forms the bulk material of teeth.[7,8] The fact that the highest rate of racemisation has been calculated in dentine, as dentine is a highly organised and mineralised material with a low renewal rate, has been highly established.[8] There are various methods and instruments available for separating D and L forms of aspartic acid like amino acid analyser, gas chromatogram, high performance liquid chromatography (HPLC), ultra-violet/fluorescent detection and radioactive carbon analysis.[9,10]

Different types of derivatising agents are used for analysis of amino acids, by various scientists and researchers, as per the feasibility and availability of resources and faith on different methods. We used Marfey's reagent as it does not requires fluorescence detector rather uses UV detector in HPLC. Marfey's reagent (1-fluro 2,4dinitro alanine amide, FDAA) has been widely used for structural analysis of peptides, confirmation of racemization in peptide synthesis and detection of small quantities of D amino acid.[11,12] As far as the available literature is concerned, this method utilizing Marfey's reagent, has been used for the first time in Indian scenario for estimation of D & L amino acid in dentine samples.

We observed a complete separation of D- and L-aspartic acid. The D/L ratio for younger age group was less, while that of the older age group was higher, suggesting that D/L aspartic acid ratio increases with age, which also signifies that the D-aspartic acid gets accumulated with age. The correlation coefficient for ratio of D/L aspartic acid with age was found to be $r = 0.876$ and it was comparable to the other studies.[3,13-16] The possible explanation for the error could be the technical limitation on the purity of the dentin sample.[10]

In 1976, Helfman & Bada noted that the age of dentine and the racemization ratio of aspartic acid in dentine of teeth were correlated to each other significantly.[13] Though others found that there is marked tendency for young individuals to have estimated ages which are too old and older individuals to have estimated ages which are too young. [9] The normal differences in body temperature (36.2-37.6 ^{o}c) have been shown to influence the rates to such a degree that age determination of older individuals may vary by up to 20 years.[13,14] The values of D/L ratio show variation among the studies, and the method used for sample preparation, reagent used for derivatisation and measurement protocol was also varying.[17] The racemization of aspartic acid have shown maxium error of estimation between 6 to 7 years with HPLC technique,[18] but it is really less than simple morphological analysis with error margins of greater than ± 15 years.[19]

Conclusion

The dentine samples were analyzed for aspartic acid enantiomers separation using FDAA as a derivatising agent. The ratio of D/L aspartic acid is synchronized with age of an individual and it is appropriate method for age estimation, but required advanced set up.

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Conflict of interest – None

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Table 1.Gradient Program for the HPLC analysis after derivatisation

Time (min)	Mobile Phase A Triethylamine phosphate & Acetonitrile 0.5M, (90:10); pH 3.5	Mobile Phase B Triethylamine phosphate & Acetonitrile 0.5M, (60:40) ; pH 3.5
0.00	100%	0%
45.00	0%	100%
55.00	100%	0%

Table 2 - D/L Ratio found in different Age groups.

S No	Age	D/L ratio	Err	Sr. No	Age	D/L ratio	Err
1	11	0.029	11	**26**	38	0.054	8
2	11	0.021	2	**27**	38	0.051	8
3	11	0.020	1	**28**	39	0.055	8
4	12	0.020	0	**29**	39	0.059	12
5	15	0.029	-6	**30**	40	0.055	7
6	14	0.020	-7	**31**	40	0.054	6
7	15	0.018	3	**32**	41	0.036	-13
8	18	0.021	5	**33**	42	0.061	11
9	20	0.022	-6	**34**	42	0.038	-12
10	22	0.023	-7	**35**	43	0.061	12
11	23	0.030	1	**36**	43	0.057	6
12	24	0.024	-8	**37**	44	0.066	14
13	25	0.029	-6	**38**	45	0.050	-2
14	28	0.024	-8	**39**	47	0.053	-2
15	29	0.035	-2	**40**	47	0.051	-4
16	30	0.039	1	**41**	46	0.049	-5
17	30	0.032	-7	**42**	49	0.056	1
18	31	0.029	-10	**43**	50	0.050	-8
19	32	0.032	-8	**44**	54	0.052	-10
20	34	0.034	-8	**45**	52	0.056	-4
21	34	0.039	-3	**46**	55	0.055	-8
22	35	0.047	4	**47**	56	0.058	-6
23	36	0.033	-11	**48**	57	0.060	-5
24	37	0.057	-12	**49**	60	0.064	-4
25	37	0.053	-8	**50**	60	0.066	-2

Figure 1- Scatter chart-showing relationship between age and D/L ratio

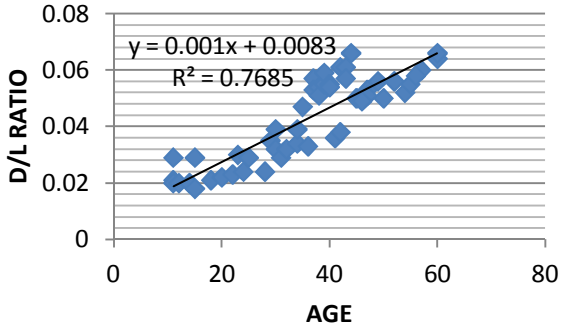
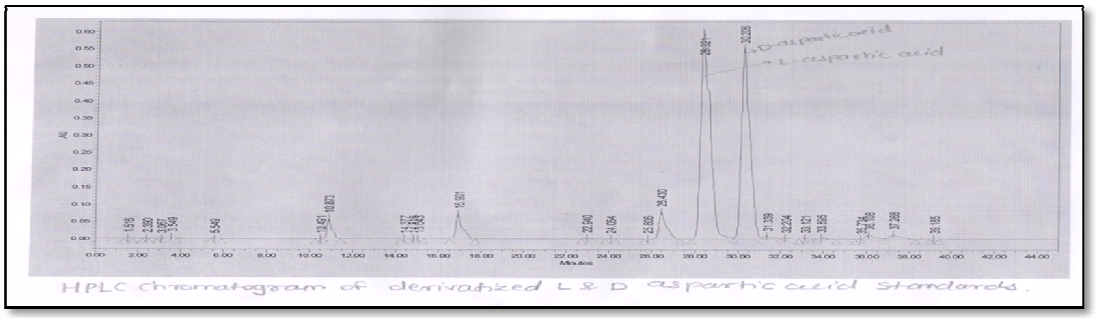


Fig. 2 HPLC chromatogram showing derivatized L & D Aspartic acid standards



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Original Research Paper

Documentation of injuries in hospital records- A study

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Abstract

Examination and documentation of injuries is one of the most important and fundamental medico-legal work done by any doctor e.g. CMO, RMO, resident or even the consultant. Injury report is one of the most important document for police to frame charges against the accused. It is the obligatory duty of a doctor to issue an injury report in the correct proforma with proper nomenclature and description of the injury. Therefore, a study was conducted in a tertiary care hospital like ours with regard to documentation of injuries by resident doctors and other medical staff. The study revealed that there are still some lacunae in documenting injuries. It is the job of Forensic Expert to train the budding doctors. So, based on the study it is suggested that teaching of Forensic Medicine should be further strengthened at the undergraduate level and Internship posting should be made compulsory in Forensic Medicine department.

Key Words: Documentation, types of injuries, nomenclature

Introduction:

In many cases dealing with injuries or wounds, the Supreme Court made the following vitally important observations.[1]

- The opinion of the medical witness who had examined the injuries of the victim should be given more importance for proper administration of justice.
- The medical science has not yet developed any process by which the exact duration of injury may be determined and there is always a margin of few hours on either side about the opinion of age of injuries.
- Only if the alleged weapon is recovered, should the doctor be asked whether the injuries mentioned by him could be caused by that weapon. Where weapon could not be discovered, its nature can be assessed from injuries described.
- It was correct on the part of the courts to rightly rely on the evidence of the doctor who first prepared the wound certificate of the deceased (in preference to description of injuries mentioned in the postmortem report.)

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The above observations emphasise the importance of the quality of medico-legal work, especially in case of examination of injuries. This prompted us to take up this study to evaluate the quality of examination and reporting of injuries in victims at a tertiary care hospital like ours.

The ability to appropriately assess, document and interpret injuries that have been sustained, is a key part of the work of any physician, surgeon or medical man, especially when the crimes of violence are increasing throughout the world.[2]

Documentation of injuries is an important aspect of medico-legal work done by the doctor. The investigation and framing of charges by the police hugely depend on the quality of the injury report or the injuries documented by the treating doctor in the hospital records. It is the primary duty of the doctor to treat the patient in any case of trauma, but once the patient is stable, the other important duty of the doctor is proper documentation of injuries. A doctor should be able to identify the type of injury, the nature of injury and the likely weapon causing the injury. Every doctor with MBBS qualification is expected to know this as Forensic Medicine is a part of undergraduate curriculum. Thus, clinical forensic work is a significant part of medical management. Forensic medicine is taught in II MBBS and presently there is an elective posting during internship for 15 days. The present study was conducted to see whether treating doctors or residents have adequate knowledge to document the injuries properly.

Aims and Objectives

- To study the types of injuries documented by the doctor
- To study whether the nomenclature of injuries is proper
- To study if the injury is mentioned in the reportwith the correct dimensions i.e. length x breadth x depth
- To study if the data to verify the age of injury is written by the doctor (based on history)

Material and Methods

As our hospital is located on National highway (NH4), we frequently get multiple cases of RTA where injuries are seen invariably.As the detailed description of injuries is legally more vital in cases of assault or non RTA cases, we focused our attention only on these cases in this study**.**All the cases of assaultadmitted in a tertiary care hospital are examined either in casualty or wards. The hospital record of all these cases was studied in detail. All the cases of self-inflicted injury were also studied. Total 104 cases were studied over a period of one year. There was no case of firearm injury in the sample of 104 cases studied by us.

Observation and Results:

Out of 104 cases, 96 cases were of assault while cases of self-inflicted injuries were 7and of domestic violence was 1.Weapons varied from bamboo, glass, knife, hockey stick, electric current, liquids etc. There were 42 cases where there was no history available with regards to causative weapon.

Nature of the weapon used was inferred from the history. Forty one cases were due to hard blunt object, while sharp edged weapon was involved in 16 cases, sharp pointed weapon in 5 cases and in 42 cases, the nature of weapon was not known. With regards to dimensions (laceration, incised and stab wound), in 38 injuries, the third dimension was not written inspite of the injury being three dimensional. In 48 injuries, the third dimension was written. Remaining injuries were two dimensional in nature.

About the age of injury, no Injury Report mentioned the signs or the factors that help in determining the age of injury.

As is observed in many other places, the fascination for the term CLW was evident in our study also. Actually, the injury wasa split laceration but unfortunately the injurywas written as CLW. In this study, the term was used to describe 67 injuries. The term sutured CLW was used in 4 cases, superficial CLW in 2 and deep CLW in 1 case. The term 'incised lacerated wound' was used to describe only one injury and 'punctured lacerated wound' to describe another injury.

Some special observations in this study were-

- In 6 cases,though the history was of assault with sharp weapon, the injury described was CLW.
- In two cases, there was a tympanic membrane perforation and in one case there was injury to vitreous.
- Surprisingly in three cases, in spite of history of assault, there was no external injury.
- There was no reference made by any medical officer about the edges or angles present, if any, in a particular wound.
- The occasional finding like bevelling or tailing of a wound was not mentioned anywhere.
- While mentioning site of injuries, the situation in reference to anatomical landmark was grossly missing.
- Use of photography was hardly made to depict/ describe the injuries.
- It was observed that in many injury reports there was no opinion about the probable causative agent and the column for remarks was also found blank in many cases.

Discussion:

Accurate interpretation of injuries is often vital to proper administration of any system of justice. These days, the term Clinical Forensic Medicine is used frequently and it is in this regard that the terminology used to describe the injuries can be of great importance. Correct use of technical terms is required not only of medico-legal practitioners but also of all health care workers who take part in the early stages of treatment of injuries. The casualty officer is often a crucial witness in court.[3] A case of assault, suicide or accident is necessarily a medico-legal case. The term medico-legal case has not been explicitly defined anywhere in law.[4]Cr.P.C 39 informs about cases where compulsory information has to be given to the police by any Indian citizen.[1] When a case of assault or suicide is admitted to the hospital, a doctor has to document injuries and prepare an injury report. While documenting injuries, the he should be aware of type of each injury, size, shape, age and nature of injury, etc. He should also note the anatomical area on which the injury was inflicted, direction of the injury and the likely weapon causing injury.

A classic example in which the choice of wording may alter fundamentally a court's view

of the facts is that between laceration and incision.[3] A laceration is caused by hard blunt object while incised wound is caused by sharp edged weapon, so wrong documentation of injury may result in acquittal of the accused if the injuries do not match with the alleged weapon.

In the present study, a total 104 cases were perused and the cases included were of assault, suicide, self-inflicted or domestic violence. Cases of RTA, fall,etc., were not considered as they are least likely to be challenged in the court as far as injury reporting is considered.

In 1969, McNamarafirst defined clinical Forensic Medicine as "the application of (forensic) medicine to victims of trauma involving the proper processing of forensic evidence".[2] Clinical forensic medicine is best defined as the application of forensic medical knowledge and techniques to the solution of law in the investigation of trauma involving living victims. In the setting of emergency departments, these techniques include correct forensic evaluation, documentation, and photography of traumatic injuries, as well as the recognition and proper handling and collection of evidentiary material for future use in legal proceedings.Clinical forensic medicine is the practice of assessing the physical condition of the living, who allege that they are victims of an assault or examining the alleged perpetrator of the offence.[2]

While the main priority of trauma physicians/surgeons always will be to provide timely and optimal care for the individual living patient that cannot be compromised, they also could serve society in general by applying some forensic principles in their approach to patients, who are victims of violence.[2] Study by A.K.Singh et.al has also shown that only 33.9% doctors are aware about various medico-legal procedures and case management.[5]

Any case of injury treated in the casualty or inpatient ward or operation theatre is a potential medico-legal issue. Medical doctors or treating physicians invite adverse remarks for obviously unintentional omission in fulfilling basic medico-legalrequirements. Failure to record certain points or recording some points improperly would lead to miscarriage of justice.[2]Perhaps, the most frequent error is the use of the word 'laceration' in the context of a cut to the skin. In the forensic setting, if the word laceration is used wrongly to describe a cut wound by knife this may have implications with regard to the credibility of the witnesses.[6]

Even in our study CLW was the most favourite term used by doctors. Terms like sutured CLW, incised lacerated wound, superficial CLW, deep CLW and punctured CLW were found to be used. Actually, split laceration is the right term but CLW is used commonly. Once the wound is sutured the doctor should mention it as stitched/ sutured wound as the original wound was seen by the doctor/s who attended first and did the job of suturing. The term superficial or deep CLW is also wrong. The right way to describe is the length and breadth in centimeters and the depth as skin/subcutaneous/muscle or bone deep. The lacerated wound has to have some depth, as it can't be superficial.Thus a doctor should know which injury is to be written as two or three dimensional. Our study revealed that in 38 cases third dimension was not mentioned though the injury was three dimensional i.e. lacerated/incised/ stab wound.

The purpose of correct assessment and proper documentation is to assist in establishing the mechanism of production of injury and also to corroborate the time of infliction of injury given by the victim or offender. The age of injury estimation is often neglected by the attending physician. Though one cannot exactly opine about the age of injury, a rough estimate can surely be given. The age of injury can be assessed by the colour changes (in case of abrasion and contusion), presence of haematoma and signs of healing like inflammation, pus formation, presence of scar/scab etc. In 104 cases studied by us none of the cases mentioned findings related to age of injury.This is a serious omission on the part of treating doctor however busy he/she may be.In spite of thorough teaching of topic of injuries at undergraduate level and giving an orientation lecture to new residents, highlighting the medico-legal importance of examination and reporting of injuries, we feel sorry about this observation. This could well be attributed to the lack of commitment and the responsibility amongst treating doctors.

The duty of care, in the critically injured, rightly outweighs the need to document injury accurately, or to retrieve crucial evidence. Lack of forensic skills mean that often hugely important evidence e.g. nature of injury or important trace materials is lost.[6] There is a clear argument for: 1) Increasing the level of Forensic skills of those involved in the care of the severely or critically injured or 2)Make available Forensic expert who can gather evidence at the earliest opportunity.[6]

Conclusion:

As documentation of injuries is important, thorough training of the doctors

concerned with medico-legal work should be done. At present Forensic Medicine is taught only in IIndProfessional of MBBS and there is an elective posting of 15 days in Forensic Medicine during internship. An orientation workshop for the residents who have newly joined for postgraduate courses (esp. surgery, orthopaedics etc.) should be arranged and a follow-up programme after few months. Even for senior faculty, regular orientation lectures should be conducted at one-two yearly intervals. This will definitely improve the quality of documentation of injuries and help police and the court in administration of justice.It's frequently observed that due to lack of Forensic knowledge and skills vitally important evidence e.g. nature, age of injury and important trace material is lost.

As mentioned above in our Institute thorough undergraduate teaching, student seminars, orientation workshops for postgraduates are regularly conducted. There is a medico-legal cell specially created to deal with medico-legal work of the hospital since 2007. There is qualified and experienced faculty available in the department of Forensic medicine and Toxicology. Whenever sought a prompt and just opinion is given by the faculty, however it is observed that the treating doctor in trauma cases have some curious apathy and lack of interest to avail the services of Forensic faculty easily available. This has definitely and adversely affected the quality of medico-legal injury reports, as seen in this study.

May we take this opportunity to express that the governing body of medical education i.e. Medical Council of India should revise the requirements about staff of FMT department considering the entire medico-legal work undertaken at the teaching hospital rather than only autopsy work. As it is presently observed that due to paucity of manpower in the department the quality of medico-legal work undertaken at a particular center, positively suffers.The additional staff in Forensic medicine department will definitely ease the burden of clinicians and finally help the judicial system in administration of justice.

To conclude

- There is lot of scope for improvement of documentation of injuries
- Active participation by staff of Forensic medicine along with the treating doctors will definitely help in improving this aspect of medico-legal care.
- After completing the study we felt that if this is the quality of documentation of injuries at a teaching hospital like ours, what must be the situation at the peripheral places.
- In our opinion medical officers either hesitate or avoid to seek help or guidance from other specialties like ENT, Ophthalmology or even Forensic expert. So there is underutilization of prevailing facilities and this probably happens because of lack of application by the concerned staff towards medico-legal work.
- There is also a dire need to develop Clinical Forensic Medicine Unit in each teaching hospital.
- The regulatory body should revise staff requirements keeping in mind the need for clinical forensic medicine.

Continuous contact programmes for all residents and faculty involved in emergency and trauma care.

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Fig 1: Type of cases.

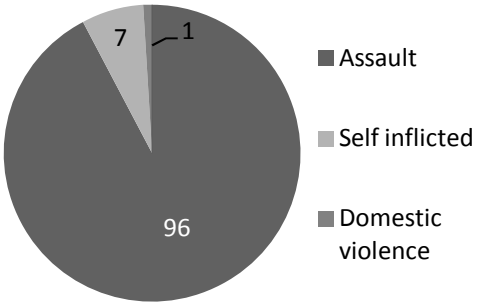


Figure 2: Nature of the weapon used

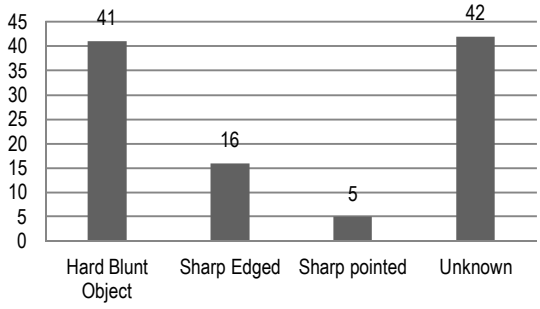


Table 1: Type & Frequency of Weapon used based on history

Type of Weapon	No.	Type of Weapon	No.
Bamboo	6	Unknown sharp weapon	10
Blade	3	Slap-hand	1
Brick	1	Pointed weapon	4
Cricket bat	1	Pencil	1
Chopper	1	Stick	1
Human bite	1	Stone	16
Glass Bottle	2	Tube light	1
Rope	1	Utensil	1
Hockey stick	1	Wooden Board	1
Iron rod	3	Wooden stick	3
Knife	2	Unknown	43
		Total	104

Table 2. Dimensions of injury documented

3 dimensional injuries mentioned in case paper	No of injuries in which 3 dimensions mentioned	No of injuries in which 3 dimensions not mentioned
Lacerated Wound	41	29
Stab Wound/Puncture wound	1	0
Incised wound	6	9

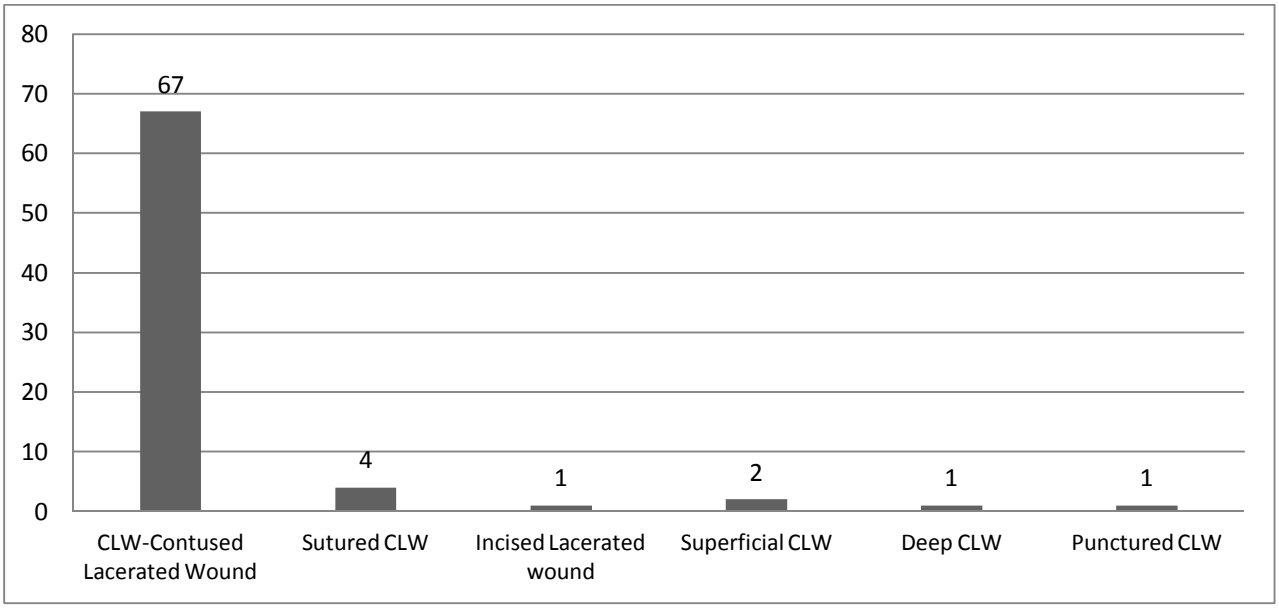
Table 3: Interval between sustaining injury and examination

Time interval between assault and Examination	No of cases
Up to 30 minutes	19
30 minutes to up to 2 hrs.	38
2 hrs.to up to 6 hrs.	18
6 hrs.to up to12 hrs.	5
12 hrs.to up to 24 hrs.	1
More than 24 hrs.	3
No history by patient	13
Time of examination not written by doctor	7
Total cases	104

Table 4: Nomenclature of injury not consistent with the weapon

Nomenclature of injury used by treating doctor	Number of cases	H/o weapon used
CLW-5	5	sharp weapon/sharp pointed weapon
Incised Lacerated wound	1	sharp weapon

Figure 3: Nomenclature for injury used by the treating doctor



J Indian Acad Forensic Med. July - September 2016, Vol. 38, No. 3 **ISSN 0971-0973**

Original Research Paper

Stone Age of Medical Council in Digital India

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Abstract

The information technology has revolutionized the world, covering all the spheres of life. The initiative by Hon'ble PM Sh. Narendra Modi for making digital India has further improved the technical advancements in Information technology. Healthcare industry is also influenced by information technology and is implementing the same in day to day life. The Medical Council of India is the regulatory body formed under the Constitution of India to frame, implement and make a check on the regulations framed for the Medical education in India. In the year 2008, Government of India notified in the official Gazette regarding amendment for minimum requirement for 100 MBBS students in the Medical Colleges which was related to development of Medical College website. The present study was done to know the status of the compliance by Medical Colleges and the view point of Medical Council regarding the compliance.

Key Words: Medical Council of India, Website, Digital India, Right to Information Act, 2005

Introduction:

The 21st century is known for technology and advancements. Internet has revolutionized the world and brought close to each other. The initiative by Hon'ble PM Sh. Narendra Modi for making digital India has further improved the technical advancements in Information technology. India has the second highest mobile database in world.[1] Information technology has also digitalized the Medical field. Now medicines are also sold online.[2] But it seems that digitalization has still not reached the Medical Council of India in its true sense. They are happy to be in the Stone Age for various reasons. The website of Medical Council of India is hardly updated and MCI feels that it's a time consuming task which shall be done at its own pace. The Government of India notified in the official Gazette of India, dated 20th October 2008, regarding the amendments for minimum requirement for 100 MBBS admissions which included the development of websites as well.[3]. The Medical Council of India also sent a notice to all the Medical Colleges regarding development of website of Medical College / institution as per the clause B.1.11 of the Gazette notification on 14 January 2009 and asked the Medical Colleges to submit the compliance report by 31st January 2009.[4]

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Material and Methods:

The study was done to evaluate the status of Medical Colleges website as per the minimum standards of admission for 100 MBBS seats. The MCI sent a notice to all the Medical Colleges regarding regular updating of their websites.[4] After a lapse of 6 months of the said notification, we searched the websites of a few Medical College to look for the compliance but unfortunately none of the websites were as per the standard laid down under clause B.1.11 of the "Minimum Requirements for 100 MBBS admission Annually Regulations 1999". Further, we filled an RTI with the CPIO of the Medical Council of India to know the steps taken by Medical Council to implement and check the regulation laid down under clause B.1.11 along with the list of Medical Colleges who have implemented/ not implemented the said regulations. The CPIO of the Medical Council did not provide any information citing the reason that this information was beyond the scope of RTI Act, 2005 along with a remark that reminders were sent to all the Medical Colleges again for the compliance. The first appeal was filled with the Appellate Authority of the Council which was also rejected and disposed off. The second appeal was filled with the Central Information Commission for not providing the correct information along with late reply. The hearing was scheduled nearly after two months. The CPIO of the Council submitted before the

Hon'ble Commissioner that the circular was issued to 289 Medical Colleges and they have received the reply from 106 Medical Colleges and waiting for others to respond so that the complete list can be provided to the appellant.

The CPIO also submitted that the interpretation of the contents of the circular by the Appellant is not correct and that they are not required to get the detailed compliance report at this stage and that the same would be provided to MCI by the Inspectors as and when they visit the Medical Colleges for inspection, as the inspection would also include the inspection of the website and compliance with the contents of the circular. The Hon'ble Commissioner, after hearing both sides, directed the CPIO to provide the list as on date to the appellant within one month with intimation to the Commission.[5] The CPIO provided a list of 112 Medical Colleges along with their website address and a list of 180 Medical Colleges with a further reminder to them to comply with the said regulations.[6] A fresh RTI was filled after four years of the Central Information Commission orders to know the present status of the same. It is now more than two years that no reply has been received from the Medical Council of India.

Discussion:

The study discusses the status of digitalization in the Medical Council of India. As per the Gazette notification, which contains 11 points regarding the development of website of Medical Colleges, it directs each and every Medical College to have their own website which should be updated in the first week of every month. The Gazette notification directs them to include the complete details of the Dean, Principal, Medical Superintendent, details regarding the teaching and non-teaching staff, details of sanctioned intake of various undergraduate and postgraduate courses along with the merit wise and category wise list of students, research publication, details of CMEs, conferences and other academic activities.

The Gazette also directs the colleges to include details of the affiliated university along with the details of its vice chancellor and registrar, result of all the examinations held during the year, any awards by students or faculty, details of recognition status of all the courses and details of clinical material in the hospital.[3] The Medical Council of India, which is the regulatory body to implement the rules, sent a notice to all the Medical Colleges in India on 14th January 2009 to implement the same and send a compliance report to the Council by 31st January 2009. The Council sent a reminder in April 2009 as it did not receive any reply from the Medical Colleges. We filled the RTI with the Council to know the status of compliance report and action taken by them against the defaulters after six months of the notice.

The Council did not provide the information citing the reason that it was beyond the scope of RTI even though it was well within the scope of RTI. The CPIO submitted before the Hon'ble Commission that they have received the compliance report from 106 Medical Colleges and that too after one year of notice and no action has been taken against the defaulters who have not provided the compliance report. The CPIO also submitted that they are still waiting to get the compliance report after one year even after sending reminders to all the Medical Colleges, without taking any action against them. The CPIO argued that the interpretation of the contents of the circular by the Appellant is not correct and that they are not required to get the detailed compliance report at this stage and that the same would be provided to the MCI by the Inspectors as and when they visit the Medical Colleges for inspection.

As per the order of the Hon'ble Commissioner, the CPIO provided a list of the 112 Medical Colleges along with the website address but still the further details regarding the implementation of 11 points of clause B.1.11 were not provided. The CPIO also made a comment that they are waiting for the others to respond so that complete information may be provided to the appellant though the same has not been provided even after five years. The appeal was disposed off by the Commissioner directing the CPIO to provide the information within one month and also warned the CPIO to be cautious in dealing with RTI matter.

Summary

The present study takes the advantage of Right to Information Act to know the status of digitalization in Medical Council of India. It is necessary to update the websites of Medical Colleges within the first week of every month as per the official Gazette of India. The MCI is the regulatory body to keep a watch on the same. It was revealed through this study that the compliance check was not made by the Medical Council for implementing the regulation regarding the updating of website. As per the orders of Hon'ble Central Information Commission the Council provided a list of 112 Medical College's website and a reminder to other Colleges to update their website.

Conclusion

The updating of website during the first week of every month providing all the details as mentioned in the clause B.1.11 of the official Gazette of India regarding minimum requirement for 100 MBBS admissions would be very helpful in eradicating the corruption in Medical education. These details can be useful in curbing the menace of Ghost faculty[7] who are regularly employed at the time of inspection. The faculty working at two different Colleges can be restricted by regularly updating the website of the Medical College and providing the compliance report to the Council. The digitalization will help in creating the database of all the Medical Colleges across the country along with the details including the Medical fraternity in real time manner which can also be updated on the official website of Medical Council of India www.mciIndia.org in real time manner. The digitalization will also reduce the requirement of surface mail and delay in time and money. The advancement of digitalization will be fruitful in eradicating the corruption from the Medical education in a timely manner.

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Corrigendum

1. Title of the article: A study of pattern of poisoning cases admitted to the Maharajah's Institute of Medical Sciences (Vizianagaram), North Andhra Pradesh. South India (Special emphasis on Insecticidal agents)

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2. *J Indian Acad Forensic Med. January- March 2016, Vol. 38, No. 1.*
15. Determination of Stature by Palm Length in Central India *Atul S. Keche, Prakash M. Mohite, Harsha A. Keche* Page No.55-58.

In the following tables the deleted part is marked in **Bold**, which are present on page no. 58.

Table 2: Palm length in Central Indian population

Gender	N	Mean	Std. Deviation	Minimum	Maximum	p-value
Male	110	10.10	0.54	8.80	11.70	0.000,**S**
Female	**120**	**9.10**	**0.53**	**7.80**	**11.10**	

Table 5: Multiplication factor for palm length in central Indian population

Gender	Multiplication factor	Standard deviation	p-value
Male	16.94	0.70	Z value=5.57
Female	**17.51**	**0.92**	p=0.000,S

Original Research Paper

Competency Based Postgraduate Medical Education in Forensic Medicine: A Pilot Study

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Abstract

Introduction: Postgraduate medical education has been evolving from the 'time and process' based paradigm into an outcome based education process. Numerous surveys have demonstrated the need of Competency-based medical education in postgraduate training. With this background, the present pilot study was carried out to assess the impact of Competency-Based Medical Education amongst the Forensic Medicine residents. **Material & Methods:** Amongst the postgraduate students of department of Forensic Medicine, two groups were formed. One group followed the existing traditional postgraduate curriculum and another followed the competency based framework to study the given topics. Assessment was done by means of theory and practical exam. Performance of the students of both groups was analyzed and compared. Perception of faculties and students towards competency based medical education was also recorded. **Results:** Students group following the competency-based framework performed well as compared to other group following the existing traditional curriculum. The difference in mean scores was statistically significant for both the theory and practical exam scores. **Conclusion:** Competency-Based Medical Education can definitely enhance the overall skill of postgraduate student in Forensic Medicine during medico-legal practice.

Key Words: Competency–based medical education; Postgraduate curriculum; Forensic Medicine

Introduction:

Competency-based medical education (CBME) refers to a move towards preparing medical professionals for practice that is basically oriented to outcome abilities and organized around competencies derived from an analysis of societal and patient needs. It involves moving away from a strictly time-based training model towards one that identifies the specific knowledge, skills and abilities needed for practice.[1] A competency is an observable ability of a health professional, integrating multiple components such as knowledge, skills, values and attitudes. Thus the competency is observable and can be assessed to ensure acquisition.[2] Therefore, particularly the postgraduate medical education has been evolving from the 'time and process' based paradigm into an education process that results in outcomes that can be demonstrated in practice.

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Numerous surveys have validated the need of Competency-based medical education, particularly in postgraduate medical education (PGME). Competency-based medical education is worth doing because it clarifies what is important and makes performance expectations more explicit in PGME. Moreover, with the additional focus on learning, teaching and assessment through competency-based education, it may be easier to overcome the current challenges in postgraduate training. Hence, the Medical Council of India in its Postgraduate Medical Education Regulations, 2000 has stated that postgraduate training be competency based and skill based.[3]

However, on referring to most of the curricula of postgraduate education in Forensic Medicine from various universities, it is evident that these traditional curricula have only mentioned in the goals and educational objectives of the syllabus that the postgraduate education be skill based in broad sense. Moreover, these curricula are knowledge driven and are based on "What do learners need to know?" There is no mention of "What outcome abilities (competencies) are needed of a postgraduate" in Forensic medicine with reference to individual topic in syllabus and thus are not outcome driven, which is the basis of competency based medical education.

With this background, the present pilot study was carried out with following aims and objectives:

1) To assess whether the Competency-Based Medical Education can enhance the overall performance and skills of postgraduate students in Forensic Medicine.
2) To know the perception of postgraduate students towards Competency-based postgraduate medical education in Forensic Medicine.

Material and Methods:

To assess the effect of competency based medical education on postgraduate students; two groups were formed amongst the junior residents undergoing M.D. – Forensic Medicine in the department of Forensic Medicine, Government Medical College, Nagpur. In both the groups there were four postgraduate students each, comprising of junior residents of first, second and third year.

A total of four chapters were selected from the existing university curriculum for M.D. (Forensic Medicine). Two chapters each were allotted to two groups. Chapters allotted to two groups were having more or less equal difficulty level. Competencies were identified for chapters which were allotted to CBME group (Study group). The competencies i.e. outcome abilities were identified after discussion with all faculties of the department. These competencies were distributed to each student of study group. They were instructed to acquire competencies during the training and actual performances of medico-legal work in the department. Thus the framework was outcome oriented with emphasis on knowledge application towards the development of overall competency for medico-legal work.

Other group (Control group) was instructed to follow the current university pattern for the two chapters which were allotted to them. The framework was process oriented with more emphasis on knowledge acquisition rather than development of skills and attitude. All the students of both groups were informed that they will be assessed by conducting theory exam of 20 marks comprising of MCQ and SAQ, and practical exam of 50 marks.

After two months, students were assessed by conducting theory and practical exam. Questions were based on chapters selected for particular group and those were distributed to respective students. MCQs were mostly centered on performance based aspect of medico-legal practice. Practical examination was conducted in such a way, so as to test the knowledge, skills and competency of the postgraduate students with respect to the important medico-legal aspects related to the chapters selected. Additionally, the practical examination was mainly focused on testing in respect of achievement of level 3 and level 4 of Miller's pyramid by the postgraduate students. Moreover, to avoid bias during the theory and practical examination, the examiners were kept unaware about groups i.e. study group and control group. Performance of the students of both groups was analyzed and compared. Moreover, the perception of postgraduate students towards the competency-based medical education was also recorded.

Observation and Results:

Students of CBME group, who were given the competencies, performed well in both theory and practical exams, as compared to the control group following existing curriculum. The mean scores of CBME group in theory **(Table 1)** and practical **(Table 2)** were higher than that of control group. **Figure 1** (Theory scores) and **Figure 2** (Practical scores) show the median score, inter-quartile range, along with the maximum and minimum score for the CBME group and control group. In the box-plot figures, horizontal line inside box indicates the median, the height of box represents the inter-quartile range, and vertical lines represent the minimum and maximum values. From the **Figure 1 and 2**, it is evident that there was significant difference between the marks obtained by the CBME group and control group. Regarding the theory scores, there was a statistically significant difference in the mean scores of the study group i.e. CBME group as compared to the control group. The p value was less than 0.05 ($p=0.0405$).

Regarding the practical scores also, there was a statistically significant difference in the mean scores of the study group i.e. CBME group as compared to the control group. The p value was less than 0.05 ($p=0.0230$).

Apart from the above assessment, the perception of the postgraduate students towards competency based medical education revealed that, most of students were not aware of the concept of competency based medical education. Regarding the identified competencies, most of the students agreed that the competencies identified by the faculties were important in day to day medico-legal practice. Moreover, regarding the questions asked in theory and practical examination, most of the students agreed that the questions were based on the medico-legal issues faced in day to day medico-legal practice.

Discussion:

Competency-based postgraduate medical education is an approach in which outcomes for education are precise in terms of specific performance measures.[4,5] It is a learner-centered methodology which gives emphasis on attainment and documentation of performance in practice, called "outcomes". In contrast, the traditional, process-oriented training involves education by means of defined frames and opportunistic learning, rather than learning by objectives defining competency.[6,7] Therefore, competency-based medical education is receiving increasing attention worldwide.[8,9] Several medical schools in the European Union are required to base their undergraduate curricula on a clear and well defined set of competencies.[10] Furthermore, in Canada and the United States, the national accreditation councils have implemented competency-based criteria for postgraduate medical education.[11,12] In Netherlands also, the Dutch Advisory Board for Postgraduate Curriculum Development (DAPCD) has reformed all postgraduate medical training into competency-based postgraduate medical education.[13]

In India, there has been a rather recent need-based progress towards competency based medical education in postgraduate studies. It is yet in a fledgling stage of discussions and planning. The Postgraduate Medical Education Regulations 2000 (PGMER) of MCI merely mention that the PG curriculum be competency-based, and that each department must produce statement of competencies.[3,14] Taking into consideration the recommendation of PGMER 2000 of MCI, most of the postgraduate curricula of Forensic Medicine from various universities have broadly mentioned in the syllabus that the postgraduate medical education be skill based. However, these curricula have not framed clear and well defined set of competencies for each of the individual topic in the syllabus. Therefore, we still have a long way ahead towards implementing competency-based medical education in postgraduate studies.

Moreover, there are certain potential perils and challenges involved in implementation of competency based medical education which needs to be considered. In an effort to assess competencies, some have resorted to breaking them down into smallest observable units of behavior, resulting in endless list of abilities that frustrate learners and teachers alike. Moreover, by focusing on an array of competencies so comprehensively, learners may perceive an underlying message that milestones and not excellence are the ultimate pursuit in medicine. Apart from this, adopting competency based medical education on a larger scale would require new teaching techniques, new modules, new assessment tools along with significant investments in teaching, infrastructure and augmented workforce.[2] Therefore, making this transition requires change at virtually all levels of postgraduate training. Additionally, for successful implementation of competency-based medical education, the support from the implementation team; faculty and the administration along with constant and clear communication between all the players are a very important prerequisite.

The present pilot study was conducted to assess overall performance of postgraduate students by adopting Competency based postgraduate medical education in Forensic Medicine as against existing traditional pattern of postgraduate education. Total number of participants was eight, which included 4 first year junior residents, 2 second year junior residents and 2 third year junior residents. After observing the results in **table 1 & 2**; it is clear that the students who followed competency-based medical education performed better as compared to those who followed the existing traditional curriculum. Furthermore, the perception of CBME group of students towards competency-based medical education revealed that the competencies were satisfactory, generated enthusiasm and interest in Forensic Medicine, resulting in better understanding of the concepts of Forensic Medicine. The students perceived that the competency based programme with clear guidelines and competency based activities will promote the achievement of skills and attitudes needed for medico-legal practice.

However, the limitation to the present study is the small number of participating students. Though we were aware of this fact, it was not possible to increase the number of students due to the limited number of sanctioned postgraduate seats. Further research is required to determine the long-term effects of implementing competency-based education at the postgraduate level. In spite of the limitation of our study, we consider our outcome results significant because of their relation to performance by the CBME group of students. Therefore, our study yields valuable information on the effect of implementing postgraduate competency-based medical education.

Conclusion and recommendations:

Competency-Based Medical Education can enhance the overall skills of postgraduate student in Forensic Medicine during medico-legal practice. After comparing the overall performance of students in both groups i.e those pursuing the existing university pattern & those following the Competency-Based framework, it is concluded that Competency-Based Medical Education can be accepted for postgraduate Course. As far as faculties are concerned, frequent training programmes may be needed to make them aware of this programme particularly in respect of identifying and assessing these competencies. Evaluation of current curriculum is primarily necessary. Moreover, from the present study we conclude that the rewards from competency-based education in postgraduate training strongly outweigh the challenges involved in implementation of the competency based framework. Since this is a preliminary study, its findings cannot be generalized to the entire postgraduate student population in health sciences. It is recommended that a larger study with more number participants and for longer duration may be undertaken to confirm emerging evidence and results.

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Table-1 Theory scores of the two student groups

CBME GROUP (n=4)		CONTROL GROUP (n=4)	
Candidate	Score (out of 20)	Candidate	Score(Out of 20)
A	15.5	E	13.5
B	15	F	13
C	12.5	G	6.5
D	12.5	H	6.5
Mean Score(± SD)	13.8(± 1.6)	Mean Score	9.8((± 3.9)

Table 2 - Practical Examination Scores of the two student groups

CBME Group (n=4)		Control Group (n=4)	
Candidate	Score (out of 50)	Candidate	Score(Out of 50)
A	36	E	27
B	33	F	29.5
C	32	G	28
D	33.5	H	28.5
Mean Score(± SD)	33.6(± 1.7)	Mean Score	28.2(± 1.0)

Figure 1- Box plot of theory scores for CBME group and control group.

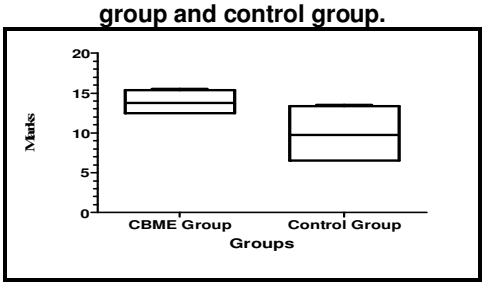
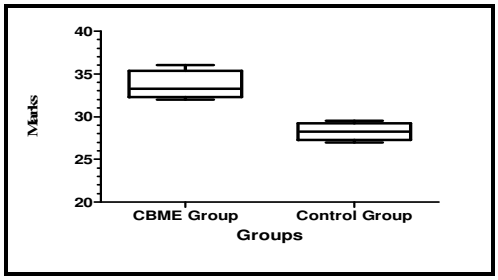


Figure 2 - Box plot of practical scores for CBME group and control group



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Original Research Paper

Custodial Deaths: A Ten Years experience from Central Maharashtra

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Abstract

Introduction: The death of a member of the public whilst detained in police custody usually leads to intense media scrutiny and considerable public unease. Though, National Human Rights Commission of India has laid down strict guidelines to be followed after custodial deaths, these deaths show alarming trends, nationwide**. Materials and methods:** To address the issue, a retrospective, autopsy based study on custodial deaths was conducted at Aurangabad for duration of 10 years (1999- 2008). **Results**: Among the 90 custodial deaths in the study, 89 were male, with maximum cases (33.3%) being from the age group of 31- 40 years. Natural causes accounted for 62 (68.9 %) deaths. Among the unnatural deaths (30 %), suicides constituted 59.3 % cases, homicides - 25.9 %, while 14.8 % were accidental deaths. Pulmonary tuberculosis was the most common cause for natural death, followed by ischaemic heart disease. Poisoning was the leading method for suicide. **Conclusion:** This study emphasizes on better implementation of medical services and tuberculosis control programme in prisons. Promoting suicidal awareness among custody staff may help in early detection of suicidal tendency in prisoners.

Key Words: Custodial deaths, tuberculosis, suicide, poisoning, human rights

Introduction:

Death in custody is defined as death occurring in some form of custodial detention, such as police cell or prison.[1] In the legal parlance, Custody *is* defined as any point in time when a person's freedom of movement has been denied by law enforcement agencies, such as during transport prior to booking, or during arrest, prosecution, sentencing, and correctional confinement.[2]

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The death of a member of the public whilst detained in police custody usually leads to intense media scrutiny and considerable public unease. Relatives of the deceased may express understandable concerns about the propriety of police behaviour and these anxieties may generate additional public disquiet.[3] Not that at each time the death is due to violent causes, but at times, may be due to natural causes or due to inadequate medical facilities or medical attention and diagnosis, or negligent behaviour of authorities or may be due to physical abuse and torture.[4] National Human Rights Commission (NHRC) of India has hence laid down strict guidelines to be followed after custodial deaths. It is found that the major reasons behind custodial deaths are mainly unawareness and carelessness on the part of custodial authorities on the health status of the inmates and poor condition of the cells.[5] Number of studies have been done on custodial deaths by various international agencies and authors in western countries[4,6-9] but only a few studies have been done in India.[4,10,11].

Materials and methods

This retrospective, autopsy based study on police custody-related deaths, during the period of 10 years from the year of January 1999 to December 2008, was conducted in the Department of Forensic Medicine and Toxicology, Government Medical College (GMC)

Aurangabad. GMC, Aurangabad is tertiary health care centre in central Maharashtra and is one of the autopsy centres authorised by the NHRC in custodial death enquiries. Location of custody varied and included deaths occurring in prisons of surrounding districts of Jalna, Jalgaon, Buldhana and open jail of Paithan. The post-mortem examination of these cases was conducted in the mortuary of the institute, as per the guidelines laid out by the NHRC. The records were analyzed for demographic profiles, previous history of disease or medication, signs of torture, cause, manner and place of death, and other relevant findings. Cause of death were categorized as unnatural (Suicide, Homicide or Accident) or natural (Tuberculosis, cardiovascular disease, renal disease, cancer etc). The categorization was based on the inquest conclusion, autopsy reports and laboratory investigation.

Results:

A total of 90 cases of custodial death were analyzed. Of these, 89 were males (98.8%). **(Table 1)** Maximum cases (33.33%) were from age group of 31-40 years; the eldest prisoner being 83 years old.**(Table 2)** 70 % of custodial deaths occurred in judicial deaths (jail).**(Table 3)** Natural causes accounted for 62 (68.88 %) deaths, whereas 27 (30%) cases were of unnatural causes.**(Table 4)** Among the unnatural deaths, suicides constituted 59.25 % cases, homicides constituted 25.9 %, while 14.8 % were accidental.**(Table 5)** Pulmonary tuberculosis was the most common cause for natural death, followed by ischaemic heart disease. Poisoning was the leading option for suicide, followed by hanging. Head injury was common method of homicide.**(Table 6)**

Discussion:

Custody of a person is defined as when his freedom of movement is denied by law enforcing authority. A person in the custody is under the supervision of the authorities and is dependent on them. So, any death occurring in the custody is considered to be a fault, in one way or other, on the part of the concerned authority.[5] As per 2011 NHRC report, there were 14,231 custody related deaths in India during the period of 2001 to 2010.[12] 1250 prison deaths occurred in Maharashtra state during years 1999 to 2008, 1200 amongst them were males.**(Fig 1)**[13] These alarming trends in deaths in custody warrant detailed analyses. An attempt was made in the present study to analyze custody related deaths according to demographic data, their cause and manner of death.

In the present retrospective study, we have analysed 90 cases of custodial deaths during the period 1999 to 2008. Maximum cases (n=15, 16.6%) were observed in 2008, much more than the previous years. Males constituted maximum cases (98.8%). Rarity of female custodial deaths is recorded by National Crime Records Bureau (NCRB) and also globally.[7,8] Bardale R, et al[4] and Dogra TD, et al[14] observed no female deaths in custody and attributed rarity of crimes by female as a reason for it. Age group of cases varied from 5 months to 83 years in present study. Single case of 5 months of female who was staying with nursing care of her convicted mother, had a natural death. It was discovered that the most frequently affected age group was 31-40 years, followed by 21-30 years. Comparable findings were observed in India[11] and Canada,[15] where 21 to 40 years was most common age group. More deaths in the younger group can possibly be explained by the fact that people in this age group are most energetic and prone to greater stresses of life and constitute the largest number of prisoners in India.[11]

With respect to manner of death, out of 90 cases, maximum cases (68.8%) were of natural deaths. Other researchers also found that natural deaths are more common than unnatural deaths,[5,16,17] but some workers[15,16] reported that unnatural suicidal deaths were more prevalent. Natural deaths were also observed to be common amongst 1702 custodial deaths (1507 natural and 195 unnatural) during the year 2014 by NCRB.[13] Among the natural deaths, most of the deaths were due to respiratory system involvement with pulmonary tuberculosis being commonest. This finding was supported by various researchers.[16,19] However, Wobeser, et al[15] found that the majority of deaths were due to cardio-vascular diseases, which was next common cause of death observed in present study. In this study, apart from pulmonary tuberculosis and ischemic heart disease, persons died due to disseminated tuberculosis, cerebral infarction, cirrhosis of liver, peritonitis, pneumothorax, meningitis and carcinoma. Tuberculosis control program within prison should be given greater emphasis by the Public Health establishment to curb higher prevalence of tuberculosis.

Suicide was the most common unnatural manner of death in present study. The present study is in line with that of Bansal, et al[16] who found that suicide is the most common unnatural

manner of death; however they found that fall from height was the cause in most of suicidal cases, as opposed to poisoning in present study. Poisoning[11] and hanging[7,10] were also observed to be most common method of suicide by other studies. Hanging, drowning and stab injury to abdomen were other suicidal modes observed in this study. Past history of psychiatric illness or deliberate self harm should be sought from detainees as they are independent risk factors for suicide in custody.[6] Promoting suicidal awareness among Police/jail surgeons and custody staff should increase likelihood of detecting suicidal tendency of a prisoner.

Assaults leading to homicides were observed in 7 cases (7.7%). Prevalence of homicides was observed in other studies and ranged from 11%[7] to 4%[9]. Head injury was the most common mode of homicide. Other methods of homicide were by firearm, stab injury to heart and multiple injuries. Homicide due to ligature strangulation[10] and burns[16] were reported in other studies.

All these cases, be it natural deaths or unnatural deaths, show some sort of carelessness and disrespect for human life on the part of authorities. Authorities are not aware about any history related to health of inmates and they take action only when the condition deteriorates and the inmates ultimately succumb to death.[10]

`Limitation of study may be apparent due to slightly older data. An investigation of a custodial death is multipronged and involves additional agency like NHRC. Scientific conclusions drawn may be inappropriate or at times inadequate when case is sub judice which may remain so for protracted period. This study holds relevancy as it has evaluated cause and manner of death of custodial deaths which come to fore after conclusions of investigation and confirmation by judiciary.

Conclusions

Maximum deaths occurred due to natural causes, with tuberculosis being the leading killer. This highlights the importance of stringent pre-arrest health check up of convicted persons. Proper ventilation and frequent fumigation of detention cells can be a preventive measure to curb respiratory ailments. Emphasis should be placed for better implementation of tuberculosis control programme in prisons. Immediate diversion of prisoners to the hospitals when their condition appears to require urgent medical attention should be practised.

Amongst violent death, most of the deaths were by suicide and poisoning remained the method of choice. Higher rate of suicide with poisoning and hanging reflects importance of recognising suicidal tendencies among prisoners. Question should be addressed as to how individuals obtain poisons and lethal weapons such as knives, ligature materials, etc. It throws light on the loose security of jails leading to access of prisoners to such agents. This study illustrate the range of diversity present in regard to human behaviour and disease and offer new directions for understanding some of the needs and conditions of those in custody.

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Table 1: Year wise distribution of cases

Sr	Year	Cases
1	1999	3
2	2000	7
3	2001	11
4	2002	10
5	2003	13
6	2004	8
7	2005	3
8	2006	10
9	2007	10
10	2008	15
	Total	90

Table 2: Gender wise distribution of cases

Sr. No	Gender	Cases
1.	Male	89
2.	Female	1

Table 3: Age Group wise distribution of cases

Sr no	Age group	No of cases (%)
1	< 10	1 (1.11)
2	11-20	2 (2.22)
3	21-30	17 (18.88)
4	31-40	30 (33.33)
5	41-50	19 (21.11)
6	51-60	16 (17.77)
7	61-70	3 (3.33)
8	71-80	1 (1.11)
9	81-90	1 (1.11)
	Total	90 (100)

Table 4: Distribution of cases according to place of death

Sr no	Place of death	No of cases (%)
1	Judicial custody (Jail)	70 (77.77)
2	Police custody	18 (20)
3	Police firing	1 (1.11)
4	In premises of police station	1 (1.11)
	Total	90 (100)

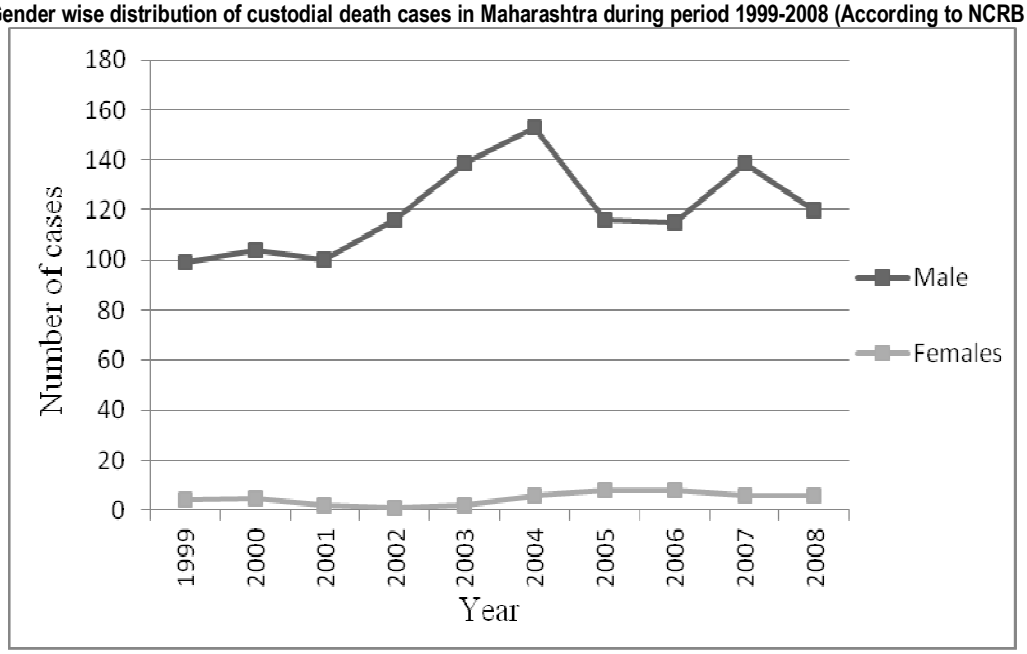
Table 5: Distribution of cases according to manner of death

Sr no	Manner		No of cases (%)
1	Natural		62 (68.88)
2	Unnatural (n=27)	Suicide	16 (17.77)
		Homicide	7 (7.77)
		Accident	4 (4.44)
3	Undetermined		1 (1.11)
	Total		90 (100)

Table 6: Distribution of cases according to Cause of death

Sr no	Cause of death		No of cases
1	Natural death	Pulmonary tuberculosis	19
		Ischaemic heart disease	17
		Disseminated tuberculosis	8
		Cerebral infarction	3
		Cirrhosis liver and complications	2
		Septicemia due to Peritonitis	2
		Pneumothorax	1
		Meningitis	1
		Carcinoma Lung	1
		Carcinoma cervix	1
2	Suicidal	Poisoning	9
		Hanging	4
		Drowning	2
		Stab injury to abdomen	1
3	Homicide	Head injury	3
		Haemorrhagic shock due to firearm injuries	2
		Multiple injuries over body	1
		Stab injury to heart	1
4.	Accidental	Head injury	4
5.	Undetermined	Undetermined	1

Figure 1: Gender wise distribution of custodial death cases in Maharashtra during period 1999-2008 (According to NCRB database)



J Indian Acad Forensic Med. July - September 2016, Vol. 38, No. 3 **ISSN 0971-0973**

Original Research Paper

An Analytical Study of Unnatural Deaths in Kakinada Area - One Year Retrospective Study

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Abstract

Day by day Unnatural deaths are increasing in number in developing countries as well as in developed countries. To analyze gender, age, manner and other specificity in unnatural deaths the present study was conducted in 758 victims who died due to unnatural manner and were autopsied at the Department of Forensic Medicine, Rangaraya Medical College, Kakinada, Andhra Pradesh, during the period January 2014 to December 2014.The study shows that total number of unnatural deaths in 2014 were 758 of which themale: female ratio was 2.3:1, in road traffic accidents-4.0:1,in hanging-1.0:1, in poisoning-2.6:1,in burns- 0.5:1, in drowning-2.7:1,in others-6.5:1. Taking the manner of death in to consideration, accidents were 567 out of which males were 412 (54%) and females, 155(20%),suicides were 165, of which, males were 98 (13%) and females, are 67(9%); while homicides were 17 of which males were 12 (1.6%) and females, 5(0.6%). In 9 cases, manner of death was not known, of this, males were 4 (0.5%) and females 5(0.6%).

Key Words: Unnatural deaths, Accidents, Suicides, Homicides, Undetermined deaths

Introduction:

Death/Brain death is defined as irreversible stoppage of brain function and cause of death is defined as any disease or injury responsible for initiating the sequence of events (brief or prolonged) resulting in the death of an individual.[1]

Manner of death is divided into two types

1) Natural- if death occurs from the disease alone
2) Unnatural- if death results directly from an injury or poison or indirectly an injury which may precipitate preexisting natural disease in an individual. This could be homicidal, suicidal, accidental or of unexplained origin.[2]

Homicide means killing of one human being as a result of conduct of the other. It may be lawful or unlawful sec 299 IPC.[3] Suicide means self-murder. Attempted suicide is an unlawful act and the person is held responsible for immediate consequence of act in India.[3-6]

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To analyze the situation of unnatural deaths inKakinadaThe present study was conductedin the Department of Forensic Medicine, Rangaraya Medical College, Kakinada. 758 victims were observed and analyzed, who died due to unnatural manner which were autopsied in the Department of Forensic Medicine, Rangaraya Medical College, Kakinada, during the period of January 2014 to December 2014.

Aims & Objectives

The present autopsy based study was conducted to analyze gender, age, manner and other specificity in unnatural deaths

Material &Methodology

The present retrograde study mainly based on the autopsy reports of unnatural deaths in Kakinada in the department of forensic medicine, rangaraya medical college.758 cases observed and analyzed according to their age, gender, manner of death and cause of death.

The subjects were divided into 5 groups according to their age i.e., <20 yrs, 21-30yrs, 31-40 yrs, 41-50 yrs & 51 yrs and above. Manner of Deaths was divided into 4 groups i.e., Accidents, Suicides, Homicides and Undetermined. Cause of Death was divided into 6 categories i.e., RTA, Hanging, Poisoning, Burns, Drowning and Others (Electric Shock, Dog bite & Snake bite).

Results

Total number of unnatural deaths that were brought to the mortuary of the department for medico-legal autopsy in 2014 were 758. Of these, males were 526, females 232, the male female ratio being - 2.3:1. Manner of death-wise, accidents were -567 (75%), suicides -165 (22%), homicides- 17 (02%), undetermined- 09 (01%).In case of accidents, males comprised 412 cases, females were 155. In suicides, males were 98, females were 67& in homicides males comprised 12 cases, females were 5, in undetermined deaths males were 4, females were 5**.[Table-1]**

Analysis of Suicides

Male – 98, Female – 67. Among unnatural deaths in men, suicides accounted for 18% deaths and in women, 29%. In men, poisoning – 80%, hanging - 11%, burns - 9%. Whereas, in women, the figures were: - burns & poisoning occupied the Ist position with 42% each; while hanging - 16%, and drowning - 1%. Burns was the last preference for men; but first preference for women contemplating suicide. In men the over-whelming choice was poison.

Cause of death (table-2 and 2a)

Road traffic accidents

The total number of road traffic accidents were 412; of which males were 334, and the male: female ratio was 4:1. There was gross disparity of 7:1 in <20 yrs age group. Vehicular accidents accounted for 78% of unnatural deaths in men; 34% of unnatural death in women.

Hanging

Total number of hanging deaths were 22; of which males 11; the male: female ratio was 1:1. Two percent of deaths were due to hanging in males; 5% in females. 90% of female deaths were in the <30yrs age group; compared to 73% of male deaths in under 30 yrs age groups.

Poisoning

Poisoning deaths were 122, of which males weres 88 and the male predominance was 3:1. Poisoning accounted for 16.6% deaths in men; 14.9% in women. Since the total no. of women resorting to suicide was less than men, the ratio was 3:1 but among women contemplating suicides, the probability of choosing poison as the option was not far behind men's choice. Only in <20yrs age group there was no gender difference - 0.9:1. In all other age groups (78% of cases) there is male predominance. The risk of women resorting to poison consumption was greatest below 30yrs (76%).

Burns

Total deaths due to burns were 125; males were 39, the rest being females. Women predominance with M:F ratio was 0.5 : 1. Burns accounted for 38% deaths in women. 68% of deaths in women occurred in the <30yrs age group, where as it was 49% in men. In the <40 yrs age group, the figures were – 85% for women & 77% for men. Accidental Burns – female deaths were double the male deaths. Suicidal Burns – female Deaths were triple.

Drowning

Total deaths due to drowning deaths were 37, of which males were 27; the male:female ratio - 2.7:1. It accounted for – 5% deaths in men, 4% in women

Other cause of deaths

Other cause of deaths like electric shock, snake bite, dog bite..etc accounted for 40 deaths of which males were 30, and the ratio - 3:1

Discussion and conclusion

The number of unnatural deaths were more in males than females because males, being more active than females are more prone to unnatural deaths like vehicular accidents, drowning etc. In different manners of deaths, accidental deaths were more common - accidents - 567 (75%), suicides -165 (22%), homicides - 17 (2%). In accidents, males were the more common victims, the vulnarable age group was 21-30 years. In this age males have more enthusiasum on rash driving and swimming.

In suicides, the percentage of unnatural deatha was more in males. Suicides were more in the age group of 21-30 years in male and females. Not achieving goals, lack of job satisfaction, love failure provokes this age persons to commit suicide. Homicides were also more in males in the age group of 30-40 years.But undetermined deaths were more in females. It tells about the present situation of females in society which needs through invetigation in their cause of death.

Descending order of cause of deaths was road traffic accidents, burns, poisoning, others, drowning and hanging. Road traffic accidents were common in males with Gross disparity of 7:1 in <20 yrs age group. Burns were common in females; for every man two women died due to burns. Because of domestic problems females choose this method for dying. This could be because of fact that they have more access to the kitchen and fire. We suspect that suicidal burns are under-reported and some

of the cases listed as accidents may in fact be suicidal in nature. We classified the cause of deaths basing on the inquest reports.

Almost 3 men were dying due to drowning for every woman. Most of these deaths occurred below 40years. The percentage of hanging deaths in males and females was the same.

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TABLE-1 Manner of death

Manner	Number (Male+Female)	Percentage
ACCIDENTS	567 (412+155)	75
SUICODES	165(98+67)	22
HOMICIDES	17(12+5)	02
UNDETERMINED	09(4+5)	01

TABLE-1A Manner of death

AGE	Accidents		Suicide		Homicide		Undetermined	
	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)
<20 yrs	68(17)	23(15)	11(11)	26(39)	1(8)	0	0	1(20)
21-30 yrs	113(27)	42(27)	35(36)	28(42)	1(8)	1(20)	1(25)	
31-40 yrs	82(20)	27(17)	28(29)	7(10)	4(34)	2(40)	1(25)	1(20)
41-50 yrs	74(18)	28(18)	18(18)	4(6)	1(8)	1(20)	1(25)	1(20)
51& above	75(18)	35(23)	6(6)	2(3)	5(42)	1(20)	1(25)	1(20)
Total	**412**	**155**	**98**	**67**	**12**	**5**	**4**	**5**

TABLE-2 Cause of death

SEX	RTA	HANGING	POISONING	BURNS	DROWNING	OTHERS
MALE	334	11	88	39	27	30
FEMALE	78	11	34	86	10	10
TOTAL	412	22	122	125	37	40

TABLE-2A Cause of death

AGE	RTA		Drowning		Hanging		Poisoning		Burns		Others	
	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)	M (%)	F (%)
<20 yrs	49(15)	7(9)	7(25)	1(10)	0	5(45.5)	13(15)	14(41)	4(10)	21(24)	7(23)	2(10)
21-30 yrs	84(25)	16(21)	8(30)	2(20)	3(27)	5(45.5)	29(33)	12(35)	15(39)	38(44)	11(37)	2(10)
31-40 yrs	68(20)	16(21)	5(19)	2(20)	5(45)	0	22(25)	4(12)	11(28)	15(17)	5(17)	3(30)
41-50 yrs	65(20)	13(17)	4(15)	1(10)	2(18)	1(9)	17(19)	3(9)	5(13)	5(6)	3(10)	3(30)
51& above	68(20)	26(32)	3(11)	4(40)	1(10)	0	7(8)	1(3)	4(10)	7(9)	4(13)	0
Total	**334**	**78**	**27**	**10**	**11**	**11**	**88**	**34**	**39**	**86**	**30**	**10**

Original Research Paper

Study of Epidemiological Profile of Hanging in Jodhpur Region of Rajasthan: An Autopsy Based Study

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Abstract

Suicidal tendencies are increasing at an alarming rate all over the world. Failures and consequent depression, being the leading cause. Hanging seems to be one of the most common methods of attempting suicide. A total 356 cases of death due to hanging, involving both males and females, were identified and studied during medicolegal autopsy at the Department of Forensic Medicine and Toxicology, DR SN Medical College, Jodhpur. Male preponderance was observed with a majority being in middle age group (72%). In females, the most commonly affected were the adolescents and the young (77%). Atypical hanging with right sided knot dominated the picture. The rope (hard material) was the most common ligature material used by males whereas females preferred dupatta (soft material). Closed places were preferred to open areas. Most of these deaths were reported among Hindus, followed by Muslims. Majority were married (males,72.7%; females,59.1%). Most of the male victims were either involved in private jobs or worked as labourers; while the females were either housewives or students.

Key Words: Hanging, marriage, suicide, soft ligature material, occupation

Introduction:

Suicide is the willful and voluntary act of a person, who understand the physical nature of the act and intends by it to accomplish result of self-destruction.[9] About 800000 people commit suicide worldwide every year,[2] of these 135000 (17%) are resident of india.[10]

The Government of India classifies a death as suicide if it meets the following three criteria

- It is an unnatural death,
- The intent to die originated within the person,
- There is a reason for the person to end his or her life.

The reason may have been specified in a suicide note or unspecified. If one of these criterions is not met, the death may be classified as death because of illness, murder or in another statistical category.[1]

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Hanging is the commonest method of committing suicide in cities and towns and is considered as painless form of death. Sometimes, hanging is adopted as a last resort after other forms of suicide (poisoning, cutthroat injury, etc.) have failed to produce the desired effect.

In 2012, Tamil Nadu (12.5% of all suicides), Maharashtra (11.9%) and West Bengal (11.0%) had the highest proportion of suicides.[3] Among large population states, Tamil Nadu and Kerala had the highest suicide rates per 100,000 people in 2012. The male to female suicide ratio has been about 2:1.[3] Jodhpur recorded a total of 117 suicides in 2014, contributing a total of 0.6 % to the total suicides in India. The death rate in Jodhpur was 10.3 per lakh against a national average of 10.6 in that year.

Asphyxia as a result of compression of the neck is a cause of death in hanging. Combined effect of asphyxia and venous congestion is the commonest cause of death in most cases.[1] The compression of neck is brought about by the weight of the body. In complete hanging, the body is fully suspended and no part of the body touches the ground whereas in partial hanging only a part of the body weight acts as the constricting force. A weight of 4.5 kg is enough to occlude the blood vessels of the neck.[3-5]

Suicide rates vary with age and males are usually the major victims. Various risk

factors for suicide are family and social factors, economic factors, in addition to psychological factors. Depression due to psychological problems, failure in love and studies, loss of near and dear, economic problems may all have forced a person to hang himself. Hanging for dowry is on an increase and has become a social problem. The number of hanging deaths is increasing day-by-day in Jodhpur. Even though hanging is usually suicidal, homicidal hanging or to kill a victim by other means and then suspend the body at a height (tree or roof) is not uncommon. In these situations, the role of the forensic pathologist is of utmost importance.

Among the materials used for suicide, household items were commonly implicated. Materials like rope, duppatta, dhoti and wire were the most common type and were available at the crime scene.

Most of the cases of hanging encountered at autopsy are atypical hanging.[6] Age, sex, visit to the scene of crime, type of ligature mark and knot, may all help to decide the manner of death in hanging.[7]

Materials& Methods:

The present retrospective study was carried out at the Department of Forensic Medicine and Toxicology, Dr. S.N. Medical College, Jodhpur (Raj). The duration of the study was 5 years from Jan. 2007 to Dec. 2011. A total of 3790 dead bodies were received for postmortem examination during the study period. Of them, 365 cases were of alleged hanging. On the basis of the post-mortem findings and correlating them with the detailed history elicited from the police and the hospital records of the deceased, it was concluded that the cause of death was hanging in 353 cases and strangulation in 12 cases. All the cases of hanging were selected for the present study.

The details regarding history of the incidence, personnel details of the deceased were recorded on specially designed Performa. The data so collected was tabulated on a master-chart and analyzed.

Observations and Discussion:

Deaths due to hanging constituted 9.3% of the total 3790 cases that were brought to the mortuary for postmortem examination over a five year period from Jan 2007 to Dec 2011. **(Table-1)** The incidence of hanging was the highest in the months of March & April (16% & 11%, respectively) and least in the month of September and October (4% & 6.2%, respectively). **(Table 2)**

The highest incidence was in the age group 21-30 years (49.9%, 176 cases), which is similar to the observations by Verghese PS,[8] followed by 31- 40 years (20.1%,71cases) and 11-20 years (16.4%, 58 cases). It was the least in the age group 0-10 years (0.3%, 1 case) and above 60 years age group (1.1% 4 cases). Majority of the victims were males, 238 cases (67.4%). **(Table 3)**

Typical hanging was observed in 13.3% cases and atypical in (86.7%). Amongst the atypical cases, the knot was either on right side (48.2%) or on the left side (44.5%) **(Table 4)** Rope was the most common ligature material used overall (49.6%) as majority of the victims were males. In females, Dupatta (54.8%) was the most common ligature material used. Both these were "easily available", as observed by Modi.[7] **(Table 5) C**losed areas were preferred by both males and females (95.2%), as compared to open place (4.8%). **(Table 6)** Majority of the victims were married (68.27%). **(Table 7)**

Suicide was more commonly reported from urban areas, 223 cases (63.17%) as compared to the rural. **(Table 8)** Most of the victims were employed in private jobs, 97 cases (27.5%) followed by students, 82 cases (23.2%), housewives, 70 cases (19.8%) and labourers, 60 cases (17%).**(Table 9)** Of the total 115 female victims, 37 (32.2%) were registered under dowry deaths. **(Table 10)**

Male preponderance can probably be explained by the fact that though emotional liability and depressive tendency as well as suicidal thoughts may be more common in females, but still “thought to act transition “ is less in females as compared to males. Tough ligature material (rope) was preferred by males while females chose a softer material like dupatta.

Suicide, even in the unmarried, was more common in males, 65 cases (58%), as compared to females, 47 cases (42%). Marriage is supposed to be a protective factor in some studies internationally while marital disharmony is amongst major risk factor for suicide in India. “The let it go – move on" attitude in western world may be reason as why the tendency to high divorce rate rather than suicide as an option is taken.

Suicide is probably less common among the rural populace as the social structure is closely knit in the rural side of India promoting harmony and preventing the psychological slide to worthlessness. Economic burdens, work pressure and peer pressure for performance and immature love affairs in teenage thus seem to be the most important areas of preventable risk factors for suicide.

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Table 1 Number of autopsy cases conducted in five years (Jan. 2007 to Dec. 2011)

Status	Number	Percentage (%)
Hanging	353	9.31
Others	3437	90.68
Total	3790	100.0

Table 2 Month wise distribution of hanging cases (Jan 2007 to Dec. 2011)

Month	Number (n=353)	Percentage (%)
January	32	9.07
February	27	7.65
March	57	16.15
April	39	11.05
May	37	10.48
June	17	4.82
July	26	7.37
August	29	8.22
September	14	3.97
October	22	6.23
November	29	8.22
December	24	6.80
Total	353	100

Table 3 Age distribution of hanging cases with sex

Ageing years	Male (n=238)		Female (n=115)		Total (n=353)	
0-10	1	0.42	0	0	1	0.28
11-20	26	10.92	32	27.83	58	16.43
21-30	120	50.42	56	48.70	176	49.86
	52	21.85	19	16.52	71	20.11
41-50	27	11.34	6	5.22	33	9.35
51-60	8	3.36	2	1.74	10	2.83
>60	4	1.68	0	0	4	1.13
Total	238	100	115	100	353	100

TABLE 4 Typical and a typical hanging

Typical/ Atypical	Position of knot			
	Back	Left	Right	Total
Typical	47 (100.0%)	-	-	47 (13.31%)
Atypical	-	136 (44.4%)	170(55.55%)	306 (86.68%)
Total	47 (13.3%)	136(38.52%)	170(48.15%)	353

Table 5 Type of ligature material

Type	Material	Male	Female	Grand Total	%
Hard	Belt	2	-	2	0.57
	Elec. Wire	6	-	6	1.70
	Iron chain	2	-	2	0.57
	Niwar	2	1	3	0.85
	Plastic Pipe	2	-	2	0.57
	Rope	153	22	175	49.58
Soft	Bed Sheet	7	-	-	0.00
	Dupatta	24	63	87	24.65
	Loongi	16	-	16	4.53
	Muffler	2	-	2	0.57
	Odhani	10	8	18	5.10
	Safaa	1	-	1	0.28
	Saree	8	21	29	8.22
	Towel	3	-	3	0.85
Total		238	115	353	100

Table 6 Place of hanging

Place of hanging	Male	Female	Grand Total	%
Closed Place	224	112	336	95.18
Open Place	14	3	17	4.82
Total	238	115	353	100

TABLE 7 MARITAL STATUS

Row Labels	Female	Male	Grand Total
Married	68	173	241
Unmarried	47	65	112
Grand Total	115	238	353

Table 8 AREA WISE DISTRIBUTION

Row Labels	Male	Female	Grand Total	%
Jodhpur Proper	146	77	223	63.17
Jodhpur Rural	92	38	130	36.83
Grand Total	238	115	353	100.00

Table 9 Occupation wise Distribution

Row Labels	Male	%	Female	%	Grand Total	%
Barber	1	0.42		0	1	0.28
Carpenter	5	2.10		0	5	1.42
Driver	9	3.78		0	9	2.55
Electrician	2	0.84		0	2	0.57
Goldsmith	4	1.68		0	4	1.13
Govt. Serv.	7	2.94		0	7	1.98
Housewife		0.00	70	60.87	70	19.83
Labour	59	24.79	1	0.87	60	17.00
Mechanic	1	0.42		0	1	0.28
Military	10	4.20		0	10	2.83
Painter	1	0.42		0	1	0.28
Private Job	93	39.08	4	3.48	97	27.48
Retired person	2	0.84		0	2	0.57
Shopkeeper	2	0.84		0	2	0.57
Student	42	17.65	40	34.78	82	23.23
Grand Total	238	100.00	115	100	353	100

TABLE 10 DOWRY DEATH IN FEMALE

Dowry Death	Female	Grand Total	%
No(-)	78	78	67.83
Yes(+)	37	37	32.17
Grand Total	115	115	100

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Original Research Paper

Change in Social Psyche: A Trigger to Commit Crime

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Abstract

The crime among the youngsters is the most suspected factor for the increase in rate and intensity of existing risks. The highest probability of extreme crime cases and the emergence of new vulnerabilities in Southern delta regions of India has stood out as the reason for undertaking this study in major prisons of this multi hazardous region. The different criminal activities among the youth are becoming one of the most important economic and political issue in the coming decades of Southern India, especially when it has a negative impact on the economic growth and has displaced lives and livelihoods of the public. This intention of committing crimes has led to decline in 'security' and 'social capital' which are the two main prerequisites for the development and progress in any society, and lacking them may end up in recession and increased crime.

Key Words: Social psych, criminology, pseudo status

Introduction:

This study reveals the significant variation in psyche in the society which is endangering the traditions, customs and a neglecting attitude towards law of the land. Deeply entrenched thoughts with respect to the modern day gadgets, brands, lifestyles, pseudo status, etc., are the triggers for increase in crimes. Every crime differs from country to country, region to region, state to state, society to society and also time to time, depending on the various situations. So, it is so difficult to mention crime as an universally acceptable definition. The scenario of every crime and careful analysis of the crime often throws light on the fact that that there is robust relationship between offending crime and thereafter excuse and justification making (Maruna and Mann, 2006). [1] Our study brings out the complex realities in and around the world of crime and make us understand how changing political, social, economic conditions, educational standards and most predominant, the psychological illness may have some influence over the present day crimes and the amendments on the legal, law, policies, enforcement and penal codes designed by the society support the deflation of crimes.

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Crime control is a reconfigured complex of interlocking structures and strategies that are themselves composed of old and new elements, the old revised and reoriented by a new operation context.[2]

The accepted social normal life of the people, being interrupted, stands out as an universal phenomenon behind the incidence of crime. A criminal is a person who commits an action that is against formal regulations of a country. However, the extent, kind, purpose, motive and intensity of the crime differs from place to place. Being a relative phenomenon, depending on the time and places, crime varies widely from society to society. Crimes, theft, violence, addiction, prostitution, robbery, and drug dealing are the reasons causing social deviances.[3] Crime issues are politicised and regularly represented as an emotional aversion, which is a cardinal sin in the sense of arguments against the use of human.[4]

Research has shown that adolescents, whose peers disapproved of delinquent behavior, were less likely to report having committed delinquent acts, including sexual assaults.[5] In this present work, it was found that violent behavior of youngsters is often for gaining independence from parents and developing a pseudo identity within the peer group. The career approach explores how criminal behaviour progresses, not necessarily in a linear manner, from tentative flirtations with rule breaking, to more sustained involvement in crime and finally to a criminal role and identity.[6]

In the present study, it was observed that crime is an action that is against one of the

public sanctions of any society and the tendency to commit crime is influenced by several factors. In the transitional period from childhood to adolescence and adolescence to maturity, youth are generally imposed to face different socio-economic crises. There is relationship between youth violence and crime and its outcomes can be analysed as an adaptive strategy which can provide a healthy environments in the society. In this regard the teenage age groups due to their vulnerablity are more prone towards committing crime. In this present study, an attempt has been made to study the different risk factors responsible for criminal behaviors of youth and also the general public.

The present study attempts to offer a sociological analysis of crime in Pondicherry state & Cuddalore prisons from 2010 to 2014. Prisons have long been associated with punishment, deprivation and poor conditions, but it is only recently that prisons have been linked to the treatment and human rights violations of mentally disordered prisoners.[7] Using data analysis methods, the findings of the study demonstrate that the highest rate of crime is related to financial reasons, and the lowest to cultural and political crimes. Our study also reveals "the relation between age and kind of crime" and "the relation between age and cooperative crimes". Thus, the crimes committed in Karaikal are more violent, financial and juvenile, indicating the threat of organized and cooperative crimes among the younger age groups. Since the rate of committing crimes in the target area of our study was dramatically increasing, leading to social damages, the present study attempts to identify and study the frequency of social factors that influence commission of crimes.

Objectives :

The main objectives of the study are:

- To analyse the criminality in terms of the theoretical background of criminology to find out the different motivational factors for their involvement in crime.
- To study the influence of modern lifestyle being the initiation for committing crime among the middle aged and young population in the modern era society.

Methods

The present study is concerned with examining the nature of criminality in criminals of both rural and urban background, lodged in three prisons of Southern-India, namely, Pondicherry, Karaikal & Cuddalore prison. The study was conducted in 2014 and all the prison inmates were under the period of imprisonment from 2010 to 2014. A total of 70 respondents took part in this study and the age group was between of 22 - 35 years. Interview method was used to collect data from the respondents of all the three prisons. The data so collected was compiled in a tabular format and analysed. Besides, respondents' age group, sex, educational standards, economic status, the type of crime and the triggering factors for committing crime were also analysed.

Results & Discussion:

The study reveals that all the convicted prisoners were male and no females were jailed in these prisons for committing the crime. The crime committed by all the male prisoners was murder and it was executed just only for the sake of gain towards the modern lifestyle. Every convict in all the prisons had accepted their crime and were found guilty. The murders committed were not intentional and were accidental or incidentally homicidal during the original criminal act. In this study there is a causal attribution to crime and this is in accordance with the work of Maruna. S [8] who also observed that causal attribution in case of a crime is depending on several dynamics**.** The crime may be commited due to the interplay of internal/external factors , it can be intentional/unintentional, and psychological stability/instability of the offender and whereas the situation which contributed to the crime was controllable/uncontrollable.

In our study, the Cuddalore prison had the maximum convicts, 38 (54.3%), as compared to Karaikal and Pondicherry prisons who had 18 and 14 prisoners (25.7% & 20%), respectively. These murders involved the relatives and the non relatives of the convicts. The majority of murders were committed on the non-relatives, 38 victims (54.3%), while the relatives accounted for 32 victims (45.7%). **[Table 1, Fig 1]** Among the prisons, Cuddalore prison had more number convicts who had murdered their relatives, (21) with 16 victims who were non relatives when compared to Karaikal with less relatives as victim (06), as against non relatives (12); followed by Pondicherry prison with least number of relatives murdered (05) as against non relatives (10). The number of victims related to the prisoners in Karaikal and Pondicherry prisons were almost equal in percentage and had a gross differences from the Cuddalore prison with respect to the relative victims to the prisoners. **[Table 2, Fig 2]**

Conclusion & suggestion:

As, It has been made clear, this study reveals the present day psych of the individuals indulged in crime as an outcome of craving towards pseudo status lifestyle. A criminal is a person that commits an action that is against formal regulations of a country While a social action at specific period of time and in a particular society can be regarded as a social deviance, it may be considered normal in a different cultural context or in the same society but within a different time span and in this regard there exist a circle. Each element is a circle between an individual and the society. As long as an individual belongs to the usual groups of a society, he / she follows the social norms. However, when one or more of these circles is weakened, the possibility of spreading deviant behaviors increases . The present study reveals a vast intensity that fosters many social damages including appropriate context for many crimes. The spread of social deviances in general, and committing crimes in particular, imposes an exorbitant costs on societies that reduces the social security and also by eroding the human resources of societies acts as a main obstacle in the way of development. That is because these social damages deprive individuals and societies from many socio-economic opportunities that form societies. Hence, the major objective of the present work was to study the social factors that influence in committing crimes like poor economic conditions, peer group pressure, family situations, neighbour-hood, alcohol addiction and media influence. **[Fig 3]**

Poverty has been found to be an attribute to a greater likelihood of involvement in crime and violence.[10] Self reported felony assault and robbery have been found to be twice as common among youth living in poverty as among middle class youth.[4] Low family income predicted self reported teen violence and convictions for violent offenses in several studies. Our study put forth, the poor economic conditions and the peer group pressure has been found responsible among the major factors that creates an impact for the youth and influencing them to commit crime, while alcohol addictions and family problems are the least influencing factors in committing crime. Most offenders, excluding perhaps psychopaths are not immune to the moral constraints on behaviour that influence all socialized beings.[11] 'The wrongfulness of one's behavior is determined by the amount of harm done and by the intentions of the actor. Offenders can excuse their behavior if they believe no one is ''really'' harmed'.[12] There is one potential solution to many of the problems set out above is the private security services with increased numbers of surveillance CCTV technologies on city streets can reduce the severity of crime. Parents must likely to teach positive social skills to their youth or to deal with their problems effectively. Few programs should be implemented to target thinking, not the behavior of the convicts and bringing about rehabilitation to the criminals. The importance of rural-urban framework is necessary that brings together the civil society, private, commercial, district and state sectors. The laws should be amended in such a manner that can change the mindset of the society at large.

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Conflict of Interest: No

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Table 1: Number of prisoners in various prisons :

Prisons	Prisoners	Percentage
Karaikal	18	25.71%
Pondicherry	14	20%
Cuddalore	38	54.29%
Total	70	100%

Table 2 : Prisoners and victim relationships :

Prisons	Relatives		Non relatives	
Karaikal	06	18.75%	12	31.58%
Pondicherry	05	15.62%	10	26.32%
Cuddalore	21	65.63%	16	42.11%
Total	32	45.71%	38	54.29%

Figure 1 : Number of prisoners in all prisons and victims relationship

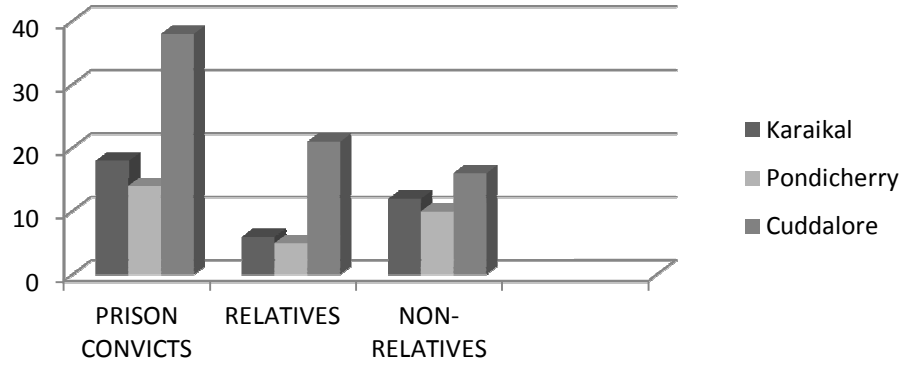

Figure 2 : Percentage of Overall victims

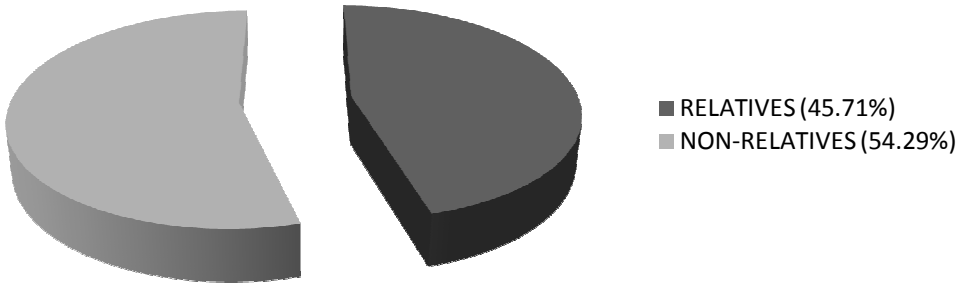

Figure 3 : Factors influencing crime rate :

Original Research Paper

Mandible - A Tool for Identification

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Abstract

Background: Identification of human remains is of prime importance in any medico-legal investigation and the determination of race, sex, age and stature remain the foremost criteria. In situations such as mass disasters and homicide, when the body is damaged beyond recognition, the mandible, being highly durable and sexually dimorphic, can be used for identification. **Aim:**The study aims at correlating mandibular measurements with gender and stature of an individual and estimating its effectiveness as an identification tool. **Methods:** This cross-sectional study was performed among 100 males and 100 females in Kasturba Medical College, Mangalore. The stature, length of the body and the ramus of the mandible (right and left) of each individual was measured. The ratio and sum of the lengths of the body and the ramus of mandible were calculated. Linear and multiple regression equations were calculated relating various mandibular measurements with gender and stature using SPSS 15.0. **Results:** Maximum correlation was established between the sum of the lengths of the ramus and body of the mandible with respect to gender and stature. The accuracy of gender estimation was calculated to be 85% for males and 83% for females. According to multiple regression equation, maximum predictive value of gender was 45.2 % while that for stature was 24.4% for males and 9% for females. **Conclusion:** This study suggests that the human mandible shows sexual diamorphism and bears great potential to serve as an efficient and affordable aid for medico-legal identification.

Key Words: Identification, mandible, gender, sexual dimorphism, stature

Introduction:

Human remains identification assumes significance in medicolegal investigations with determination of age, sex, race and stature being the primary objective. Determination of sex is the beginning step in such identifications as the other parameters, such as stature depend upon it.

If the body is putrefied, mutilated, extensively charred or brought as fragmented remains, especially in mass disasters and homicides,conventional routine parameters of identification such as name, facial features, built, etc, fail to yield results.[1] Skeleton of the body is usually found intact in such cases owing to its high resistance to environmental changesthus helping in identification.

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If entire skeleton is available, the accuracy of identification and sex determination is 100%. This accuracy decreases with the decrease in the number of available skeletal remains.[2-4]

Skull is usually found in skeletal remains either intact or damaged and in the later situation,the mandible may help us indetermination of identity.The mandible is the largest and strongest facial bone in the skull and it retains its shape better than other bones.[5] Existing literaturesuggests the presence of sexual dimorphism in male and female mandibles.[2,5-11] However, there is not enough evidence correlating the mandible with the stature.

The aim of this study was to correlate the mandibular measurements with the gender and stature of an individual. It intended to investigate the accuracy with which gender and stature can be estimated using mandibular measurement which may provide a quick and easy method of identification and may serve as a crucial tool for medicolegal identification.

Material and Methods:

This cross-sectional study was conducted at Kasturba Medical College, Mangalore,among 100 male and 100 female

students between 18- 30 years of age. A written informed consent was taken from the study participants. Stature of the subjects was measured to the accuracy of 0.1 cm using a stadiometer graduated in centimeters. Subjects were asked to stand barefoot with back of head, back of shoulders, buttocks and heels touching the vertical rod of the instrument. Subject's head was positioned in the Frankfort horizontal plane, and the head plate was brought into firm contact with the vertex.

The mandibular measurements of both the right and left side were recorded using a plastic measuring tape with the subject in sitting position. The length of the ramus of the mandible was measured along the posterior border of the mandible extending from condylar process to the gonial angle i.e. from A to B.**(Fig 1)** Externally, the condylar process can be felt anterior to the tragus. The length of the body of the mandible was measured from the gonial angle to the mental protuberance i.e. from B to C.**(Fig 1)**Externally, the mental protuberance corresponds to the midpoint of chin of the subject. The measurements were taken in centimeters with the accuracy of 0.1cm and the sum(S) and ratio(R) of the lengths of the body and the ramus of the mandible were calculated.

Data evaluation was done using SPSS version 15.0 , p value of <0.05 was considered significant. Data analysis was done using student's unpaired "t" test, Pearson's correlation coefficient, regression analysis and Chi –Square test.

Results and Discussion

The mandible is the largest and hardest facial bone and retains its shape better than other bones,thus, adding significance in the forensic and physical anthropologic field. The mandible can be used to distinguish between sexes.[5] However, its usefulness as a tool in serving for calculation of stature has not been explored fully. Studies have been conducted using osteometrics for determination of stature of an individual . The commonly used bones include the long bones such as humerus and femur. One such study has been conducted using the mandible alone by Milani C, et al.[12] However, a few studies have been conducted for estimation of stature using the skull by a number of workers in the field.[13-17]

This study was carried out in a medical college in Mangalore among 200 medical students (100 males and 100 females) between the age of 18-30. Linear regression equations were derived for gender and stature using various mandibular parameters.According to the results, **Table-1**, there exists a statistically significant difference between the stature of males and females. The p-value is highly significant(<0.001).The mean height for females is 159.84 cm while the mean height for males is 174.50 cm. The sexual dimorphism was 17.54%.

It can be concluded from **Table-2** that a statistically significant difference exists between the length of the body and the length of the ramus of the mandible of males and females.This is in accordance with various studies that have been conducted in the past by Saini V,et al,[2] Indira AP, et al,[4]and other researchers,[5-11]suggesting the presence of sexual dimorphism in the mandible.It can also be comprehended that no statistically significant difference exists between the measurements of the right and left side thus, henceforth measurements of the right side(RR and BR) have been used for all calculations. The mean values of BR for males and females is 6.584 cm and 7.213 cm respectively.The mean values of RR formales and females is 6.584 cm and 7.213 cm, respectively.

Table-3 shows that a statistically significant difference exists between the sum of the lengths of the ramus and the body of the mandible of males and females. The mean value of S for females and males is 17.11cm and 18.71cm respectively. However, there is no statistically significant difference in the values of R between males and females. The p-value is 0.95 which is not significant. The mean values of R for females and males,respectively are 1.604 cm and 1.606 cm.

Table-4 shows that the maximum predictive valueof gender is elicited by S(42.6%) followed by the BR (39.3%) and RR(23.7%). Linear regression equation was not calculated using R since its p value with respect to gender was not significant. The maximum correlation existed between gender and S(0.652) followed by BR(0.63) and RR(0.487).According to **Table-5**, the predictive value and correlation of gender is maximum using RR,BR and R,that is 45.2 % and 0.672 respectively, with a standard error of 0.374. Predictive value and correlation of gender using RR and BR is 43.8% and 0.661 with a standard error of 0.377 while that using S and R is 44% and 0.664 with a standard error of 0.376.

According to **Table-6**, the accuracy of determination of gender is maximum using S,that is 85% for males and 83% for females. This means that using the linear regression equation derived for S, the gender of 85% males and 83% females could be estimated accurately. The accuracy was minimum using RR, that is

70% for males and 77% for females. These results are in accordancewith other studies where the accuracy of gender estimation using various mandibular parameters was 76% as computed byIndira AP,et al,[4] and 83.9% (83.6% in males and 84.2% in females)according to a study by KharoshahMA et al in Egyptian population.[9] It's also in agreement with a study of Hu K-S,et al, in which positive predictive value of 92.4% in males and 73.7% in females were obtained.[5]

The p-value was calculated for stature with respect to RR, BR, S and R for both males and females. For males, the p-value was significant with respect to all the four parameters(p-value<0.05) while for females, a significant p-value was found to exist only with respect to RR and S.

According to **Table-7**, in case of males, S shows maximum predictive value of 23.7% with respect to stature with a standard error of 5.763 cm. The predictive value of stature with respect to RR and BR is 19.7% and 11.2% respectively with a standard error of 5.909 cm and 6.214 cm respectively. Minimum predictive value of stature is with respect to R, that is, 6.1% with standard error of 6.390 cm. The correlation of stature is maximum with S (0.486) followed by RR (0.444), BR (0.335), and R (0.247).

According to **Table-8**, in case of females, S shows a positive predictive value of 8% and a correlation of 0.282 with respect to stature with a standard error of 4.992 cm while RR shows a predictive value of 7.6% and a correlation of0.276 with a standard error of 5.002 cm.

In accordance with Table-9, the predictive value and correlation of stature is 9% and 0.299 in females(using RR and S) and 24.4% and 0.494 in males(using RR and BR).This proves that when more than one parameters are used, the predictive value of determination of stature is higher. This is in accordance with the study conducted byMilaniC, et al,[12] according to which, predictive values ranging from 13.9% to 40.5% using linear regression equation and 50.2% using multiple regression equation were obtained using different mandibular measurements.

Conclusion

In case of mass disasters or mishaps where the bodies are damaged beyond recognition or in cases where only a part of the body is available,it becomes extremely cumbersome to determine the identity of an individual. In such cases, forensic identification is possible using skeletal remains. The most commonly used bones are skull and pelvis for determination of sex of an individual. The skull alone can provide an accuracy of 92%.However if the whole of the skull is not available, then the mandible can serve as an aid in gender determination.[4]

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Figure 1. Diagrammatic Representation of Mandibular Landmarks used for measurements

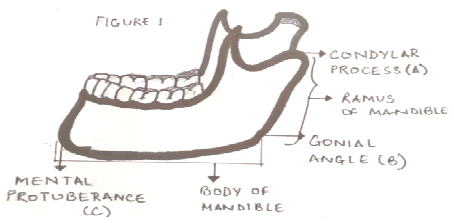

TABLE-1: Descriptive analysis of gender and stature

	GENDER	Mean(cm)	Minimum(cm)	Maximum(cm)	Std Dev (cm)	Sexual dimorphism	P-Value
STATURE	Female	159.841	149.5	173.5	5.18	17.54	<0.001
	Male	174.507	160	191	6.56		

TABLE-2: Descriptive analysis of gender with RR, RL, BR and BL

MANDIBULAR MEASUREMENT	GENDER	Mean(cm)	Minimum (cm)	Maximum (cm)	Std Dev (cm)	P-value	Sexual dimorphism(%)
RR	Female	6.584	5.6	7.8	0.45	<0.001	7.84
	Male	7.213	5.4	8.7	0.66		
RL	Female	6.584	5.6	7.8	0.45	<0.001	7.84
	Male	7.213	5.4	8.7	0.66		
BR	Female	10.527	9.00	12.50	0.56	<0.001	11.41
	Male	11.498	8.70	13.30	0.64		
BL	Female	10.527	9.00	12.50	0.56	<0.001	11.41
	Male	11.498	8.70	13.30	0.64		

RR=Length of ramus of mandible (right side) BL=Length of body of mandible(left) RL=Length of ramus of mandible (left side)
BR=Length of body of mandible(right)

TABLE-3: Descriptive analysis of gender with S and R

	GENDER	Mean(cm)	Minimum(cm)	Maximum(cm)	Std Dev (cm)	P-value	Sexual dimorphism
S	Female	17.11	15.10	19.10	0.801	<0.001	12.114
	Male	18.71	15.40	21.80	1.049		
R	Female	1.604	1.33	1.93	0.120	0.95	0.063
	Male	1.606	1.33	2.11	0.160		

S= Sum(RR + BR) ; R= Ratio(BR/RR)

TABLE-4: Linear regression equations for gender estimation

GENDER	R	R^2	STD ERROR(cm)
(RR*0.376) -1.096	0.487	0.237	0.439
(BR*0.408)-2.997	0.63	0.393	0.390
(S*0.266)-3.265	0.652	0.426	0.380

RR=Length of ramus of mandible(right); BR=Length of body of mandible(right); S=Sum (RR+BR)

TABLE-5: Multiple regression equations for gender estimation

PARAMETERS	GENDER	R	R^2	STD ERROR
RR , BR	-3.42+(RR*0.18)+(BR*0.334)	0.661	0.438	0.377
S , R	-4.126+(0.275*SUM)+(0.438*RATIO)	0.664	0.440	0.376
RR, BR ,R	-9.823+(1.146*RR)+(-0.282*BR)+(4.063*RATIO)	0.672	0.452	0.374
S,BR,RR	-9.874+(0.544*SUM)-(0.759*BR)+(4.361*RR)	0.689	0.474	0.371

RR=Length of ramus of mandible(right); BR= Length of body of mandible(right) S= Sum(RR+BR); R= Ratio(BR/RR)

TABLE-6:Accuracy of gender estimation

Measurement	Males	Females
S	85%	83%
BR	85%	73%
BR,RR,S	84%	81%
RR,BR,R	82%	82%
S,R	82%	82%
RR,BR	82%	82%
RR	70%	77%

RR=Length of ramus of mandible(right); BR=Length of body of mandible(right) S= Sum(RR+BR); R=Ratio(BR/RR)

TABLE-7: Linear regression equations for stature (males)

MEASUREMENT	STATURE(cm)	R	R^2	STD ERROR(cm)
S	(S*3.041)+117.603	0.486	0.237	5.763
RR	(RR*4.391)+142.833	0.444	0.197	5.909
BR	(BR*3.416)+135.323	0.335	0.112	6.214
R	190.773-(R*10.128)	0.247	0.061	6.390

S=Sum(RR+BR); R= Ratio(BR/RR) RR= Length of ramus of mandible (right); BR= Length of body of mandible (right)

TABLE-8: linear regression equation for stature(females)

MEASUREMENT	STATURE(cm)	R	R^2	STD ERROR(cm)
S	(S*1.825)+128.615	0.282	0.080	4.992
RR	(RR*3.163)+139.013	0.276	0.076	5.002

S= Sum(RR+BR); RR= Length of ramus of mandible (right)

TABLE-9: Multiple regression equation for stature estimation

GENDER	STATURE(cm)	R	R^2	STD ERROR(cm)
FEMALE	129.549+(RR*1.689)+(S*1.112)	0.299	0.090	4.99
MALE	121.019+(3.747*RR)+(2.301*BR)	0.494	0.244	5.76

RR- Length of ramus of mandible (right); BR- Length of body of mandible(right); S= Sum (RR+BR)

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Original Research Paper

Comparative Study on Atherosclerotic Involvement of the Major Coronary Arteries

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Abstract

Atherosclerosis is the commonest and the most important of the arterial diseases affecting the aorta, coronaries and cerebral arterial systems. Coronary artery disease accounts for an overwhelming majority (about 80%) of cardiovascular sudden deaths. The present study was conducted to compare the atherosclerotic involvement of the major coronaries. The study duration was of 2 years & included 120 medicolegal postmortem cases. The major coronary arteries were sectioned transversely at intervals of not more than 0.3 cm as well as longitudinally, up to its ostia. Sections were taken from the affected coronary arteries and sent for histopathology. The data was evaluated statistically. The total prevalence of coronary atherosclerosis was found to be 69.1%. The coronary artery most often involved by atherosclerosis was LCA and least affected was the circumflex artery.

Key Words: Coronary artery disease, coronary artery atherosclerosis, Prevalence.

Introduction:

Atherosclerosis is a specific form of arteriosclerosis affecting primarily the intima of large and medium sized muscular arteries and is characterized by fibro-fatty plaques or atheromas.[1] It mostly affects the aorta, coronaries and cerebral arterial systems. As coronary artery narrowing or obstruction underlies the myocardial hypoxia (anoxia) in the vast majority of cases, IHD has in the past been referred to as coronary heart disease (CHD). However, the International Classification of Diseases prefers the term IHD.[2]

Cardiovascular diseases comprise a major proportion of all sudden and unexpected natural deaths. Coronary artery disease accounts for an overwhelming majority (about 80%) of cardiovascular sudden deaths.[3] Coronary artery atherosclerosis is the principle cause of CAD (coronary artery disease) and is the single largest killer of both men and women. Atherosclerosis affects various regions of circulation and yields distinct clinical manifestations. Atherosclerosis of coronary arteries commonly causes myocardial infarction (MI) and angina pectoris.

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In the coronary circulation, the proximal left anterior descending (LAD) artery exhibits a particular predilection for developing atherosclerotic occlusive disease.[4]

Atherogenesis occurs over a period of many decades. After a generally prolonged “silent” period, atherosclerosis may become clinically manifest. The clinical expressions of atherosclerosis may be chronic or acute, such as myocardial infarction, a cerebro-vascular accident, or sudden cardiac death. Some may never experience clinical manifestations of arterial disease despite the presence of widespread atherosclerosis, which is demonstrated in postmortem examination done.[4]

Materials and Methods:

The present study was carried out in the department of Forensic Medicine and Toxicology, in collaboration with the department of Pathology, at MGIMS, Sewagram, Wardha. The study duration was of 2 years and included 120 medicolegal postmortem cases conducted at our institute. Preliminary data was recorded from the short history of each case. Specimen of hearts were collected from these cases. They were fixed in 10% formalin. The heart was isolated and dissected as per standard procedure. Major coronary arteries were sectioned transversely by sharp knife at intervals of not more than 0.3 cm as well as longitudinally up to its ostia (**Photo 1**). In each case, from the major coronary arteries, sections were taken if there were positive signs of atherosclerosis on macroscopic examination (**Photo 2**) and

preserved in 10% formalin in separate labeled bottles (1- Right coronary artery, 2- Left anterior descending coronary artery and 3–Circumflex artery) (**Photo 3**). These sections were sent for histopathological study and grading of atherosclerosis (**Photo 4**) according to Stary.[5] The histopathological examination was done in the department of pathology.

The data was analyzed according to Kagan and Uemura (1976).[6] Evaluation was done by means of Chi-square test (χ^2) and Fisher exact probability test, both of which compare the proportions of cases falling into various categories in one group with the proportions of cases falling into the same categories in another group. The probability level of significance for the entire statistical test was arbitrarily set as P=0.05.

Observation & Results:

The total numbers of subjects were 120 (90 males & 30 females). The coronary arteries showing positive signs of atherosclerosis were subjected to histopathological examination. The results are shown in various tables below.

The atherosclerotic changes increase with age, being lowest in 10-19 years age group (28.6%) and highest in 60 and above age group (100.0%). The overall prevalence of coronary atherosclerosis is found to be 69.1%. It was 60% (18 out of 30) in females and 70% (63 out of 90) in males (**Table 1**).

The right coronary artery was found to be affected by atherosclerosis in 57.5% cases, left coronary in 60% cases and circumflex in 48.3% cases (**Table 2**).

The level of atherosclerosis in all the coronary arteries in each subject was added to find out the total level of coronary atherosclerosis in each subject. The total level of atherosclerosis of all the subjects in the same age group were added to find out the total level of atherosclerosis in that particular age group. Then the mean levels of atherosclerosis in all the age groups were calculated. The level of atherosclerosis in coronaries examined showed significant rise with age. It was the lowest in the age group 10-19 years (0.35) and highest in 60 and above year age group (4.19). Also higher degree of coronary atherosclerosis was found in males (2.36) than in females (1.90) (**Table 3**).

The mean level of atherosclerosis in circumflex artery has shown a rising trend with age. It is highest in age group 60 and above (3.96) and lowest in age group 10-19 years (0.28) (**Table 4**). Similar trends were observed in the LAD & RC also.

A study done by Subramaniyam, et al in 1964, consisting of 317 males and 175 females revealed that coronary atherosclerosis was present in 52% males and 32% females (total 70%). S. Padmavati, et al in 1968 observed this in 71% males and 63% females (total 67.3%). H. Singh, et al in 2005, observed prevalence of coronary atherosclerosis in 78% cases (80% in males and 66.6% in females). In our study, out of 120 cases (90 males and 30 females) 69.1% were found affected with coronary atherosclerosis. Males were affected in 70% and females in 60% cases (**Table 5**).

Discussion:

The study is based on grading system that takes into account both the area of most severe involvement and total extent of intimal involvement of the coronary arteries. In the present study, out of 120 cases, there were 75% males and 25% females, which are more or less similar to most of the studies conducted in the past. Harkirat Singh, et al studied 170 cases, of which 140 (85%) were males and 30 (15%) were females.[7] Padmavati and Sandhu observed 74.5% males and 25.5% females in their study.[8] There were more number of male bodies than females available randomly for autopsies in the ratio of 3:1. This figure is in agreement with figures given by S. Padmavati, et al, Roberts WC, and Bhargava and Bhargava.[8-10] In the present study, the total number of males in each age group were more than the number of females in that respective age group.

In the present study we found that more number of subjects were affected with coronary atherosclerosis as age advances. In 10-19 years age group, 28.6% of the subjects were observed affected with atherosclerosis, while in the age group 20-29 years, 29.2%; in the age group 30-39 years, 57.7%; in 40-49 years age group, 84.2%; in the age group 50-59 years, 94.7% and in the age group 60 and above years age group, 100% subjects were found to be affected with coronary atherosclerosis. The total prevalence of coronary atherosclerosis was found to be 69.1%. In males it was 70% and in females it was 60%. Total mean level of atherosclerosis in all the coronary arteries examined was found to be 0.35 in the age group 10-19 years, 0.58 in the age group 20-29 years, 1.34 in the age group 30-39 years, 2.43 in the age group 40-49 years, 3.52 in the age group 50-59 years and highest i.e. 4.19 in the 60 and above age group. It shows that the severity of atherosclerotic lesion also increases with advancing age. Also higher degree of atherosclerosis was found in males

(2.36) than in females (1.90). Thus, the prevalence and severity was found to be more in males than in females.

Harkirat Singh, et al observed that the incidence of coronary atherosclerosis was more in males than in females.[7] Strong and McGill found that males had approximately 3 times greater proportion of the intimal surface involvement than the females.[11] Roberts WC, et al observed that significantly higher proportion of men had vascular catastrophes than did women.[12] Matova EE inferred that women are known to die less frequently than men from coronary heart disease. He reported that only 28% women die because of coronary heart disease.[13]

In our study, it was observed that the coronary vessel most often involved by atherosclerosis is the LCA, followed by RCA. The least affected was the circumflex artery. Bhargava and Bhargava also reported that the anterior descending branch of LCA showed the highest incidence of atherosclerosis, followed by the RCA. The other vessels were infrequently involved.[10] Also, in study by P. Chakraborty, et al, LAD involvement was seen in 55.6% cases, while that of. RCA & CX was found to be 27.8 % & 11.1%, respectively. These findings coincide with our study.[14] Vijay Singh, et al, MSN Murthy, et al and Baroldi, et al in their study found left anterior descending branch of left coronary as the most often involved vessel followed by circumflex artery and the least affected vessel was the RCA. [15-17]

In our study, 69.1% subjects were found to be affected with coronary atherosclerosis (70% males 60% females). A study done by Subramaniyam, et al revealed that coronary atherosclerosis was present in 52% males and 32% females (total 70%). S. Padmavati, et al found this in 71% males and 63% females (total 67.3%). H. Singh, et al observed prevalence of coronary atherosclerosis in 78% cases (80% in males and 66.6% in females).[7,8] Thus prevalence of coronary atherosclerosis was more in males.

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Photo1: Sectioning the major coronary arteries

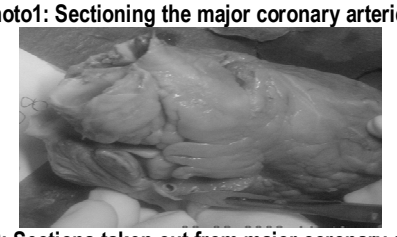

Photo 2: Sections taken out from major coronary arteries

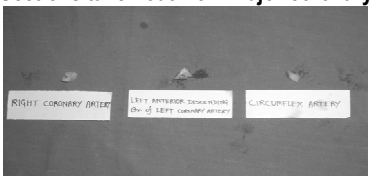

Photo 3: Preserving each section in separate bottles for histopathology

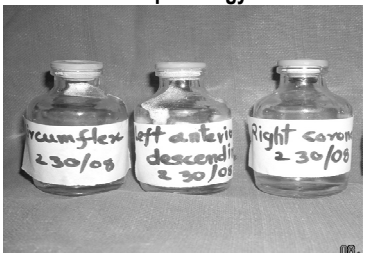

Table 1: Coronary atherosclerosis in the subjects (n=120)

Age group	Atherosclerosis changes			Statistical Significance
	Present(%)	Absent(%)	Total(%)	
10-19	02 (28.6)	05 (71.4)	07 (100)	χ^2=43.13 p<0.0001 Significant
20-29	07 (29.2)	17 (70.8)	24 (100)	
30-39	15 (57.7)	11 (42.3)	26 (100)	
40-49	16 (84.2)	03 (15.8)	19 (100)	
50-59	18 (94.7)	01 (5.3)	19 (100)	
60 & above	25 (100)	00 (0.0)	25 (100)	
Total	**83 (69.1)**	**37 (30.8)**	**120 (100)**	
Sex				1.17 p-value=0.27 NS,p>0.05
Male	63(70.0)	27(30.0)	90(100)	
Female	18(60.0)	12(40.0)	30(100)	

Table 2: Level of atherosclerotic changes in various arteries examined

Level of Atherosclerosis	No. of arteries showing different levels of Atherosclerosis			Statistical significance
	RCA	LCA	Cx	
1	00	00	00	34.17 p-value=0.03 Significant P<0.05
2	29	34	26	
3	1	2	0	
4	6	3	4	
5	24	20	18	
6	6	5	4	
7	2	3	2	
8	1	5	4	
No. of arteries with atherosclerosis	69(57.5%)	72(60%)	58(48.3%)	
No. of arteries withoutAtherosclerosis	51	48	62	
Total arteries examined	120	120	120	

Table 3: Overall atherosclerotic changes by selected variables

S.No.	Variable	Total subjects	Mean level of atherosclerosis in all arteries examined	Statistical Significance
1.	**Age group**			
	10-19	07(5.9)	0.35±0.62	F=21.33 p=0.000 S,p<0.05
	20-29	24(20.0)	0.58±0.91	
	30-39	26(21.7)	1.34±1.50	
	40-49	19(15.8)	2.43±1.82	
	50-59	19(15.8)	3.52±1.73	
	60 & above	25(20.8)	4.19±1.62	
	Total	**120(100.0)**	**2.19±2.03**	
2.	**Sex**			
	Male	90(75.0)	2.36±2.00	t=1.07 p-value=0.28 NS,p>0.05
	Female	30(25.0)	1.90±2.12	
	Total	**120(100.0)**		

Table 4: Atherosclerotic changes in Circumflex artery

Age group	Total Subjects	Mean level of Atherosclerosis	Statistical Significance
10-19	07 (5.9)	0.28±0.75	F-value=10.95 p-value=0.000 S,p<0.05
20-29	24 (20.0)	0.25±0.67	
30-39	26 (21.7)	1.19±1.93	
40-49	19 (15.8)	1.84±2.40	
50-59	19 (15.8)	2.89±2.18	
60 & above	25 (20.8)	3.96±2.60	
Total	**120 (100)**	**1.90±2.39**	

Photo4: Coronary artery showing grade VII changes on histopathology (H&E x 10).

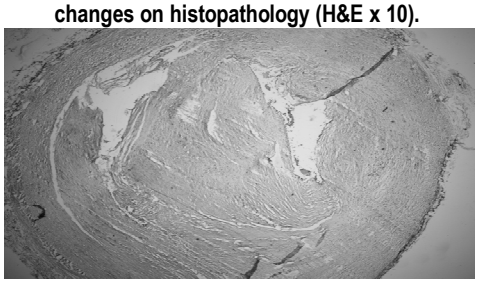

Table 5: Comparison of other studies with present study

S. No.	Author	Year of study	Sample size	Sex		Results %		Total %
				Male	Female	Male	Female	
1.	R. Subramaniyam, et al	1964	492	317	175	52%	32%	70%
2.	S. Padmavati et al	1968	555	413	142	71%	63%	67.3%
3.	H. Singh, et al	2005	200	170	30	80%	66.6%	78%
4.	Present Study	2008	120	90	30	70%	60%	69.1%

Original Research Paper

Role of Study of Diatoms in forensic investigations - Two Year Retrospective Study

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Abstract

Diatoms are a group of unicellular algae that have been recorded and classified for over 200 years and have been used in a range of applications in forensic field. Diatom analysis is a valuable tool in forensic field and it is useful in diagnosis of drowning cases. The basic principal of the "diatom test" in drowning is based on correlation between diatoms present in the medium where the possible drowning took place and inhalation of water causes penetration of diatoms into the alveolar system and blood stream. These diatoms got deposited into the brain, kidneys and other organs. For solving of drowning cases, hard bones like sternum or clavicle as well as soft tissues (lungs and liver) of drowned bodies and sample of water in which possible drowning take place are usually sent to the Forensic Science Laboratories for detection of diatom. A retrospective study was conducted in the department of Forensic Medicine and Toxicology, G.G.S. Medical College, Faridkot which included all cases brought by police referred from Faridkot district and nearby districts to department from a period of October 2012 to October 2014 with alleged history of drowning. During this period a total of 100 cases were brought by police to the department of Forensic Medicine and Toxicology, G.G.S. Medical College, Faridkot. The male to female ratio of the cases was 5.25:1. The most common age group was 20-40 years for males as well as females. Thirty eight percent victims were from rural background while twenty seven percent victims were of urban background. Background of rest of the cases was unknown. Diatom test was found to be positive in 38 cases while it was negative in rest of the cases.

Key Words: Drowning, decomposition, postmortem, diatoms.

Introduction:

Death by drowning is defined as a death due to submersion in a liquid and the mechanism in acute drowning is hypoxemia and irreversible cerebral anoxia [1]. Drowning is a form of asphyxia due to aspiration of fluid into air-passages, caused by submersion in water or any other fluid. It is one of the most difficult modes of death to prove at postmortem, especially when the body is not in a fresh condition.

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Drowning denotes a confined concept where death is suffered due to submersion in water or any other liquid and the word immersion/submersion conveys a broader concept where death might have been due to drowning or some other cause, though the body had been recovered from water. The diagnosis of drowning is one of the most difficult diagnoses in forensic pathology and therefore a great number of tests have been proposed to allow a confirmation of death by drowning of a victim [2, 3]. Diatom test is one of these test and works as an important tool in diagnosis of death due to drowning. If a body is found in water it does not necessarily mean, that this person has drowned. When a corpse is recovered from water, there is usually a suspicion whether it was a case of ante-mortem or post-mortem drowning i.e. whether the body was drowned before or after death. To diagnose the cause of death in such cases, presence of diatoms in the body tissues is very useful evidence. From various chemical and other tests the presence of diatoms inside the body is proved. The type of diatoms found in that body tissues are compared with types of diatoms species present in the water body from

where the corpse is recovered to determine the scene of occurrence for the reconstruction of events.

Diatoms, the most common type of phytoplankton, are a major group of eukaryotic algae which are ubiquitous to a wide variety of aquatic habitats. These are useful in linking suspects and victims to crime scenes in and around water. When a person drowns, water is inhaled into the lungs and enters into the circulatory system, so any diatom present in the drowning medium can ultimately find their way into internal organs such as bone marrow of a drowning victim. As soon the diatoms are in the blood stream, they travel through the system. From the lungs into the heart, to the liver, kidney, bone marrow, brain and so on. If a person drowns then water will flow into the lung.

The basic principle of the diatom test in drowning is based on inference that diatoms are present in the medium where the possible drowning took place and that the inhalation of water causes penetration of diatoms into the alveolar system and bloodstream, and thus, their deposition into the brain, kidneys and other organs[4, 5, 6, 7, 8, 9.] The application of diatom analysis in determining whether drowning was the cause of death has proved to be a valuable tool in forensic field. Pollanen [10] supported the validity and utility of the diatom tests for drowning through the analyses of 771 cases of drowning.

Increase in the number of diatoms in the internal organs was thought to confirm that the body had drowned and, if a sample of the water was also taken at the presumed site of drowning, the similarity of different species of diatoms in the water and the body could be determined. On the other hand, if a dead body was dropped into water, although diatoms could reach the lung by passive percolation, no circulatory transfer could occur and so (theoretically) no diatoms would be present in the distant organs. The advantages claimed for this technique include the fact that it could be used even in the presence of putrefaction, if protected tissue such as bone marrow was examined. Unfortunately, diatom test is often negative, even in undoubted cases of drowning in waterways full of diatoms, and there have been numerous false positive results that are said to have occurred for a variety of technical reasons.

This test became a direct screening test for the diagnosis of drowning. The presence of aquatic diatoms in a cadaver has long been held by many workers to be a clear indicator of death by drowning.[10,11,12] The presence of diatoms can be established and analyzed both quantitatively and qualitatively through a diatom test. This can lead not only to a more direct determination of the cause of death, but also can help to pinpoint the site of a suspected drowning. [13]

Therefore, during autopsy, one must focus one's attention to distinguish between changes which are due to drowning and those which are otherwise, i.e. those which occur in bodies immersed/submerged/ disposed in water after death from causes other than drowning.[14] Accidental drowning occurs often in India, nearly 40,000 Indians die annually from drowning. It also occurs among persons at bathing places while bathing in deep water. Females may fall accidentally into a well while drawing water from it. Children may also accidentally fall into ponds or lakes while playing near their banks. They may even fall accidentally into domestic vessels of water, such as water tanks, bathtubs and buckets. Accidental drowning in shallow water is very rare, except when the individual happens to be intoxicated, insane or epileptic.[15]

Once the decomposition has started, it becomes more difficult to prove the mode of death as a result of drowning during autopsy, as the reliable signs of drowning are often minimal, obscure or completely absent.

Materials and Methods:

This retrospective study was conducted in the department of Forensic Medicine and Toxicology, G.G.S. Medical College, Faridkot. This included all cases referred from Faridkot district and nearby districts brought by police to department from a period of October 2012 to October 2014 with alleged history of drowning. After post-mortem examination of dead bodies, sternum bone (other materials like clavicle, femur in case sternum is not available) along with the water samples (From where the dead bodies were recovered) were being sent as exhibits to the laboratory. Cases were opened and processed following standard methodology. In all cases exhibits were put into different jars. 50 ml of nitric acid was added in each jar containing the sternum. Samples were left undisturbed overnight and boiled for half an hour on next day.

A clear yellow solution was obtained with a fat layer at the top. The fat layer was discarded and the remaining samples were centrifuged at 4000 rpm for 10 minutes. The process of centrifugation was repeated three times in the same way. Supernatant was discarded and the pellets were washed with distilled water and re-centrifuged. Microscopic

slides were then prepared from the pellets after washing, dried on hot plate and studied under the microscope after applying immersion oil. Slides were also prepared from the water sample sent to the laboratory in which possible drowning took place. The siliceous exoskeleton imparts uniqueness to their structure. Diatoms were extracted from the various body tissues by various methods of digestion and centrifugation. These should be extracted in such a way that there should be minimum damage to the frustules. The diatoms found in the water samples taken from the suspected drowning area. If it gives a positive result, it can lead towards a positive frame in ascertaining the site of drowning and helps in linking the site to the victim.

Diatoms play an important role in establishing the death due to drowning. Noticeable changes in the diversity of this botanical evidence can further be used in forensic investigation of drowning cases where drowning site is under suspicion. It happens particularly in those cases where drowning site is not available or body has been moved from one location of site to other.

Observations:

Total of 100 cases were referred from Faridkot district and nearby districts during the period of two years from 1st October 2012 to 31st October 2014 with alleged history of drowning. Age and gender wise distribution of cases is shown in **Table-1.** Males were more common (84%) as compare to females (16%). In thirty eight cases the diatoms present in bone marrow were showing similarity with the diatoms present in control sample of water. Thirty eight percent victims were from rural background while twenty seven percent victims were of urban background. Background of rest of the cases was unknown as shown in **Table-2.** In 62% cases either diatoms were present only in water and absent in bone marrow or diatoms were absent in water and bone marrow both **Table-3.**

Horton (2007) employee the ˝Diatom test˝ in two case study of drowning i.e., the body of a woman was found floating in the river and the dead body of a boy was found face down in the pond. He examined in the drowning cases, the best correlation in water sample as well as bone sample. Horton et al., (2006) also examined the drowning cases on the bases of diatom test. After the diatom test, it was examined that diatom was detected in all body samples. Hence the result will be positive and death due to drowning.[16,17]

Discussion:

First discovery of diatoms in lungs was made by Hofmann [18] but a successful attempt was made by Revenstorf [19] who correlated this presence of diatoms in lung in solving the drowning mystery. This method was improved by digesting lung tissue with acid for the extraction of diatoms. [20] Detection of diatoms in blood and parenchymatous organs was successfully made by Incze. [21] This work was further carried out by Tamasaka [22] but this time source of diatoms was bone marrow.

There is a little controversy about the reliability of the diatom test; only a few workers have expressed contrary view about this method. Perhaps the most passionate condemnation of the diatom test is the fact that diatoms may be seen in the tissues and bone marrow of those who have died by means other than drowning and who are not found in water. [23, 24, 25, 26] Diatoms were also detected in marrow of sternum of the drowned subject by Timperman J [27] and reported that this sample is more advantageous to use in comparison to the marrow of long bones because acid digestion time taken by this sample was less. More suggestions were given by Auer A [28] that diatom test would be of much importance in the diagnosis of drowning cases, origin of diatoms found in bone marrow is known i.e. matching of diatoms from both putative water medium and tissue of drowned body is must required for the success of this test.

Dead bodies are commonly found immersed in water and other fluids in all manner, places and circumstances. Such cases prove the most difficult medico-legal problems. In Northern India, it is common custom to throw dead bodies into running streams, and the fact of finding a dead body in water does not, therefore, lead one to presume that drowning caused death. Again, victims are often murdered or poisoned first and then their bodies are thrown into water to avoid the detection of crime. Therefore, when the body recovers from the water, it is very essential to examine the body not only for the evidence of external and internal injuries with their antemortem or postmortem nature but also for the signs of poisoning. When the body is decomposed the diatom test is the only reliable finding, which can provide supportive evidence for the diagnosis of antemortem drowning. Though the diatom test has certain limitations, like diatoms could have been inhaled or ingested with material containing diatoms before death or contamination of the glassware and reagents that are used to detect diatoms. Yet, the

quantitative and qualitative identification of diatoms in experienced hands provides the most reliable proof of drowning. [29]

If proper care is taken with all specification and analysis is performed without Contamination, it can serve as significant supportive evidence in investigation of crime. However, in the present study, due care is taken to avoid contamination and use of tap water is avoided completely throughout the procedure of sample preparation. In conclusion, five cases reported in our study were solved by using diatom test for drowning and it was proved very significant by providing the actual cause of death.

Conclusion:

Diatoms found inside the body of a drowned victim may serve as corroborative evidence in the diagnosis of cause of death. It can be ascertained that whether the death is ante-mortem or post-mortem. Diatoms are not always there in all of the drowning cases but if present and present in distant organs in abundance they definitely provide a positive evidence in favour of ante-mortem drowning.

There is a lot of controversy about the reliability of diatom tests. A conclusion was drawn that presence of diatoms in organs of systemic circulation is a good evidence that death occurred by drowning, but absence of diatoms does not rule out the diagnosis of drowning and in areas where there is a great degree of air and water pollution with diatoms, the method may not be reliable. Many authors do not consider this as a valuable and a fool proof method. The fact which supports their opinion is that diatoms are not only inhaled through water, they can also be inhaled through air as they can also be found in the air and from there they can gain entry by the respiratory system. But the studies made by various authors form a view that diatom test is very reliable in ascertaining ante-mortem or post-mortem drowning by taking each and every aspect with great care and keen observation.

A definite conclusion can be drawn if proper care is taken to avoid every sort of contamination and by knowing all necessary specification of the diatom test, it can provide a great assistance in the investigation of drowning cases. According to this criterion, the diatoms found in the blood and organs of the victim (such as sternum), must be the same. This is to refute the objections of many pathologists who assert that diatoms are ubiquitous in human tissues.

Considering the status of diatom test, British and American forensic pathologists have divergent opinion about the value of diatoms in drowning. Perhaps one of the reasons of this "Great Divide" is that the diatom test originated on the British Continent. There is hardly a medico legal journal that has not taken part in the “war of diatoms” in one way or another.

Though the diagnosis of drowning in decomposed corpses is based on the exclusion basis but we suggest that diatom analysis in decomposed corpses can be used as a criterion for the positive diagnosis of drowning death when no gross mutilation of the body is there. Diatom test is very reliable in ascertaining ante-mortem or post-mortem drowning if proper care is taken to avoid every sort of contamination and by knowing all necessary specification of the diatom test. We have also observed the same in our study that analysis of diatoms in test sample of bone marrow and control sample of water in immersion cases supported the diagnosis of death by drowning. It is not wise to delay the postmortem in decomposed cases as the findings may further get obliterated and distorted.

But a little controversy about the reliability of diatom test cannot be ruled out. It was suggested that if proper care is taken with all specification and analysis is performed without contamination, it can serve as significant supportive evidence in investigation of crime. In the present study, due care is taken to avoid contamination throughout the procedure of sample preparation.

The “diatom test” for drowning is one of the most often applied and studied application of diatom analysis in forensic investigations and become an established forensic technique because diatoms have many attributes that are applicable to forensic field. Diatom test also provide a record of environmental conditions via, diatoms relationship to water quality and aquatic habitat. In our present cases study, a correlation is established between water sample in which present drowning took place and bone sample i.e., sternum, clavicle and femur.

To diagnose the cause of death in all decomposed and such cases, comparative study of diatoms in body tissues and water sample is the only reliable finding, which can be used with other supportive evidences to prove the death due to drowning, as well as to determine the site of drowning. From the present study we could be able to prove scientifically that the positive diatom test and similarity of diatoms in test sample of bone marrow and control sample of water is the only strong evidence of antemortem drowning especially in decomposed corpses,

where no other signs of ante mortem drowning are present.

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Table 3: Diatom Test Report

Positive		Negative	
No.	%	No.	%
38	38	62	62

Table 1: Age and gender-wise distribution of cases

Age(in years)	Male		Female		Total	
	Number	%	Number	%	Number	%
00-20	16	19.05	05	31.25	21	21
20-40	57	67.85	11	68.75	68	68
40-60	10	11.90	00	00.00	10	10
>60	01	01.20	00	00.00	01	01
Total	84	84.00	16	16.00	100	100

Table 2: Urban/Rural background

Background	Male		Female		Total	
	Number	%	Number	%	Number	%
Rural	31	36.90	07	43.75	38	38
Urban	24	28.57	03	18.75	27	27
Unknown	29	34.53	06	37.50	35	35
Total	84	84	16	16	100	100

Original Research Paper

Ulna - A Tool for Identification

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Abstract

In the field of forensic anthropology, determining stature, which is one of the various parameters of identification for establishing individuality of the person, from skeletal remains, especially from isolated bones, has been an age old problem. Measurement of length of long bones is being widely used to calculate stature. The objective of this study is to estimate the stature of the individual by measuring the length of Ulna. This cross sectional study included 300 medical students of which 150 were males and 150 were females. The length of both right and left Ulna were measured along with the height of the individual. The measurements were tabulated and a linear regression formula was derived to estimate stature separately for both males and females. A linear regression equation was deduced for males and females as follows:

Males: Height = 80.068 + 1.681 X R + 1.618 X L Females: Height = 71.454 + 3.192 X R + 0.295 X L

Where R denotes right ulnar length and L denotes left ulnar length

The stature of the individual can be reliably estimated by measuring the length of the Ulna and it's accuracy is more in females compared to males.

Key Words: Stature, Ulna, long bones

Introduction:

Identification is the determination of individuality of a person.[1] The successful identification of the deceased is vital to the progress of any forensic investigation. Determination of stature from skeletal fragments and mutilated bodies is of prime importance in forensic identification.[1]

Stature estimation usually is based on measurement of long bones. Most commonly used is the tibia.[2,3] Few studies published on estimation of stature from Ulna in the western Communities. The problem is that the ratios and formulae are population specific and the reliability of estimating stature for another population is regarded with concern.[2,4-6]

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The ulna is a long bone, prismatic in form, placed at the medial side of the forearm, parallel with the radius, and is homologous with the fibula of the lower limb. It has an upper end, lower end, and a shaft. The upper end presents the olecranon and the coronoid processes, and two concave, articular cavities, the semilunar and radial notches. The body at its upper part is prismatic in form, and curved ; its central part is straight; its lower part is rounded and smooth. The lower end is made up of the head and the styloid process. The ulna articulates with the humerus and radius.[7-10]

The present study tries to establish a relationship between the length of ulna and height of the individual to establish stature in fragmented skeletal remains and mutilated bodies and derive values from an Indian population.

Material and Method:

Design and study setting: The present cross sectional study was conducted in the Department of Forensic medicine and Toxicology, Kasturba Medical College, Mangalore, from August to September 2011. The study sample included 150 male and 150 female medical students of Indian origin.

Exclusion criteria: Students with deformity or any congenital abnormalities of the upper limbs were excluded from the study.

Data Collection: The length of the of the right and left ulna was measured with a standard venier calliper from the apex of the olecranon to the styloid process with the elbow in full flexion and the height of the individual was measured with a calibrated standing meter rule. The measurements were tabulated in the proforma and the data was analysed using SPSS version 18 statistical package and linear regression formulae were derived to determine the stature separately for males and females. Informed consent was taken from the participating students along with the requisite Institutional ethical committee clearance.

Observations and Results:

A total of 300 students, 150 male & 150 female, were included in the study. The observations recorded were analysed using SPSS software version 18 package and a regression formula was derived for both males and females along with the percentage accuracy. The age group in females and males ranged from 17 to 22 years and 19 to 22 years respectively.

The descriptive analysis of the data showed variation of length of right and left ulna in males to range from 25.60 cm to 32.80 cm and 25.20 cm to 32.50 cm respectively. Similarly, the variations of length of right and left ulna in females ranged from 22.40 cm to 29.80 cm and 22.70 cm to 35.30 cm respectively. The height of the male students ranged from 159 to 192 cm whereas in females it ranged from 147 cm to 177 cm.

A linear regression equation was deduced for males and females as follows:

Males: Height = 80.068 + 1.681 X R + 1.618 X L

Females: Height = 71.454 + 3.192 X R + 0.295 X L

Where R denotes right ulnar length and L denotes left ulnar length

The accuracy of prediction of stature of a person was also calculated for the regression equation deduced. The percentage of accuracy for males was 69%, while for females, it was 80 %.

Discussion:

Stature is one of the various parameters of identification for establishing individuality of the person. It is well known that there is a definite relationship between the height of the person and various parts of the body like head, trunk and lengths of upper and lower limbs. To assess the height of an individual, from measurements of different parts of the body, has always been of immense interest to Anatomists, Anthropologists and Forensic experts.[11]

Estimation of stature from measurements of various long bones of the extremities has been attempted by many scientists with varying degree of accuracy. All such calculations depend on the fact that limbs exhibit consistent ratios relative to the total height of a person. These ratios are linked to age, sex and race.[12]

As per physical anthropology, long bones of the limbs are the best to estimate the height of a deceased. Many of previous workers have done this study on cadavers but cadavers cannot represent a population & they are largely of persons who are aged and might have suffered from chronic debilitating diseases, likely to have been dying in an abnormal posture and it may not be possible to straighten the body to get accurate stature measurement.[11] In this scenario, determination of stature of a person by studying the percutaneous length of long bone could be of some use. Studies based on long bones of the lower limb are the most precise, but those based on upper limb long bone measurements are also reliable. Ulna is a long bone that is often used for body height estimation as it gives more accuracy in devising regression equation of stature than the length of leg bone like Tibia.[13]

Ulna is mostly subcutaneous throughout its length and is easily approachable for measurements. So it was selected for the present study. Ossification of the Ulna starts at 8th fetal week and the proximal epiphysis fuses with the shaft in the 14th year in females and 16th year in males. The distal epiphysis unites with the shaft in the 17th year in females and 18th year in males.[14,15] As after the age of 50 years there will be some degenerative changes in joints and cartilages leading to erroneous results, the current study involved only young medical school students.

The present study was based on a sample size of 300 medical students. The height of the students in erect position was correlated with the length of the right and left ulna. The mean height in males and females in the present study was found to be 175.45 cm and 161.48 cm, respectively. Whereas, in a similar study conducted by Maloykumar[16] in males, showed the mean height to be 164.32cm; length of right and left Ulna to be 27.13cm & 27.01cm respectively.

Various workers[17-22] had shown significant correlation between height and ulna bone length, other long bones and different parts of the body. Allbrook D[17] derived regression formulae for estimation of stature from the length of Ulna as Stature: 88.94 + 3.06(ulnar length) ± 4.4 (Standard error). Athawala[18] derived a regression formula for estimation of stature and Left Radius (cm) ± 3.66cm. Stature = 56.9709cm +3.9613 X average length of Right and Left Ulna (cm) ± 3.64cm. Sarojini Devi, et al[19] computed correlation coefficient (r = 0.619 for male and 0.584 for female) and regression equation formula for estimation of stature by using upper arm length among living population of Maring tribes of pallel area, Chandel district, Manipur.

In the present study, the percentage of accuracy for estimation of stature from length of ulna is more in females than in males with accuracy of 80 %. Height-estimation formulae based on ulna length show similar levels of accuracy to calculations based on the length of other upper limb long bones. This is supported by the standard errors of the estimations reported in several studies. Authors have underlined the need for population-specific stature estimation formulae for more than 100 years. The main reason for this is that the ratios of various body parts to stature differ from one population to another. In addition to ethnic differences, secular trends[23] and even environmental factors, such as socioeconomic and nutritional status, can influence body proportions.[24,25] This study addresses the dearth of similar studies in Indian population and a population specific regression equation has been derived for males and females to determine the stature with a reasonable accuracy. This can go a long way in establishing the stature in case of dismembered body parts and skeletal remains and help in the Investigation of identity of unknown mutilated body parts.

Conclusion:

The results of the study show that the percutaneous length of the ulna can be reliable parameter to determine the stature of a person. The accuracy of estimation of stature in females is high when compared to males with regression equation derived.

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Table 1 Descriptive Statistics: length of ulna height of the students

Sex	Bone	N	Minimum (in cm)	Maximum (in cm)	Mean(in cm)	Std. Deviation
Male	Right ulna	150	25.60	32.80	28.9480	1.26006
	Left ulna	150	25.20	32.50	28.8653	1.26507
	Height	150	159.00	192.00	175.4500	5.97387
Female	Right ulna	150	22.40	29.80	25.8080	1.46014
	Left ulna	150	22.70	35.30	25.8853	1.65539
	Height	150	147.00	177.00	161.4813	6.36383

Table 2: Percentage accuracy of prediction

Sex	Model	R	Std. Error of the Estimate
Male	1	.689	4.35700
Female	1	.799	3.85527

Corrigendum

This is to certify that by mistake the tables submitted with the manuscript titled "study of skull fractures in fatal cranio cerebral injuries in light with the manner of death" published in **Vol. 38, no.2, April-June, 2016, pg 220** are not those referred in the text. The actual tables are submitted here with. Kindly bear with it. Dr Geeta Sahu, Dr Subal Naik

TABLE -1 (PERCENTAGE DISTRIBUTION OF VICTIMS IN HOMICIDAL AND NON HOMICIDAL CATAGORIES)

NO.OF CASES	HOMICIDE	%	NON-HOMICIDE			
			ACCIDENT	%	SUICIDE	%
200	26	13%	174	87%	-	-

TABLE- 2(A) (SKULL INVOLVEMENT IN CRANIO CEREBERAL INJURY)

CATEGORY		FRONTAL				PARIETAL			
		FISSURE#	DEPRESSED#	COMMINUTED#	CUT#	FISSURE#	DEPRESSED#	COMMINUTED#	CUT#
HOMICIDE		2(1%)	5(2.5%)	3(1.5%)	1(0.5%)	7(3.5%)	9(4.5%)	11(5.5%)	3(1.5%)
NON-HOMICIDE	RTA	22(11%)	14(7%)	8(4%)	_	56(28%)	11(5.5%)	22(11%)	_
	FFH	1(0.5%)	4(2%)	3(1.5%)	_	6(3%)	1(0.5%)	2(1%)	_
	FHO	_	1(0.5%)	1(0.5%)	_	3(1.5%)	5(2.5%)	5(2.5%)	_
	DFH	2(1%)	_	1(0.5%)	_	3(1.5%)	_	2(1%)	_
	TOTAL	13.50%	12%	8%	0.50%	38%	13%	21%	1.50%

TABLE- 2(B) (SKULL INVOLVEMENT IN CRANIO CEREBERAL INJURY)

CATEGORY		TEMPORAL				OCCIPITAL				BASE
		FISSURE#	DEPRESSED#	COMMINUTED#	CUT#	FISSURE#	DEPRESSED#	COMMINUTED#	CUT#	
HOMICIDE		8(4%)	_	_	2(1%)	6(3%)	_	_	2(15%)	7(3.5%)
NON-HOMICIDE	RTA	40(20%)	8(4%)	12(6%)	_	18(9%)	3(1.5%)	_	_	50(25%)
	FFH	5(2.5%)	_	3(1.5%)	_	5(2.5%)	1(0.5%)	2(1%)	_	4(2%)
	FHO	_	2(1%)	3(1.5%)	_	_	1(0.5%)	2(1%)	_	3(1.5%)
	DFH	6(3%)	_	4(2%)	_	5(2.5%)	_	1(0.5%)	_	1(0.5%)
	TOTAL	**29.50%**	**5%**	**11%**	**1%**	**16%**	**2.50%**	**3%**	**1%**	**32.50%**

TABLE-3 (TYPES OF INTRACRANIAL INJURIES WITH FRACTURE SKULL)

		EDH	SDH	SAH	ICH	C	LC	BSH
HOMICIDE		6(23%)	8(30.8%)	13(50%)	12(46.2%)	4(15.4%)	10(38.4%)	6(23%)
NON HOMICIDE	RTA	28(21%)	89(64%)	21(15%)	13(9%)	17(12.5%)	62(45%)	43(30.8%)
	FFH	5(33.5%)	7(46.7%)	3(20%)	1(6.7%)	_	3(20%)	5(33.3%)
	FHO	2(22.3%)	_	_	3(33.3%)	_	5(55.6%)	2(22.3%)
	DFG	2(18.2%)	7(63.7%)	1(9%)	1(9%)	2(18%)	4(36%)	2(19.%)

TABLE-4 (TYPES OF INTRACRANIAL INJURIES WITHOUT FRACTURE SKULL)

		EDH	SDH	SAH	ICH	C	LC	BSH
HOMICIDE		_	3(11.5%)	_	_	2(7.6%)	_	_
NON HOMICIDE	RTA	_	36(26%)	27(19.5%)	9(6.3%)	27(19.2%)	24(17.2%)	16(11.6%)
	FFH	_	5(34.4%)	2(13.4%)	2(13.4%)	1(6.8%)	_	7(46.6%)
	FHO	_	_	_	3(38.4%)	2(22.3%)	5(55.6%)	1(11.2%)
	DFG	_	2(18.2%)	3(27.2%)	2(18.2%)	_	2(18.2%)	2(18.2%)

Review Research Paper

Sudden unexpected death in epilepsy: are we missing it?

[1]Raghvendra Singh Shekhawat, [2]Puneet Setia

Abstract

The investigation of sudden unexpected death lies at the core of practice of forensic pathology. It is well established that people with epilepsy have an increased risk of unexpected death. They experience sudden unexpected death two to three times that of general population. The incidence of SUDEP (sudden unexpected death in epilepsy) itself ranges from 1 to 2 per 1000 patients years. Many times, the autopsy is negative, and if there is not a more convincing cause of death, the individual's demise is usually attributed to the terminal seizure associated with autonomic cardiac and/or respiratory dysfunction. Although the exact mechanism of death from a terminal seizure is not definitively known, seizures are known to disrupt autonomic nervous system function and have been known to induce dangerous tachyarrhythmias, bradyarrhythmias, and asystole.

Key Words: Sudden unexpected death in epilepsy, sudden neurological death

Introduction:

Death attributed to, and occurring immediately or soon after the onset of a neurological illness or neurological phenomenon is known as sudden neurological death (SND). Cases of SND fall into one of the following categories:[1]

1. Death is witnessed and occurs before clinical investigation of signs and symptoms can be carried out
2. A witnessed cardiopulmonary arrest occurs because of the abrupt onset of a neurological disease or condition
3. Un-witnessed or witnessed sudden death with epilepsy.

Out of these, the last category is an extra challenge to the forensic pathologist and constitutes a constellation of categories. SUDEP is a category of deaths in people with epilepsy and not a condition. Definitions for what is included in this category are needed as they allow for comparisons between different studies and monitoring trends. Two SUDEP definitions/classification systems[2,3] have been in use for last few years. The Nashef definition (as given below), focuses on strictly defined cases with negative post mortem, while the Annegers definition[4] additionally give guidance on classifying the many cases where information is incomplete, with definite, probable and possible categories. Both these definitions are useful.

"SUDEP: Sudden, unexpected, witnessed or unwitnessed, non traumatic and non drowning death in an individual with epilepsy, with or without evidence for a seizure and excluding documented status epilepticus, where post mortem examination does not reveal a toxicological or anatomic cause for death." [2]

Later in 2012, Naschef, et al. proposed a Unified SUDEP Definition and Classification which states that cases be left unclassified when data are insufficient to reasonably permit their classification, and that the possible SUDEP category includes only the cases with competing causes of death **(Table 1).**[5]

The mechanism of SUDEP:

Even after three decades of research, the mechanism of SUDEP remains controversial. Potential mechanisms include cardiac arrhythmia, postictal cardiomyopathy, depressed autonomic function and seizure-related respiratory failure.[6,7] The most common is seizure-related neurogenic cardiac rhythm disturbance; followed by neurogenic respiratory disturbance in the form of lung edema and apnea. These two types of seizure-related disturbances have been studied clinically and experimentally in efforts to define the mechanism(s) of SUDEP. In addition, the possible role of psychological stress and gene mutation has only recently been raised. The mechanisms are as follows:

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a. **Cardiac:** The association of seizures with self limited, non fatal cardiac arrhythmias is well established. The most common of these is tachycardia in association with generalized tonic-clonic seizures. The dramatic cardiac changes caused by repeated seizures could build up over time leading to progressive damage to the heart until a final, fatal seizure-induced episode occurs.

Studies have shown that the sympathetic component of cardiac innervation can lead to production of fatal tachyarrhythmias.[7] There has also been a proposal that postganglionic cardiac sympathetic innervation is altered in association with temporal lobe epilepsy and may be a pathophysiological risk factor for SUDEP.[8]

b. **Respiratory:** The association of lack of oxygenation and seizures has been studied thoroughly. The decrease in oxygen saturation below 90% during episode of epilepsy has been observed.[9,10] Ictal hypoxemia occurs often in patients with localization-related epilepsy and may be pronounced and prolonged; even with seizures that do not progress to generalized convulsions. There is also a probability that in seizures with oxygen desaturatinon there is a greater than two fold increase in likelihood that the QT interval is shortened.

Forensic aspects of SUDEP:

a. **Drowning:** Often the epileptic individuals are found dead in swimming pools, bathtubs, and natural water bodies. It might become a challenge for the autopsy surgeon and the Investigating Officer to ascertain that a victim who was found immersed in the water body, and whose findings are not suggestive of water aspiration, did not drown (due to laryngospasm), but rather died of true SUDEP and simply sank in the water after the attack when he was lifeless. To add to the challenge, the diagnosis of antemortem drowning is frequently difficult to ascertain and many a times a diagnosis of exclusion.[11]

b. **In home or workplace:** Most often the site of occurrence of an unwitnessed epileptic death is the home, that too in the bedroom. Deaths associated with SUDEP have been seen patients during sleep.[12] Also, the body of a SUDEP victim may be found in other places of home like garage, lawn and remote corners of the home, raising a suspicion of some foul play.

c. **Outdoors:** Death in epileptic patients can occur outside the home and the body can remain unnoticed for a considerable duration. A meticulously done autopsy can often establish the cause of death in decomposed bodies.[13]

d. **Road traffic accidents:** It can be difficult for an autopsy surgeon to evaluate a road traffic accident death in which the driver had lost control over the vehicle due to an epileptic attack. Autopsies of SUDEP victims have shown a higher incidence of brain lesions.[14] Demonstration of pathologic findings of epileptic foci can be important in insurance claims.

Autopsy protocol in SUDEP:

a. **Role of autopsy:** It is important to conduct a careful post-mortem examination of deaths related to SUDEP, primarily to exclude other anatomical (cardiac) cause of death. Although, by definition, significant swelling, shift or herniation is absent in such deaths, but dissection of brain may reveal mild swelling and high-average brain weights.[15] It is perhaps a common misconception that the brain in SUDEP cases is normal in the vast majority of cases. Analysis of the larger SUDEP series report macroscopic abnormalities in half to two-thirds of cases.[16] The Royal College of Pathologists recommends that best practice in SUDEP is retention of the whole brain with fixation and thorough neuropathological examination including sampling of specific regions for microscopic examination, known to be vulnerable to alteration in patients with epilepsy.[17]

b. **Collecting relevant information:** Before beginning the autopsy, following details should be asked for:

1. Details of type of seizures and any recent deterioration
2. Details of antiepileptic drug intake and compliance
3. Any prior MRI/EEG data: This may help to target brain tissue sampling
4. Details of circumstances surrounding death: Photographs, position of body, evidence of intoxication, eye-witness accounts
5. Any other relevant co-morbidity: Cardiac disease, drug abuse, diabetes, etc.[18]

c. **The autopsy Procedure:** This includes:

1. Documentation of external injuries, evidence of incontinence and tongue biting, petechial haemorrhages indicative of terminal asphyxia, gum hypertrophy, evidence of related neurological disorders.
2. Full autopsy
3. Sampling for histopathology, toxicological analysis, biochemistry etc.

d. **Specific Significant organs:**

1. **Brain:** The Royal College of Pathologist's guidelines on autopsy practice in epilepsy recommend whole brain fixation and examination after a period of 2-3 weeks. If this is

not permissible, the next best practice is to fix coronal slices of the brain (taken 1.5 cm thick piece from just in front of the midbrain and just behind the midbrain) for a short period (2-3 days) followed by photography and histopathology sampling. If even this is not permissible then small tissue samples must be selected and trimmed for histopathological analysis and the brain immediately returned to the body at the time of autopsy. It has been shown in SUDEP series that if the brain is cut and examined in fresh rather than a fixed state, pathology is more likely to be overlooked.[16]

The following sampling guidelines are recommended:[19]

It is recommended to take coronal slices, 1.5 cm thick, which should be just in front of brain (cerebrum) and just behind the midbrain. This will include the cerebral samples. Brain sites considered suitable for histological sampling includes slides from Cingulate gyrus, Hippocampus and parahippocampus gyrus, Middle frontal gyrus, Superior and middle temporal gyri, Caudate nucleus, Putamen and globus pallidus, and Cerebellar vermis. Studies have shown that various microscopic findings, including neuronal clusters, increased perivascular oligodendroglia, gliosis, cystic gliotic lesions, decreased myelin, cerebellar Bergmann's gliosis, and folial atrophy, are present in a higher percentage of the brains of sudden unexpected death in epilepsy subjects.

2.**Other recommended blocks/ organs/ samples:**

i. **Heart:** Available studies shows that hearts of SUDEP victims have an increased incidence of perivascular and interstitial fibrosis and myocyte vacuolization. These findings are more pronounced in the subendocardial region.[20,21] The current Royal College of Pathologists guidelines for autopsy practice in epilepsy deaths recommend that three blocks of left ventricle and one block of right ventricle are sampled to exclude vascular-ischemic damage or other cause of cardiac death as myocarditis.

ii. **Lungs:** Pulmonary oedema can be found in 50-90% of SUDEP related deaths.[14,16] It is important to document the lung weights in these cases.

iii. **Toxicology samples:** Samples of blood, urine and gastric contents should be collected for analysis of medication intake, drug abuse and alcohol intoxication.

iv. **Vitreous humour:** In case of history of diabetes and any metabolic disorder samples should be taken for biochemistry.

v. **Hair testing:** It has been recommended for assessing long term drug compliance.[22]

vi. **Molecular and genetic testing:** In future this can be utilized for detection of channelopathies.

Role of toxicological screening:

Toxicological screening should be an integral part of the deaths related to SUDEP. There can be situations when the SUDEP related deaths are not associated with presence of significant amount of antiepileptic drugs in the deceased. In such scenarios it is important to ascertain the casual relation between blood level of anti-epileptic drugs and incidence of SUDEP. This theme has got specific importance in the fact that inability to detect significant titres of anti-epileptic drugs in the blood samples may raise question on the compliance of the patient towards medication.[23] Earlier, polytherepy was the mainstay of treatment of epileptic conditions, but now the new drugs have got a lower profile of adverse drug reactions, thus minimising the chance of non-compliance. These newer generation of antiepileptic agents includes drugs like gabapentin, topiramate, tigabine, lamotrigine, etc. An additional risk can be attributed to the antiepileptic agents having their adverse effect on the cardiac rhythm and contractibility.[24]

Apart from the assessment of compliance of the patient many other questions also need to be addressed in deaths related with SUDEP, like the actual dose of the drug, the combination in which the dose was taken, recent change in dose of the drug or sudden withdrawal, any known drug interactions, validity of the assay method for evaluating post-mortem blood levels of the drug, etc.[25] While making an inquiry into the deaths related to SUDEP, a prompt and thoughtful inquiry should be made about the pharmacological risk factors.

Role of immune-histochemistry:

Studies have found that certain markers like HSP-70 and c-Jun can be utilized for detection of acute neuronal injury in the deaths associated with SUDEP.[26] Fibrinogen positive purkinje cells have also been proposed in the past to be markers of epilepsy.

Conclusion and recommendations:

Precise epidemiological data on mortality and cause of death are not available from India or most other developing countries. Meta-analysis of published and unpublished studies puts the overall prevalence rate of epilepsy in India at 5.59 per 1,000 populations.[27] The task for an autopsy surgeon becomes more demanding and

challenging in the scenario where there are no standard guidelines and lack of training in pathology. SUDEP related deaths may have significant implications both in civil and criminal cases. Therefore, it is advisable to develop and follow a standard autopsy protocol for deaths related to SUDEP. Role of a carefully conducted verbal autopsy and retrospective questioning shouldn't be ignored in such cases. This would not only lead to quality autopsy services, but would also aid in the administration of rightful justice.

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Table 1: Proposed unified sudden unexpected death in epilepsy (SUDEP) definition and classification

1.*Definite SUDEP* [a]: Sudden, unexpected, witnessed or unwitnessed, nontraumatic and nondrowning death, occurring in benign circumstances, in an individual with epilepsy, with or without evidence for a seizure and excluding documented status epilepticus (seizure duration ≥30 min or seizures without recovery in between), in which post-mortem examination does not reveal a cause of death

1a. *Definite SUDEP Plus* [a]: Satisfying the definition of Definite SUDEP, if a concomitant condition other than epilepsy is identified before or after death, if the death may have been due to the combined effect of both conditions, and if autopsy or direct observations/recordings of terminal event did not prove the concomitant condition to be the cause of death

2. *Probable SUDEP/Probable SUDEP Plus* [a]: Same as Definite SUDEP but without autopsy. The victim should have died unexpectedly while in a reasonable state of health, during normal activities, and in benign circumstances, without a known structural cause of death

3.*Possible SUDEP* [a]: A competing cause of death is present

4.*Near-SUDEP/Near-SUDEP Plus*: A patient with epilepsy survives resuscitation for more than 1 h after a cardio respiratory arrest that has no structural cause identified after investigation

5.*Not SUDEP*: A clear cause of death is known

6.*Unclassified*: Incomplete information available; not possible to classify

[a] If a death is witnessed; an arbitrary cut-off of death within 1 h from acute collapse is suggested.

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Review Research Paper

Methods to Open the Skull at Autopsy: An analysis

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Abstract

During a medico-legal autopsy, a forensic pathologist opens the skull wide at bony landmarks for better access into the cranial cavity. This helps to observe the intracranial findings of medicolegal significance and to remove the brain intact for better assessment of the findings. The various methods for opening the skull available, include - use of hammer and chisel, manual saw or electric saw; each with its own advantages and disadvantages. Comparison of time, effort and skill required for each of these methods and in the current scenario, the possibility of risk of acquisition of multi-drug resistant tuberculosis (MDR TB) or HIV infection from the deceased is being discussed. One significant issue associated with hammer and chisel method used for opening the skull includes either extension or creation of fractures (artefacts).This can be minimised by limiting the use of hammer and chisel in opening the skull. A vibrating electric saw with vacuum aspirator or bone dust collector is recommended for opening the skull for autopsies. If the facility of vacuum aspirator or bone dust collector is not available, other methods of opening the skull as compared to use of electric saw would be safer in terms of risk of exposure to MDR TB, HIV infections or others which could spread by bone aerosol generation.

Key Words: Skull opening, Autopsy, Electric vibratory saw, Hammer and chisel, Bone aerosol, Safety

Introduction:

Human skull is opened in different ways by anatomists, pathologists, forensic pathologists and surgeons.Skull is opened in a living person by the surgeons and in the deceased by the anatomists and pathologists. The basic principle in opening the skull contrasts in these two groups. In the living, a conservative approach is preferred; while in the deceased, the approach is academic or investigational, and hence, liberal. The methods used are generally determined by the availability of equipment or instruments, experience in using the equipment, the reason for opening the skull and the continuation of practices followed in the specialty or the Institute. A conservative approach is required for surgeries wherein a smaller segment of the skull is removed to probe into the underlying intracranial pathology. Anatomists and pathologists advocate the removal of the entire vault of the skull as a routine, to facilitate removal of brain intact.

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In medico legal autopsies in India, it is mandatory to do a complete autopsy which includes opening of the skull and examination of the brain. It is also mandatory to examine the base of skull after removing the brain from the cranial cavity. Although there is paucity of data describing different processes used across the country, it is considered, in the light of diverse affordability of institutional set-ups, that these processes vary considerably. While hammer-chisel and manual saw approach is the least expensive and hence most widely used, electric saws are used in a few sophisticated higher set-ups.

Review of literature:

Incidence of pathological autopsies are declining all over the world [1-3] and anatomical dissections are limited by their requirement. The cadavers used for anatomical dissections can be screened for diseases. The cadavers used for anatomical dissections are also well embalmed so that threat of infection is reduced. The medicolegal autopsies continue to be done in large numbers and at some places, are on the rise. Screening for infections is not possible before conducting the autopsy and the magnitude of this uncertainty increases in non hospitalised deaths.

Various methods of opening skull have been tried over time by surgeons and anatomists. For medicolegal autopsies in India currently, the predominant method of opening

the skull is by using hammer and chisel. Very few centres use an electric saw or a vibratory saw. The methods used by anatomists and surgeons were studied and their advantages and disadvantages compared.

An issue arising with use of hammer and chisel for opening the skulls is creation of skull fractures or the extension of existing fracture. To minimize it, the cranial saw should completely cut through the cranium and minimum force should be used to separate cut edges of cranium. Hammer and chisel should never be used to complete cranial saw cuts.[4]

The Cunnigham's Manual of Practical Anatomy, Volume 3,[5] used by medical undergraduates, states the use of two processes to open the calvaria: one to open outer table, the compact layer of skull till spongy bone part, the diploe and the other process involving opening of the inner table. A mark is drawn by the pencil around the skull horizontally using a string passing just above the orbital margins in the front and external occipital protuberance at the back in midline. This line guides the location of the cut on the skull. Usage of saw is mentioned for opening the outer table, not mentioning the type of saw. The saw dust turns red when the outer table has been sawed and spongy layer of bone, dipole is reached. The breaking of inner thin layer of compact bone requires precise adjustments in amount of force to be used to prevent injury to brain tissue. The anatomical variation in thickness of skull, with extremely thin skull in the temporal region must be remembered. Use of blunt chisel with controlled force for the strokes is described. Even after splitting the inner table, the calvarium tends to remain in its place and does not lift free. It requires a manual outwardly directed pull, with the help of chisel in the cut made in calvarium, to lift it.[5]

In a forensic manual, the method described varies and involves intermittent cuts around the skull to be made by an electric oscillating saw. The cut at the back over the occipital protuberance at mid is made to dip at about 160 degrees. The use of chisel is limited to cracking the inner table of the skull.[6]

In 1993, the Journal of Clinical Pathology, in an article 'How to tackle a possible Creutzfeldt-Jakob disease necropsy' described removal of the skull using the saw and accessing the brain tissue, by the use of saw and chisel, both within an enclosure made by a polythene bag.[7] The concept of use of polythene bag around the saw to prevent spread of organism and infection had thus emerged.

A book on History of Neurosurgery describes surgeons Scultetus, William Hey and Ambroise Pare using hand saw, circular or disc saw and Hey's saw. These methods were cumbersome, dangerous and inefficient.[8] The hand saw called Gigli saw included a flexible, twisted wire cable with looped ends were fixed on hooks on the two 'T' handles. Moving the T handle would slide the cable over the bone, making a notch that continued through the bone. This method is often used for amputations.[4]

Another Forensic Autopsy Handbook &Atlas[9] states that the skull be opened using an electrical saw called the Stryker saw. Homer H. Stryker, an American orthopedic surgeon, patented the saw in 1947 which is a vibrating or oscillating saw. This is a handy electric saw used for cutting ribs and the skull, available with various blade sizes and shapes to have access to bones of even small size at a particular site, for example, the petrous temporal bone, which would require a small blade to open it from the base of the skull.

Many saws now have a safety device that prevents deeper cut. After removing the skull, the dura is incised and everted. The penetration level of the blade of the saw is assessed and used accordingly. The Stryker blade is moved from side to side to avoid piercing at greater depth.[9]

An autopsy book from USA compares use of bone saw and Stryker saw, the bone saw requiring more effort in use compared to Stryker saw, but the Stryker saw creating more harmful aerosol waste (very fine particles of bone dust suspended in the air). Inhalation of the aerosol during an autopsy can produce respiratory or other illnesses.[10] Another autopsy reference book also affirms and states that the aerosol puts the pathologist, mortuary technician and other persons (students, observers, etc) at risk of infections like tuberculosis, including multi drug resistant (MDR) tuberculosis.[11]

Another reference defines a high risk necropsy as 'post-mortem examination of a deceased person who has had or is likely to have had, a serious infectious disease that can be transmitted to those present at the necropsy, thereby causing them serious illness and/ or premature death' and states that a siginificant biological risk faced by mortuary workers is Mycobacterium tuberculosis infection .[12] At Syracuse Medical Examiner's office and Los Angeles Coroner's office, outbreaks of autopsy transmitted tuberculosis have been reported due to inadequate ventilation, in the 1990s.[10]

Result:

Use of hammer and chisel requires effort and time. It also leaves rough jagged pointed ends of bones. These ends of bones may damage the gloves when dura is being cut or brain being removed from the cranial cavity. Hammer and chisel also do not permit precision in the shape of the skull to be cut and the desired dip in shape of the skull at the back is not possible. Splashing of blood or spread of smaller bone pieces is also a possibility. Control of depth of skull to be cut is also improbable. Possibility of creation of artefactual fractures is also increased. The dip of 160 degrees at the back at mid prevents sideways movement of vault of skull when vault is replaced back on the head after completion of autopsy.

With use of electric vibrating or oscillating saw, the speed of work, preciseness of size, shape and depth in opening the vault of the skull is achieved along with ease of work and minimal possibility of introduction of an artefact. Use of saw fitted with a vacuum aspirator is recommended for the generated aerosols. The spread of infection by aerosol can further be minimised by having well ventilated autopsy rooms with 12 air exchanges per hour exhaust systems around the autopsy table directing air and aerosols away from persons conducting the autopsy as per the Guidelines on airborne infection control, mentioned by Ministry of Health and Family Welfare, New Delhi.[14]

In 1993, pathological autopsy on a person with Creutzfeldt Jakob disease was described as being conducted under cover of polythene bag to prevent risk of spread of infection to autopsy surgeon. With more varied infections known to be present 23 years later and their spread substantiated at autopsy, it is but prudent to have vacuum aspirator also available at autopsy.

Discussion:

Infection from tuberculosis including multi drug resistant tuberculosis has been identified as a definite risk of autopsy work on exposure to aerosols generated by using bone saws.[10,11,13,15] It is also suggested that patients with tuberculosis may be more infectious at necropsy than during life.[16] Infections like HIV have been known to survive in cadavers for a considerable amount of time (up to 16 days after death, if stored at 2^0 C) and viable HIV has been isolated from bone fragments, spleen, brain, bone marrow and lymph nodes at autopsy 6 days post mortem.[17]

Sawing by metallic wire or hacksaw is less bloody and more conservative therefore it is used when a particular surgical intervention is required, for example, in case of a massive head trauma. Occasionally, while examining findings of historical or archaeological relevance like skeletal remains, which needs to be preserved, the least destructive approach is preferred.[9] The bony dust dispersion produced by the use of the Stryker saw constitutes a health hazard, so the procedure must be carried out with appropriate means of protection. Collecting the dust inside a plastic protective bag or, alternatively, by wearing protective suits should minimize dispersion of the potentially infectious bone dust. Whatever the method, the Stryker saw should always be equipped with a vacuum aspirator.[9]

Having a well ventilated autopsy suite,[13] use of oscillating saw with a vacuum aspirator to open the skull and cut the ribs and having Personal Protective Equipment (PPE) for persons involved in conducting autopsy is perhaps the ideal solution. In the absence or paucity of resources to have ideal equipment or an ideal working place, use of PPE should never be compromised.

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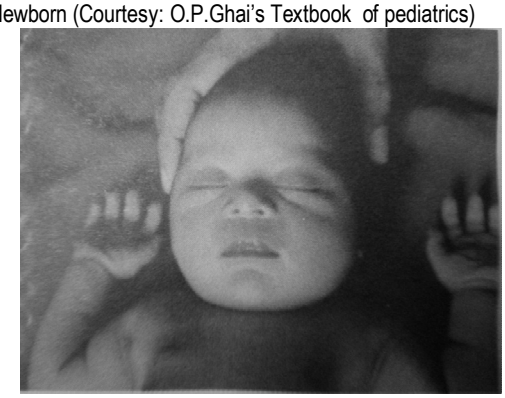
Table no-5: Case features

Sr no		Features achieved normally at 1yr	Present case study
1.	Radiology	Complete ossification of Capitate & Hamate bone. Appearance of ossificaion centres for head of humerus.	Complete ossification of Capitate & Hamate bone.
2.	Dental	All central &Lateral incisors, First molar are erupted.	No eruption of any teeths.
3.	Pediatric	Neckholding, Crawling (11 months), Standing without support,Grasp reflex,bidextrous grasp, Palmar grasp, Pincer grasp, Turns head to sound,Cooing,Monosyllables,Bisyllables, Social smile, Recognising mother,Smiles at mirror image , Waves bye-bye etc.	Grasp reflex present, social smile present, cooing achieved, No neck holding.
4.	Height & Weight	At birth, height- 45 to 50 cm & weight - 2.5 to 3 kg. At 6 months height - 54 cm and weight - 5 to 6 kg. At 1 yr height - 58 to 60 cm & weight - 7.5 to 9 kg.	Height-68cm & weight- 6.9kg.

Photograph no-1
X-ray of Wrist (AP View)

X-ray of wrist showing complete ossification of Hamate and capitates bone.

Photograph no-2::
Down's syndrome in
Newborn (Courtesy: O.P.Ghai's Textbook of pediatrics)



Review Research Paper

Age Estimation from Dental Evidences - A Review

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Abstract

Estimating age becomes a challenging task in medico-legal cases depending upon the nature of sample or evidence. In forensic odontology, dental growth and development parameters have been correlated with age using number of techniques. Since many years, different methods have been proposed to estimate age and with the span of time and these have been modified in order to attain greater accuracy. Generally, it is suggested to accommodate various techniques of skeletal, dental and molecular aspects to enhance the results, most importantly in the case of forensic matters where precision and accuracy is the foremost concern of the forensic odontologist dealing with the dental evidence. This paper reviews the common radiological and morphological methods used to estimate age in forensic odontology.

Key Words: Age estimation, forensic odontologist, radiological, morphological.

Introduction:

The major objective of identifying dental evidence in forensic odontology is achieved by application of a number of techniques and methods. They may range from the study of morphological and developmental variation (dental traits or morphology), metrics of human dentition to molecular analysis. For years studies on dental traits and their variation aid in identification.[1] By proper interpretation from the amount and nature of dental variability, correct identification of hominoids can be made. There is a significant role of dental identification in the fields of paleoanthropology, forensic anthropology, comparative odontology and clinical dentistry. Primarily, the forensic odontologist performs identification by comparing ante mortem records to the available post-mortem records to reconstruct the identification.[2]

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However, there were always minimal possibilities of recovery of antemortem data. Therefore, other approaches of identification were considered simultaneously from time to time. For accurate biological profiling or the complete individual identity, the basic attributes like sex, age and race are to be established from human dentition in cases with an odontological background. In forensic investigations, dentition has been routinely used in the form of complete dental cast, fully or partially intact teeth in living, actual extracted loose teeth collected from a crime scene or archaeological sites. The evidentiary value of human teeth has been well exhibited in courts and legal systems backed with opinions of an expert witness which are the inferences derived from analytical skills and techniques such as bitemark analysis, dental radiographs, cheiloscopy, rugoscopy, molecular examination and analysis of the odontological evidence. The testimony presented by experts may change a verdict of a case depending on the thoroughness of the cross-examination.[3,4]

Age Estimation in Forensic Odontology

Age-related changes in teeth are a continuous process of biological and physical stages occurring throughout an individual's life commencing from intrauterine life to adulthood. These stages, when evaluated and analyzed using appropriate method, aid in estimating age. An important aspect of forensic odontology is the estimation of age probably for number of unexplained cases associated with legal

backgrounds such as assigning age identity of unidentified remains, investigations related to immigrations, refugees and children having no records of their exact age, criminal cases where age is cautiously manipulated to skip severe punishments indispensable for adults as compared to juvenile. Diverse dental features as developing pattern and stages, changes analogous to morphology histology and biochemical in individual dentitions are some of the important factors contributing a significant role in age estimation. For many years and even today, the most reliable and perhaps the most persistent method evolved from the use of dental radiographs. In contemporary studies, radiographic techniques are being enhanced with digitization in addition to some optical adjustments and attachments of software reducing errors to a far extent.[5] **Table 1** shows some of the methods which marked their contribution in determining age from years to till date.

Schour and Massler method (1941)

Schour and Massler[6] compressed dental development stages of primary and secondary teeth into 21 steps based on the age group and generated charts assigning numeric values to the stages of development. They compared the calcification stages of teeth on radiographs with the available standards. These charts were updated regularly by the American Dental Association (ADA) and they further published them in 1982.[7,8] In 1941 they published an article explaining different stages of teeth eruption. Later in 1944, another article was published by Schour and Massler, in which they documented the reliability of eruption theories in age estimation, in-depth knowledge of eruption pattern and eventually factors which can stand up to this kind of research.[9]

Gustafson's method (1950)[10]

The unique features identified as age indicators of the teeth are the key to identification in odontology. The unique features are the result of changes occurring with the chronological increase in age. Age estimation in Forensic odontology is comparatively an important task depending on the state of samples being analyzed. Gustafson, in the year 1950, produced the first scientific report emphasizing on the statistical importance of the dental characteristics to calculate age. Different histological changes (attrition, deposition, apposition and resorption) were recorded on sectioned adult human teeth and clustered into a number of stages and scored corresponding to the age of an individual. A formula was derived using a sum of all these scores. Among all the factors integrated, root translucency has been regarded as an important feature closely related to aging.

$A_n + P_n + S_n + C_n + R_n + Tn$= Points, where n = maturity scoring

A_n= Attrition

P_n=Periondontosis

S_n= Secondary dentine deposition

C_n= Cementum apposition

R_n= Root Resorption

T_n= Dentine Translucency

It was found that an increase in the total score corresponds to an increase in age. The average error with this method was 3.6 years.[10] Histological changes mentioned in the Gustafson method were studied in a sample of 228 longitudinally sectioned teeth. The scores assigned to different parameters were added and plotted against actual age and simultaneously regression formula was generated to estimate age. Same scores were used to estimate age from the Gustafson formula. The comparative analysis of the results obtained from both the formula was done by using Pearson's correlation and regression analysis. Both the formulae showed that the correlation between chronological age and age estimated was statistically significant ($0.92; p<0.001$).Though both the results showed strong correlation, but the mean error (±5.47) were slightly less in the newly derived formula than that of Gustafson's formula (±6.35) which shows the population specificity of the Gustafson method.[11]

Further research on Gustafson's technique uncovered some limitations such as the sample size, tooth type, cause of periodontosis which were some of the measured parameters in the original study. Consequently, alterations and changes were recommended to minimize these loopholes. Therefore, Dalitz, Bang and Ramn, Johanson, Maples and Rice improvised the existing method and models. Dalitz concluded that two dental features secondary cementum and root resorption can be excluded and extended the scores from 0-4 instead of 0-3 as given by Gustafson. He suggested the following regression formula $E = 8.691 + 5.146A + 5.338P + 1.866S + 8.411T$. Maples, on a different note, attempted to focus on the positioning of the tooth to improve the technique but failed. Ultimately Maple and Rice corrected the existing formula of Gustafson to ($Y= 13.45 + 4.26x$) in order to increase the correlation of age to the different variables.[12-16]

Nolla's technique (1960)

Nolla's method of calculating age was based on the ten different stages (scoring 0-10) of mineralization in relation to age of permanent teeth in mandible and maxilla on radiographs.[17] The supplementary mineralization stages in the method further expand its scope of efficiency and validity for age estimation. Methods based on staging of teeth formation associated with age were considered more accurate as the calcification is controlled genetically and moreover they are less exposed to environmental effects.[18]

In a study constituting of Spanish and Portuguese population, the reliability of radiological methods, Nolla and Demirjian, et al., was investigated. It was observed that Nolla's method assessed age with greater accuracy than that of Demirjian, et al. method. They concluded that males showed a stronger correlation of mineralization stages with age than females.[19]

Moorer, Fanning and Hunt method (1963)

Assessment of age based on the dental maturation using radiographs was divided into 14 progressive stages of mineralization for single and multi-rooted teeth in Moorer, Fanning and Hunt method. Deciduous and permanent teeth were studied simultaneously in their survey that developed charts for a certain age group. Charts developed by Moorer, Fanning and Hunt illustrate average age and two standard deviations that correspond with the developmental stages of the teeth. Values between the two standard deviations were the age range in which 95% of the population under study would probably fall, representing the particular developmental stages. Besides forensic medicine, this method of age estimation can be used in other fields where age is to be determined for complete identification including dentistry.[20]

Individuals with an age range between 3years to16 years belonging to three different ethnic ancestries, when analyzed according to Moorer, Fanning and Hunt (MFH) method and Demirjian, Goldstein and Tanners (DGT) method revealed that the underestimation of the ages of all the three samples by MFH was over 90% in each sample group. The over-estimation of the ages of the samples varied from 79.2% for Indians, 86.3% for the Tygerberg children and 90% for the Black children.[21]

Bang and Ramm (1970)

Tooth formation, an ongoing process of mineralization results in anatomical and physiological changes. One such change corresponding to age is the transparency of root dentine and is observed macroscopically by using the light source that passes through the teeth. Root dentine transparency begins to increase with age representing the maturity of teeth. Translucency initiates at the root apex advances towards the coronal. Bang and Ramm in their study observed translucency in roots of 265 individuals (978 roots) collected from individuals visiting dental centers and autopsies. When practically implicated, molars and bicuspids were the impetus for the current measurement and therefore only incisors and cuspids were included in their study. Depending on the length of translucency, they generated formulae.[13]

For translucency length < 9mm

Age = $B_0 + B_1 + B2X2$

For translucency length > 9mm

Age = $B_0 + B_1X$

B_0= Regression Constant

B_1 & B_2= Regression Coefficient

X = Translucency Length

The comparison of the degree of translucency measured by a digital method to the results obtained from a conventional method using a caliper on fifty freshly extracted teeth revealed that no technique is superior to other as their correlation coefficient to age were statistically significant ($p < 0.001$). The regression equation derived was applied to an independent sample also revealed the equal potential of both the methods within ±5 years of the actual age. Further studies on a large scale were suggested to verify which method is more reliable to estimate the age.[22]

Demirjian, Goldstein and Tanners method (1973)

The most popular and widely used method was introduced by Demirjian, et al., in 1973 based on the eight different stages of calcification in crown and root of the permanent tooth on a French-Canadian children. These stages were scored as per the degree of calcification which in turn was an age-dependent factor.

- A- mineralization of single occlusal points without fusion of the calcifications
- B- fusion of the calcifications - occlusal outline recognizable
- C- enamel development of the crown completed, beginning dentine deposition,
- D-crown development completed up to the enamel-cement-verge
- E-root length shorter than height of the crown

- F- root length greater or equal to height of the crown
- G- root development completed, Foramen apical still open
- H- Foramen apical closed)

Demirjian, et al., assumed that their scoring system framework is a substantial measuring instrument for general application. According to them, the pattern of development of the teeth won't be distinctive in various populations, so the maturity scores will be similar irrespective of population differences. The differences will emerge only when these are changed to dental ages, for which regression analysis was performed for each of the populations. So Demirjian's maturity scores utilized various phases of eight teeth independently for males and females.[23]

Each stage allocated a score and sum of these scores were recorded on a scale of 0-100 indicating their dental maturity and hence their actual age was calculated. Later the accuracy of the mentioned method was further verified and was applied to different populations of the world. A meta-analysis [24]of papers published from 1973-2011 that used Demirjian's data set for age estimation revealed that on average, the Demirjian dataset overestimated the age of females by 0.65 years and males by 0.60 years.

Lamendin (1992)

Lamendin[25] suggested a non-destructive method based on two specific dental features i.e. Translucency of the tooth root and periodontosis against root height on single-rooted teeth. The study was conducted on single-rooted teeth collected from cadavers of the population having an ethnic background of French. This method was further revised by Prince and Ubelakar in the year 2002.[26] They developed a new formula separately for each sex and the varying population. More concrete results were obtained from the new formula. To further validate this method variations produced during detection of luminance of the transparent zone was evaluated using statistically technical error of measurement analysis of 129 single rooted teeth. Coefficients of the variables "arithmetic mean" and "standard deviation" of luminance were found to be highly influential on regression formula so generated from multiple regression analysis.[27]

Kvaal and Solheim (1995)

Kvaal and Solheim introduced the combined effect of morphological and radiological techniques to predict the age of adults on extracted teeth.[28] Length, as well as the width of both the pulp and the root, was measured on the conventional radiographs.

Pulp- Root Length (P)
Pulp Tooth Length (R)
Tooth root length (T)
Pulp- Root width at mid- root level (C)
Pulp- Root width (at CEJ Cemento-enamel-junction) (A)
Pulp root width at midpoint (between C and A) (B)
Mean of B/C (W)
Mean of P/R (L)
Mean of all ratios excluding T (M)

Index formed by pulp and root ratio was analyzed and significant results were achieved using the derived regression formula:

Age = 129.8 – 316.4 (M) – 66.8 (W-L)

The authors further investigated the technique on periapical radiographs [29] and later Bosman,s et al.,[30] applied the method on panoramic radiographs and concluded that results were in accordance with the original study. A sample of 100 orthopantomographs was divided into two groups and analyzed with and without Kvaal's criteria. On the basis of Kvaal's criteria, the difference between chronological age and real age was 8.3 years. This suggests that the accuracy of this method depends on the precision of measurements and quality and number of the orthopantomographs.[31]

Cameriere (2006)

Cameriere et al.,[32] employed a method of assessing age based on the measurement of open apices dimensions of roots of the permanent tooth. Developed in the era of extensive digital exposure, this method attempted to provide an enhanced image to measure distance evenly from inner sides of the apices and the complete length. Such images were uploaded by using computer aided drafting program followed by recording the distance with more ease and minimal error arising from the concept of magnification and angle adjustments. For the age group of 6 to 13 years of age, this method was considered to produce far better results than all other existing technique.[33-34]

Recently, Marques Fernandes et al.,[35] proved the accuracy of this method in a Brazilian sample of 160 children aged between 5 and 15 years. De Luca et al., [36] showed that this technique is very useful and may be recommended for practical application both in forensic odontology and clinical dentistry.

Conclusion

Assessment of age in forensic odontology is a holistic approach that comprises the different aspects of dentition and dental practices. Though there are some fluctuations in the accuracy rate observed in the existing techniques but with the advent of advanced analytical, digital and molecular techniques incorporated with time, highly effective and accurate results are produced. At the same time, researchers from the current fields are advised and recommended to have multiple approaches to validate the results in order to maintain the legal importance of dental evidence. Keeping in view the role of odontologist the handling of odontological cases by non dental experts remains the foremost injustice.

On the other hand, these methods used to determine age depend on various factors that cannot be passed over. Population variation, geographical factors and environmental effects, tooth type, dental diseases compromise the major influential factors in the research field of dentistry. Population-specific studies and formulation of regression equation results in the standardization of methods are essential. This will enable generation of the functional database for estimating age and complete identification of recovered dental samples in the future.

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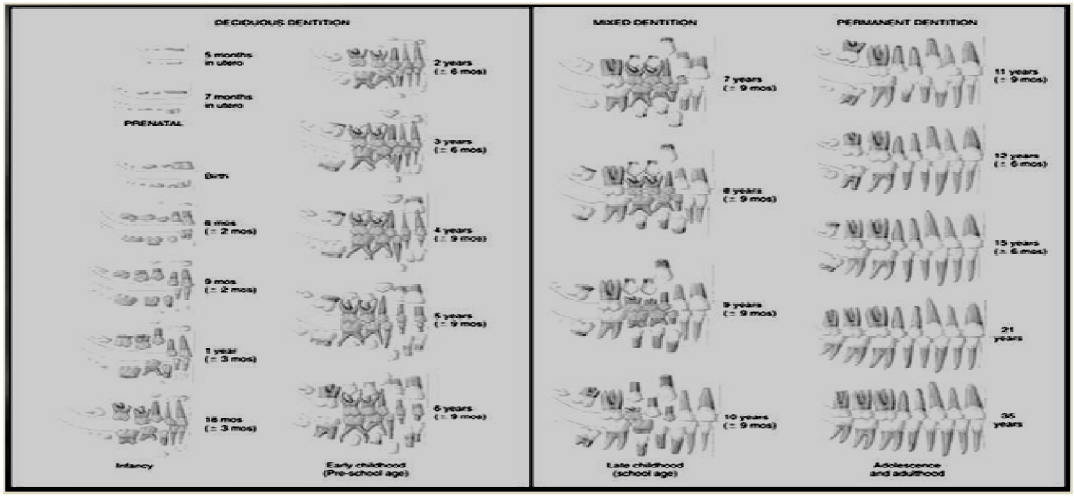
Table 1 - Different methods of age estimation

Method	Year	Inclusion	Suggested Formula/ Scoring
Schour and Masseler method [6]	1941	Stages-21 (developmental) starting from fifth month of intrauterine to 21 years. Sample- Deciduous and permanent teeth Method- Histological and radiological.	---
Gustafson's Method [10]	1950	Parameters- Six age-related parameters Attrition(An), Periondontosis (Pn), Secondary dentine deposition (Sn) Cementum apposition (Cn) Apical Resorption (Rn) Root Translucency (Tn) Sample-Ground sections of teeth Method- Histological and morphological	X= An+ Pn + Sn + Cn + Rn + Tn. X= Total points 4-scores =0-3(0,1,2,3) Age= 11.43 + 4.56X
Nolla's method [17]	1960	Stages- 10 stages of mineralization Sample- Permanent maxillary and mandibular teeth	---
Dalitz Method [12]	1962	Revised Gustafson's method	Age = 8.691 + 5.146A + 5.338P + 1.866S + 8.411T 5-scores=0-4 (0,1,2,3,4)
Moorees, Fanning and Hunt method [20]	1963	Stages- 14 (mineralization) Sample- Multi and single rooted tooth (maxillary incisors and all eight mandibular teeth.)	---
Bang and Ramm Method [13]	1970	Measurement- Root dentine Transparency length Sample- Sectioned and unsectioned multi-rooted teeth	---
Demirjian, Goldstein and Tanner Method [23]	1973	Stages- stages of eight teeth A- mineralization of single occlusal points without fusion of the calcifications B- fusion of the calcifications - occlusal outline recognizable C- enamel development of the crown completed, beginning dentine deposition, D-crown development completed up to the enamel-cement-verge E-root length shorter than height of the crown F- root length greater or equal to height of the crown G- root development completed, Foramen apical still open H- Foramen apical closed) Left side of the mandible. Method- Radiological	Age = 129.8 – 316.4 (M) – 66.8 (W-L)
Lamendin *et al.*,[25]	1992	Measurements- Periodontosis and root transparency adjacent to root height Sample- Single rooted teeth.	Age= 0.18 × P + 0.42 × RT + 25.53 *P* = periodontosis height × 100/root height, *RT* = root transparency × 100/root height.
Kvaal and Solheim method [29]	1994	Measurement- Length and width of pulp root and tooth. Sample - Mandibular and maxillary teeth Source- Radiographs	Age = 129.8 – (316.4 × m) (6.8 × [W-L])
Cameriere method [32]	2006	Measurement- Open apices in tooth roots.	Age = 9.402- 0.879c+0.663n8.971 + 0.375 g + 1.631 × 5 + 0.674 N_0 – 0.711-0.106SN_0 C= Variable (boys) 0 (girls) $N_{0=}$ Teeth with apical ends of the roots closed

Fig 1.Dental developmental chart by Schour and Massler
(From Schour L, Massler M: The development of the human dentition, J Am Dent Assoc 28:1153, 1941.)



Review Research Paper

Some procedures for the identification bodies from mass graves

[1]Tanja Prodović

Abstract

Mass graves which consist of bodies of people who died in war crimes are not part of human sufferings in modern history nor are they specific for human misfortune nowadays. However, the achievements of the current technology in the mass cemetery discovery and the impossibility of their complete concealment from media and global judgment of public opinion make them particularly important for war events in the contemporary world.

The article gives a brief review of the identification method which will increase the success of identification and will satisfy its basic aim by mutual completion: to respect the deceased and a way to return respect to their families, which supports the human rights protection of both the deceased and the alive. The identification procedure consists of: collecting antemortem data, taking photographs of the body, the description of clothes and body belongings, court-medical autopsy, body display, dactyloscopy, taking material for laboratory analysis, the DNA analysis.

Key Words: Expert team, Body, Mass graves, Identification, DNA analysis

Introduction:

Centuries in the past, chroniclers recorded many casualties of big fire disasters, strong earthquakes, floods, mass epidemics of contagious diseases and unrestrained war crimes.

The word forensics comes from the Latin word forensis (at square) which is derived from the Latin word forum (square). In the ancient Rome, when it was not clear how a person died, the bodies were displayed at the square Forum Romanum, and people who were experts helped in identifying the causes of death. Since the square was the place of judgment too, the above mentioned word meant also court, i.e., judge or judicial[1] in a figurative sense.

Unfortunately, in the previous and in this century too, the years of the expansion of the phenomenon of "mass graves" and "ethnic cleansing" have returned. One of the recordings on mass destruction in the 20th century dates back from the period of World War II.

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Namely, in the summer of 1940, the Soviet army killed Polish officers and war prisoners and secretly buried them in the mass cemetery located in Belarus.[2] This 'mass grave' was discovered later on and more than 4000 bodies were exhumedform the site.

In the last decades, civil wars in South and Central America, Asia, Africa and recently in the Balkans took several hundred thousand lives.[2,3] Mass graves which contain bodies killed in war crimes are not part of human sufferings in modern history nor are they specific for human misfortune nowadays.[3] However, the achievements of the current technology in the mass graves discovery and the impossibility of their complete concealment from media and global judgment of public opinion make them particularly important for war events in the contemporary world.

Apart from the painful knowledge that mass graves hide secretly buried victims of war devastations who are not only victims, but also, unfortunately and very often, unprotected civilians involved by war devastation unwillingly; mass graves impose many problems to be solved such as: circumstances, time and way of their origin, their total number, the number of buried bodies, body identification, the confirmation of the cause of death, responsibilities for their existence, mass graves cleansing and the space nearby, the realization of the hygienic and epidemiological measures in order to prevent ecological contamination of the area, the alleviation of pain of cousins whose members deceased, the legal issues related to

criminal charges for those responsible for casualties, the ability of society to face the reality of mass graves existence nowadays etc. To solve these issues involves many segments of society in total, state institution whose task is to take part in this job. A special role in all that are devoted to judicial institutions, the military and police, health and media sectors. The involvement of all these institutions, which are clumsy by themselves means a good organization and coordination so that all the tasks would be completed in the most economic and useful way.[4-6]

In reality, all activities start by bringing about a decision of the courts for starting the investigation related to the existence of mass graves. From the medico-legal aspect, the issues deriving from the decision to start the investigation mean the following: to determine the total number of bodies in graves, body identification, to determine the origin, cause and time of death in every single case, to make the team of examiners and determine the deadlines for the examination. In all this, court-medical body identification is a special and delicate issue.[7]

Identification (ID) means all procedures which confirm the identification of the bodies, i.e., which confirm the truth of identity of a certain person, body parts, traces and objects with an aim to discover certain characteristics which point to a certain identification.[1] The process of ID can be conducted on both the live and dead persons in medico-legal practice, but the ID of the deceased is unfortunately more frequent and difficult problem.[8]

Depending on the circumstances of the case and the state of postmortem body changes, different methods of identification for human remains are used; starting from subjective identification of a person, where the family recognizes on the basis of physical looks or clothes and personal effects; to the objective results of dactyloscopy and autopsy analysis. That approach is possible if we talk about the identification of the fresh corpse. It is very often the case that identification must be conducted on significantly changed bodies of the dead, dependinmg on climatic conditions and postmortem intervals.[9]

ID is a special problem in cases of mass disaster which happen not only in various accidents (train collision, bus and plane crashes);[10-14] but also in mine closures and accidents, in natural catastrophes (earthquakes, floods) or in war conditions,[2,5,15-19] which could be, unfortunately, confirmed by our recent past related to the casualties of war regardless of the fact whether it is soldiers or civilians.

With the fast development of genetics and molecular biology, the DNA analysis takes greater role in body identification. Still, the role of classic, natural disciplines, in everyday practice is still important and the main reason is their accessibility and the costs. Therefore, we should use the advantages of the "new" along with the existing "classic" methods, and for that purpose, balance them more successfully.

Engagement of the unique expert teams is recommended in practice because it has been proven that these experts, in complex situations, guarantee that the overall work will be accomplished according to the best principles of forensic practice.

The identification of human remains is very a often long and complex procedure. In every process of identification, it is necessary to have all the relevant teams coordinated, and the methods of identification are to be used according to a certain plan by using different methods which would increase the success of identification and will satisfy its basic aim by mutual completion: to respect the deceased and a way to return respect to their families, which supports the human rights protection of both the deceased and the alive.[1]

Procedure of identification of the bodies in mass graves

When it is about identification of the war casualties, the community's obligation is to get the exhumation and body identification done. However, this process is complex because of many reasons; the migration of civilians and the military mobility, interruption of the population file, identical soldier uniform, intentional destruction of war documents, great number of the dead in the collective cemeteries, inadequate burial and exhumation, change of place of the body in the so-called secondary graves, a long interval from the moment of death till the exhumation with a significant decaying change of the body and skeleton, presenc of only certain parts of the body or just the fragments of bones, etc.[1] In order to conceal war crimes, i.e., to conceal the place of burial, warring sides use different methods such as exhumation and transfer of remains from one burial place to another, transfer to a tertiary location, dismemberment and mixing of the body parts, which additionally make it difficult to determine the number of bodies, etc.[20]

Procedure of ID (the preparatory acts and the very process of identification)

One of the first acts should be to make a photographic and video recording of the place

and location of the cemeteries, which should be immediately confirmed and marked. Then the graves are dug out carefully so that the bodies wouldn't be damaged, i.e., avoiding further destruction.

The digging out of bodies should be supervised by the expert team coordinator who could manage the process appropriately. In coordination of the executive team of the job, a way of digging should be determined precisely while the removing of layers of earth, deposits or a similar material, so as to reach up to the layers, which according to the change of color or humidity, point to the closeness of the body. From here onwards, the use of heavy machines should be stopped. People should be given instructions to start digging carefully with shovels, and when the parts of the first bodies are found, they should continue working with showels and brooms so that the bodies would be discovered more carefully. When the first remains are discovered, diagnosed as human, a photo and video recording is taken of the found body condition in the very graves, and then the same bodies are marked in a previously determined way and will be photographed again on the spot, sketched in their position, so that the position of the body and everything with it or on it is recorded. The body remains are then taken out of the graves with everything that belongs to it, takeing care not to violate their original appearance, and then they are taken to the already determined and prepared areas (tents or some temporary buildings) to receive bodies (the receiving post).[1,8]

At the Receiving post, the bodies are placed in a predetermined order, and then, according to the order of marking, they are taken to a temporary aytopsy room for conducting a thorough postmortem examination, as per protocol. At the autopsy area, criminology technicians should be present who could do the photographing and video recording of the body, then of the naked body which is brought for examination; finger prints should be taken for dactylography. The medicolegal experts and their assistants should record the finding in a standardized form. The doctor who does the autopsy also records the places of injury and the body changes in a previously prepared human body schemes.

Procedure of the body examination at the place of examination:

- Making of video recording and the detailed body photographing (according to the previously determined procedure), including photographing of both the clothed and naked body from different angles and noting the detailed description of the body with the special attention to the characteristic parts of clothes and belonging and identification papers found with the body or in it clothes which are especially photographed.[8]
- Placing the artefacts with the body in plastic bags and tagging it with identification details, including the unique number given at the time of retreival.
- Placing the clothes in a special nylon bag and tagging it with identification details, including the unique number given at the time of retreival.
- Measuring of certain anthropological parameters, such as body length, length and the width of the skull, length of the lower jaw distance, determining of the angle between the body and the neck of the thigh bone, pelvic measurements, length of long bones such as femur, tibia, fibula, humerus, ulna and radius.[2,8]
- Special attention be paid to the condition of the teeth, dentures, if any; body deformity, bone scars and prosthesis, if any, etc.[10-13,15,16,21]
- Taking samples for laboratory analysis in a standardized manner, their proper packing and labeling.
- Repacking the autopsied body in a special transport bag with a plastic card having all the identification data.
- Special teams to do the disinfection of the cemetery and all the posts where the expert team works,and also to maintain proper hygenic conditions at the sites, along with proper personal protection. Same protection and hygine be maintained for all personell entering and exiting the areas.
- the whole team of experts should take care of the physical security and personal safety of all participants involved as well as the security of the mass graves and the equipment.

If the bodies and the clothes, artefacts, etc. are to be kept for identification by the relatives, the same is to be done in a separate area, away from the autopsy room. Once identification is made beyond doubt, the biody be released after all medicolegal and other formalities are completed.

Some procedures in the body identification

The procedures of identification mean the following: collecting antemortem data, taking body photographs, the description of clothes and belongings of the body, body description and medicolegal autopsy, body display, dactyloscopy, taking material for laboratory

analysis and the eventual body identity confirmation.[8]

a) Collecting antemortem data:

It means collecting data about missing persons in a certain area from where the disappearance is reported by the relatives, or from the military/ police who record the personal data of their members, including their age, sex, body characteristics (height, weight, body constitution, hair color, eye color, potential deformities, scars, tattoos, personal marks, sick condition during life, surgical intervention data, prosthesis aids, injuries during life) as well as the data about clothes and belongings missing persons had during the time of disappearance. It is helpful if photographs of the missing persons taken shortly before the disappearance, are found. Dental records, if any, are important.

b) Body photographing:

As previously explained, photographs of the body at the burial site, clothed and unclothed, be taken from different angles. It is especially necessary to photograph face and the characteristic changes at some body parts (deformities, scars, tattoos, birthmarks, prosthesis, artificial teeth, parts of fingers or extremities, etc.). A video recording is need too, if possible. These become a part of the expert documentation process and it should be insisted that they be done the same day as the examination of the body.

c) The description of clothes and body belongings:

The description of clothes is done at the place for examination and autopsy when their description in relation to the current situation is made (the clothes and belongings can be very dirty, burnt, stained with the soft and decaying changed remains, tissues, etc.). The clothes are to be air-dried in a pre-designated, secure place, before packing them as described earlier. If need be, the clothes can be washed and cleaned in order to remove dirt, then the clothes are dried and photographed, examined in detail and described, of their appearance, color of the fabric, brand of the maker, size, buttons, prints in some parts of clothes, damages, etc. The description of clothes and the documentation made is also part of the expert team documentation which is being created.[8]

d) The description of the body and the court-medical autopsy:

It is a basic and a very significant procedure in the process of identification. It could mean only external examination, but when the medicolegal autopsy is done, it also means the internal body examination.

With the external examination, the general body characteristics are described depending on the state of preservation, such as: age, body length, signs of death, quality and hair color, color of iris, state of teeth, appearance of their critical surfaces and prosthesis, if any; the condition of neck and the chest, state of breasts in female bodies, the state of the front belly, the pubic area, circumcision in case of males; tattoos, scars, characteristic birthmarks, body deformities, skin disease, etc.

In case of the length of the body, Leonardo da Vinci (15.4.1452 – 2.5.1519) in his Cannon of human proportions (Vitruvian man) determined the parameters for fast assessment of the body height. He calculated that the length of the skull and the body height is 8:1 (scientifically 7.9); 2 skull lengths correspond to the height of nipples in males; 3 lengths of skull mark the place of the navel; and 4 lengths of the skull mark the place of perineum, i.e., half of the whole body length. The span of the arms spread corresponds to the total body height. The center of the circle, with the rotation of the body with the spread arms and legs, corresponds to the navel.[22]

It is especially important to describe in detail all body injuries, including the exact location, the shape, the proportion, the direction of its positioning, close medical characteristics etc.[8,12].

It is possible to do identification of the body by superimposition. In these cases the skull photographs, or more rarely, x-rayed photographs of skull are superimposed over the photograph of the person when he was alive, in order to determine the possibility of overlapping of the characteristic anthropometric points of the skull and face, and the correct position of the parts of the face too (eyes, nose, lips, ears) on the examined skull.[23]

In the internal examination, it is necessary to measure the proportions of the apex of the skull, the thickness of bones; with infants, also the proportion of the parietal bone and the body mass. In collaboration with the anthropologist, certain anthropological parameters are also to be taken. It is necessary to pay attention to the degree of ossification of some bones, the fusion of epiphyses and sutures of the skull, etc. internal description of the injuries is important sio that tracks of various injuries can tell about the relative position of the deceased.

e) Body display:

The showing of the body to the relatives and acquaintances is a classic and simple procedure in body identification which goes with the receiving of the data from the persons who reported the missing person. Before showing, the body should be washed and the external visible injuries should be covered. The statements given by the relatives while they see the body may not be reliable since they find themselves in a special psychological state on that occasion. That's why, the data about the missing person should be taken first and then the body display should be organized.

The recognition of the deceased might be difficult if the postmortem changes are advanced or the injuries which destroyed certain body characteristics. It is especially important with the decay, saponification, carbonization, dismemberment and body destruction.[22]

f) Dactyloscopy:

This procedure in the body identification is widespread nowadays. It implies the use of finger prints from the skin of the pulp of the fingers and their analysis and comparison with the prints taken from the missing persons while they were alive. This procedure is difficult if the decaying changes are advanced or when, from different reasons, the pulp skin is missing or is damaged significantly.

g) Taking material for laboratory analysis:

Depending on the level of the body preservation, during autopsy material for laboratory analysis should be taken which should clarify the immediate cause of death and circumstances of death on one hand, and which help identification, on the other. In order to determine the cause of death, all relevant samples are preserved. DNA analysis is especially important [16-19, 24-26]. One of the most important cases when mitochondrial DNA analysis was done, is the case of the royal family Romanov in Russia. After the fall of communism, the body remains of the Russian czar Nikola II, his wife and the three daughters were exhumed in 1991. However, the body remains of the young czar Alexei and his sister Maria were not among them. In the summer of 2007, the bones of two young people were found in vicinity of the place where the remains of other members of the family Romanov had been found. The expert team showed that the body remains belong to the young czar Alexei and his sister Maria.[27]

For DNA analysis, teeth are usually taken from the body or samples of long bones (primarily thigh bones, and then forearm bones, shin, radius, elbow bone, fibula or vertebrae) or in the absence of the same, any other bone or muscle sample. All samples should bear the same identification data as the body. The three basic conditions on which a successful DNA depends are: the quantity of samples, the level of decay DNA and the sample clarity. The most frequent problems faced in such samples dug out of the mass graves are degradation and contamination of DNA molecules.[1] Though DNA is a "new method of scientific proof", but it has its limitations, especially in cases when mitochondrial DNA from bone samples is not possible due to the lack of DNA samples of close relatives or because of the degradation or postmortem contamination of DNA.[24] It is important to mention that by DNA it will not be possible to determine siblings, in cases of mass graves where there are victims siblings. It may be said without doubt that the two skeletons belong to two brothers, but some other methods and procedures – dental cards, height, previous injuries, clothes, some documents, etc. must be used; in some of the cases attention must be paid because of the possibility to change the samples), though DNA shows that both skeletons (brothers) belong to the same pair of parents without doubt.[23]

h) Eventual identity confirmation:

The final identity confirmation is a task for all members of the expert team. After receiving DNA results, the members of the expert team analyse all the results and then make a final report for each body and complete the notes. In the end, all documents, prepared in duplicate, are signed by the members of the team. The coordinator of the expert team checks all documentation and then he makes the Report about the whole process of identification giving all the necessary details related to the organization and the work of each expert, as well as the identification process and the final results. These are forwarded to the authorities. At the same time, a copy of each report is to be filed in the archives of the institutions which organized the expert team. After the identification is done, relatives are notified about the time and the way of taking the bodies from the place for their final burial/ cremation/ performing last rites, asthe case may be.

The handing and taking over of the bodies is witnessed by the investigative officials and the coordinator of the expert team, the team of local communal firm which takes care of the digging, transferring and packing the bodies, and the team of Hygienic and epidemiological service and the sanitary inspector who is in

charge for the area where this takes place. The coordinator of the expert team gives appropriate documentation to the relatives and the confirmation of death and the papers to transfer the body so that the relatives could transport the body and organize its last rites.

Concluding considerations

The process of mass graves body identification is a complex, painful and responsible task which includes the overlapping of different requirements of general interest, courts, investigative agencies, expert teams and the presence of the missing person's relatives. It should be a well organized and coordinated effort under the supervision of the coordinator of the expert team.

With the development of genetics and molecular biology, the change of DNA takes greater role in the process of body identification. Nevertheless, the role of classic and natural disciplines in everyday practice is still reliable, and the main reason is their accessibility and cost. Therefore, the advantage of the "new" and the existent "classic" methods should be used and for that purpose they should be successfully corelated. Body identification from mass graves is a very responsible, complex task and from the aspect of the effort put in, the energy and finances, it is a very expensive procedure which does not tolerate improvisation but it requires responsibility and a good organization in the first place.

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Case Report

Pain killed Army man- A Case Report

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Abstract

Shock has been attributed as the cause of death in many cases due to its vast nature and physio-pathology. Shock, haemorrhage and shock, hypovolumic shock, neurogenic shock, and vaso-vagal shock all are used to describe the cause of death in both natural and un-natural deaths. Neurogenic shock and pain remains as expressed or hidden major or minor component of cause of death from injury in many cases, where death occurs within few hours. The present authors havepresented a case of death where a middle aged army man, otherwise healthy and supposed to be more resistant to pain, died due to severe pain from acute appendicitis.

Key Words: Shock, Neurogenic shock, Pain, Appendicitis, Cause of death

Introduction:

Pain remains a major worry of human suffering from the time immemorial. The entire medical science has been evolved around management of pain that may be either of traumatic or pathological origin.

Neurogenic shock or pain remains as expressed or hidden major or minor component of shock and cause of death from injury, where death occurs within few hours. In cases of multiple bodily injuries, multiple bone fractures, thermal burns and corrosive acid poisoning, neurogenic shock play a vital role for the death of the patient. Similarly, in case of myocardial infarction, peptic ulcer, strangulated hernia, intussusceptions, rupture of ectopic pregnancy,neurogenic shock again play an important role for the death of the patient. As such pain has no limitation.Cases have been reported where minimal visible trauma have lead to death.[1,2,3] Cases also have been reported where chronic pain patients died within few days after stoppage of pain relieving medications.[4]

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The present authors have noticed a case of death where middle aged army personnel, otherwise healthy died due to neurogenic shock from acute appendicitis.

Case Report:

A 44 years old male dead body was referred to the Department of Forensic Medicine for medico-legal autopsy. There was alleged history that the deceased was suffering from acute pain abdomen since the morning. Due to increase in severity of pain, he was taken to the hospital for treatment by his fellow army staff, but was declared brought dead at about12.50 P.M.

Autopsy findings:

A. External findings:

- It was a male dead body of thin to average body built, aged about 44 years and body length measuring 176cm. Eyes were closed, cornea were hazy and pupils were dilated. Mouth was closed, tongue was inside the mouth cavity and teeth were intact. Rigor mortis was developedonly in the neck and upper limbs. Post-mortem lividity was marked on the back. Natural orifices were free from any discharge or bleeding. Cyanosis was absent. Signs of putrefaction were not developed.
- No external injury of any type could be detected anywhere on the body of the deceased.

B. Internal Findings:

- Meninges and brain were found congested. Both lungs were found intact and congested. Heart was normal and contained fluid blood in all the four chambers. No blockage of coronary arteries was seen.Peritoneal cavity contained about 50 ml of straw colored free fluid. Liver, spleen and both kidneys were

found intact and congested. Stomach was intact and contained about 200 ml of watery fluid without emitting any characteristic odour. Appendix was intact but red in colour, inflamed, measured 7cm long and 4cm by circumference.No other pathology or injury could be found anywhere inside the body.

Based upon the history and autopsy findings, cause of death was attributed to neurogenic shock as a result of acute appendicitis. Chemical analysis report of preserved viscera on later date rule out common poisons.

Discussion:

Unexpected, sudden death due to severe pain is poorly appreciated, since many observers still view pain as harmless nuisance rather than a potential physiologic calamity. It can cause death by cardiac arrhythmia either due to combined physiologic effects of excessive catecholamine release and autonomic sympathetic discharge leading to coronary spasm or due to adrenal insufficiency leading to severe electrolyte imbalance.[4]

Neurogenic shock is usually seen in anesthetic accidents, spinal cord injuries which occurs due to loss of vascular tone resulting in peripheral pooling of blood,[5]and in burn cases due to intense pain and fright**.**[6] Reflex vagal inhibition is sudden stoppage of heart due to excessive stimulation of vagus. The term thus is a misnomer. Vagus is stimulated, which in turn inhibits the heart; thus it is not the vagus which is inhibited, but the heart. Reflex vagal inhibition can be seen in blunt injuries of the abdomen or scrotum, like squeezing of testicles. There are no pathognomonic autopsy findings. Cause of death is derived mainly after exclusion of other causes.[7]

A similar case has been reported where a patient of anorexia nervosa had died of neurogenic shock following gastric rupture.[8] Vagal inhibition of heart due to sudden fright or emotion or trigger area injuries, death resulting so is called instantaneous physiologic death,vasovagal shock,vagal inhibition or neurogenic shock**.**[9]

Conclusion:

Problems encountered regarding concluding cause of death during autopsy are variable. In deaths due to neurogenic shock as a result of minimal or no visible trauma, it becomes a difficult task for forensic pathologist to conclude his opinion. On the other side, deaths due to neurogenic shock as a result of minimal pathology is not an easy job at all to diagnose unless thorough and meticulous autopsy is carried out. In such scenarios, cause of death can only be concluded by exclusion criteria after thorough post-mortem examination, chemical and toxicological analysis, histopathological examination, microbial and biochemical examination of body fluids.

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Case Report

Pseudocyesis in a Case of Sexual Assault - A rare case report & review of psychosocial & medical factors in literature

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Abstract

Delusion of pregnancy can be described as a false and fixed belief of being pregnant despite factual evidence to the contrary. An unmarried 32 year old woman was brought for medical examination to the department of Forensic Medicine at Burdwan Medical College by the police with the allegations that the accused had physical relationship with her with a promise for marriage which had led to the current pregnancy. After clinical examination and preliminary test of urine for pregnancy, conducted at the Gynae & Obs department, which came negative, the patient was sent for USG examination to the Radiology Department for confirmation of pregnancy. The USG report did not reveal any pregnancy. The patient was referred back to the department of Forensic Medicine for medico-legal examination, the next day. On the day of the second examination, it was found that an old healed tear was present in the hymen. These findings and the review of the literature show us that in some cases where the underlying cause for development of such psychiatric disorder is known, it can help to formulate the management of such sexual assault victims in a more humane manner and better clinical outcome of the aforesaid victims can be expected by treating the underlying factors.

Key Words: Pseudocyesis, sexual assault, psychosocial-medical factors, Forensic psychiatry

Introduction:

Delusion of pregnancy can be described as a false and fixed belief of being pregnant despite factual evidence to the contrary.[1,2] This interesting phenomenological symptom has been reported not only in women but also in men.[21] The symptom can present as a part of another disorder or can present in isolation. When present independently, a delusion of pregnancy is described as somatic type of delusional disorder according to Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5), within the realms of schizophrenia spectrum and other psychotic disorders.[3]

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The literature on the topic seems to have included case reports, and large-scale epidemiological descriptive or cohort studies are lacking. The rarity of the delusion of pregnancy coupled with the lack of coherent data about its characteristics calls for a systematic documentation of literature pertaining to this symptom to inform further clinical practice and research inquiry.[4]

Although diagnosis is not always clear in the published reports, this suggests that, in most cases described in recent years, the affected women suffer from a concomitant psychotic illness. In the past, pseudocyesis has been reported as rare but, in developing countries, India [5] or sub-Saharan Africa [6], it is considered fairly common. It has a reported occurrence rate in Africa of 1 in every 344 pregnancies.[7] Over a period of 5 years, of 486 women with abdominal distension in Ghana who came for sonography thinking they might be pregnant, three were diagnosed with pseudocyesis (of the others, almost half had fibroids, 10% had a benign ovarian tumor, 10% had cancer of the cervix with ascites; about 7% suffered only from obesity).[8] In Nigeria [9], five out of 242 women who came for sonography for gynecological complaints referable to the lower abdomen were diagnosed with pseudocyesis. Out of 3200 women presenting for infertility treatment in a teaching hospital in Sudan over a

five-year period, 20 were diagnosed with pseudocyesis.[10] Though once said to occur only 1- 6 times per 22000 births in the West[11], Moselhy et al [12] reported in 2000 that they ascertained three cases in a six month period in an acute psychiatric ward in Birmingham, United Kingdom.

Case report

An unmarried 32 year old woman with suspected pregnancy was brought for medical examination to the department of Forensic Medicine at Burdwan Medical College by the police. She had alleged that the accused had had physical relationship with her with a promise for marriage which had led to the current pregnancy. While the preliminary queries were done it was found that the victim suffered from severe hearing impairment and after obtaining her consent the victim was examined in presence of an interpreter. On examination on the first day, it was seen that that the abdomen was bulged in the lower part which corresponded with about 16 weeks gestation, when felt per-abdomen. On external examination and inspection of hymen, an old healed tear was noticed. No other injury or abnormality was noted. The victim was referred to department of Gynecology and Obstetrics for opinion and management of the suspected pregnancy.

After clinical examination conducted at the G&O department and urine test for pregnancy came negative, the patient was sent for USG examination to the Radiology Department for confirmation of pregnancy. The USG report did not reveal any pregnancy. The patient was referred back to the department for Medico-legal examination the next day. On the day of the second examination, it was found that an old healed tear was present at 6^0 clock position on the hymen, the labia majora was fleshy covering the labia minora partly. No foreign body or venereal disease was present. Vaginal swab smear was collected and sent for chemical examination to the Forensic Science Laboratory.

Discussion

Developing the erroneous belief that one is pregnant is an understandable process, making the delusion of pregnancy a useful template against which to study the evolution of other, less explicable delusions. It is important to consider the associated psychotic features that might be present in women with delusions of pregnancy as were present in the current case. On the other hand, women with pseudocyesis have the clinical presentation centered on the false signs and symptoms of pregnancy. There are no associated psychotic features in such cases.

Majority of cases of pseudocyesis are described in reproductive age women and 80% of the affected women are said to be married. In fact, because pregnancy is a highly respected state and women are treated especially well during this time by their spouses, in-laws, and society in general, giving up the pregnant state may be psychologically difficult. Simon, et al [13] describe two cases where a delusional pregnancy occurred shortly after delivery, during the postpartum period, and seemed to be motivated by the wish to continue to be treated as if pregnant. In Muslim cultures, a husband cannot divorce his wife while she is pregnant. In some religious traditions, pregnancy and breast-feeding absolve women from unwanted sexual activity.[14] From the results of their series of cases, Rosch, et al [15] conclude that false pregnancy can be an unconscious adaptive strategy to guard against loss of a relationship. This view is seconded by Ibekwe,[6] whose case describes an imagined pregnancy that brought the patient personal fulfillment, stability to her marriage and newfound acceptance from her in-laws. Ibekwe suggests that the delusion solved the dilemma faced by this infertile woman in a culture (Nigerian) that places immense value on children not only because procreation is religiously mandated, but also because it is economically necessary for survival and generational continuity. In sub-Saharan Africa, infertility is said to affect one third of all couples,[16] is always blamed on the woman, and leads to discrimination and abuse.[17] In developing countries, violence against infertile women is reported to occur in 10 to 60 percent of instances.[18]

The analysis of the reviewed studies showed that pseudocyesis shares many endocrine traits with both polycystic ovarian syndrome and major depressive disorder, although the endocrine traits are more akin to polycystic ovarian syndrome than to major depressive disorder. Although other neuro-endocrine/endocrine pathways may be involved, the neuro-endocrine/endocrine mechanisms may lead to the development of pseudocyetic traits including hypomenorrhea or amenorrhea, galactorrhea, diurnal and/or nocturnal hyperprolactinemia, abdominal distension and apparent fetal movements and labor pains at the expected date of delivery.[1]

When antipsychotic medication was used to treat psychotic symptoms in these women, it led to high prolactin levels and apparent manifestations of pregnancy, such as

amenorrhea and galactorrhea, thus reinforcing a false conviction of pregnancy.[22]

A pervious paper reports the case of a delusional pregnancy that developed in a drug-naïve young woman affected by paranoid schizophrenia and Hashimoto-related hyper-prolactinemia.. In this instance, however, amelioration of delusional beliefs did not ensue from hyper-prolactinemia normalization, but was mostly due to cognitive restructuring of distorted thinking (together with the antipsychotic treatment). This finding confirms the importance of considering the key role of the interaction of biological, cognitive and psychological mechanisms in the construction of inaccurate beliefs and feelings about pregnancy. [19]

Conclusion

The clinical picture is heterogeneous (duration, mechanisms, topics and pre-existing psychiatric disorders). Both Pseudocyesis and delusional pregnancy are said to be rare syndromes, but are reported frequently in developing countries. A distinction has been made between the two syndromes, but the line of demarcation is blurred. The study on sexual abuse victims show that factors as extreme poverty, relationship instability, and recurrent partner abuse play an important role in the enactment of Pseudocyesis within a culture that treasures children for economic survival and generational continuity. [20] The awareness of this cultural dimension is considered relevant to effective clinical care. Hence, we can conclude from this case that if the underlying cause for development of such psychiatric disorder is known, it can help to formulate the management of such sexual assault victims in a more humane manner and better clinical outcome of the aforesaid victims can be expected if treatment of these underlying factors is kept in mind.

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Case Report

Strangulation with poisoning - Homicide: A Case Report

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Abstract

Asphyxial deaths are the most difficult to be diagnosed on autopsy. A meticulous postmortem examination is required to know the cause and more efforts are needed to know the manner of death. Strangulation deaths are usually homicidal and should be confirmed only after ruling out other causes of death. Strangulation is difficult to execute in ordinary circumstances or until the victim is intoxicated and there is a clear intention of the assailant for committing homicide. One such case is being discussed in which clear intention of homicide is revealed after meticulous postmortem examination, though history given by relatives was different.

Key Words: Asphyxia, strangulation, homicide, intoxication

Introduction:

Asphyxial deaths are difficult to diagnose on autopsy. It is a Herculean task to know the manner of death in such cases. Manual Strangulation is almost always homicidal in nature.

Contusions are produced as result of grasping the neck of victim by assailant's fingers; those produced by tips and pads of fingers are oval or round in shape and are of the size of digits, measuring about 1.5 to 2 cm. If one hand is used, it may be possible to have one prominent contusions on one side of neck (due to thumb) and three to four contusions on the other side (due to fingers).[1]

Though strangulation is not so easy to commit unless the victim is intoxicated with alcohol or poison and leaves no evidence on autopsy, which is a clear cut intention of homicide. Generally homicide by strangulation is done at time when victim opposes sexual assault, as in case of a female or may be in a child also. But detection of poison in stomach indicates that offence was a planned murder.

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Case History:

A 9 yr old Hindu male boy complained of vomiting and loose motions after the noon lunch on 30/3/13 at about 2.00 pm. He was taken in an unconscious state to a private hospital where he was declared Brought Dead. The police was informed and the body was sent for post mortem examination after completing all the medico-legal formalities to know the cause of death to LTMMC & LTMGH, Sion, Mumbai.

AUTOPSY FINDING:-

It was the body of an average built boy in blue T shirt and black colored pant, lying in supine position on autopsy table, eyes closed, mouth partially opened, white froth oozing out from mouth and nostrils and postmortem lividity present on the dependent areas. Following injuries were noted:

1. Contused abrasion of size 8x1.5 cm was present on left side of neck, horizontally over anterior aspect obliquely with parchmentised skin, reddish in colour.
2. Crescentric contused abrasion of 1x1 cm on right side of neck, just below the angle of mandible, reddish in colour.
3. Two linear abrasion of size 0.5x0.1 cm, each, present 1 cm above the medial aspect of right clavicle, reddish in colour.
4. Abrasion of size 1x1 cm present over back of neck on left side, reddish in colour.

On Neck dissection :- There were multiple areas of intramuscular hematoma present in the muscles of neck, which did not get washed off with water, just beneath and corresponding to injuries present on anterior aspect of neck.
Stomach:- It contained 150cc semisolid food material and hemorrhagic mucosa with offensive

garlic like smell. The stomach, along with the routine viscera, was sent for chemical analysis.

Organs were also preserved for histo-pathological examination.

Perianal examination:-Anal opening was wide and relaxed and size 2 cm diameter. No evidence of injury or erythema.

Discussion

Strangulation should not be used as a synonym for hanging. Strangulation is defined as asphyxia by closure of the blood vessels and / or air passages of the neck as a result of external pressure on the neck.[2]

The distinction between these three entities is attributed to the cause of the external pressure on the neck - either a constricting band tightened by the gravitational weight of the body or part of the body (hanging); a constricting band tightened by a force other than the body weight (ligature strangulation); or an external pressure by hands, forearms or other limbs (manual strangulation), and strangulation in itself being an imprecise term. [3]

On basis of the history narrated by police and the injury and findings observed on postmortem examination, it was found that there is a great difference between the two, as the autopsy findings were suggestive of manual strangulation (throttling).

Chemical analysis report of viscera showed presence of organophosphorous insecticide Chlorpyriphos (Pyrinex). Other report from FSL i.e. for swabs for semen detection, blood grouping and nail clipping came inconclusive. Histopathological examination report said nothing but congestion.

Final cause of death was given as “Shock due to Manual Strangulation associated with Chlorpyriphos (Pyrinex). poisoning.”

Conclusion

Death due to compression of neck is one of the most important area of investigation of unnatural deaths encountered in day to day medico legal work. In present case, postmortem findings suggested that injuries over neck were caused by manual strangulation with the right hand of assailant and viscera report suggest poisoning, both confirming intentional approach of assailant for homicide.

The nature of violence is so wide and varied that it is a challenging task for the autopsy surgeon, therefore careful and meticulous study of every cases is mandatory to bring out cause and manner of Death.

Acknowledments

Authors would like to thank Teachers and Professor in Department of Forensic Medicine and Toxicology at LTMMC & LTMGH, Sion, Mumbai, for their precious guidance and support.

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Fig.1. Contused abrasion on left side of neck of victim

Fig.2. Intramuscular Hematoma in Neck muscles

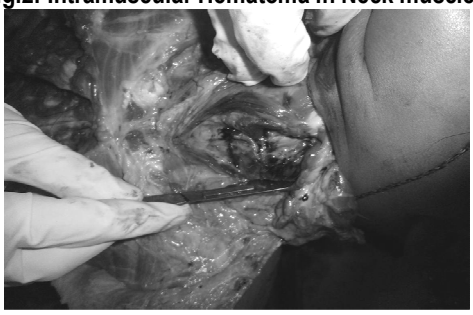

Fig.3. Hemorrhagic stomach mucosa with offensive smell

Case Report

Effects of Fatal Organophosphorus Poisoning on Pituitary Gland as Detected by Histopathology

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Abstract

Pituitary gland, regarded by the biologists as "the master gland" of human body, is a pea sized gland with average weight of 0.5gram, controlling almost all the endocrine glands of the human body. In a country like India, having agriculture based economy, Organophosphorus compounds (OPCs) are widely used for pest control which leads to increased risk of human exposure and as such, poisoning; mainly accidental or suicidal and rarely homicidal. In a number of cases, it has been shown that organophosphorus compounds significantly derange the endocrinal homeostasis of human body, which in conjunction with the cholinergic surge, results in typical signs and symptoms of OPC poisoning. In this present case, we have tried to find out the impact (structural/ microscopic) on the pituitary gland, of an otherwise healthy person, who has succumbed to acute OPC poisoning.

Key Words: Pituitary gland, Organophosphorus compounds, Endocrinal system, OPC poisoning, cholinergic surge, histopathology

Introduction:

Organophosphate compound (OPC) poisoning is fairly common in the developing countries such as India. Organophosphorus (OP) compounds have been employed as pesticides, petroleum additives and chemical warfare nerve agents. The organophosphates are being used as pesticides for more than 50 years and are still being used in most developing countries. It is believed that between 750,000 and 3,000,000 OP poisoning occur globally every year.[1] Organophosphorus pesticide poisoning can result from occupational, accidental or intentional exposure. Mortality is higher in the developing countries where OP pesticides are readily available and may be used for committing suicide. They are estimated to cause 300,000 fatalities annually**.**[1] The acute and delayed effects of OPC poisoning, either qualitative or quantitative; on hormones secreted by pituitary and its target glands are largely unknown.

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In critical illnesses, several drugs and various stressful conditions modify the functions of neurotransmitters which consequently affect the secretion of pituitary hormones. Although the role of neurotransmitters in the regulation of endocrine system is well known, cholinergic actions have been less investigated. In animals, cholinesterase inhibitors were shown to modify the pituitary-thyroid and pituitary-adrenal axes, and to affect prolactin levels**.**[1-4] The aim of the present casework was to make a documentation of the histopathological effects of the organophosphate compounds on the pituitary gland.

The Case:

A 45year old person, with a positive history of occupational exposure to Organo-phosphorus compounds, being a farmer, had ingested Parathion, an OPC belonging to Aryl group, on an October afternoon. Finally, he was referred to Calcutta Medical College & Hospital and succumbed after 48 hours even after rigorous treatment, both supportive and with Atropine Sulphate and Pralidoxime. The body of the said patient was subsequently sent to the Kolkata Police Morgue for Medico legal autopsy.
Autopsy Findings:

- **Findings on External examination:**

Postmortem hypostasis was well developed with bluish discoloration of tips of fingers and nail beds on both hands. Pupils were fully dilated on both sides with intense congestion of conjunctiva. Blood stained froth

was seen to come out through mouth and nostrils.

❖ **Findings on Internal examination:**

All the internal organs were noted to be intensely congested and typical kerosene like smell was emanating from all the body cavities. The gastric mucosa was congested with evidence of patchy submucosal hemorrhage. Few petechial spots were noted sub-pleurally in the interlobar surfaces of the lungs.

***Dissection of the pituitary*:**

After dissecting out the brain, the four glenoid processes were located, in between which the *Diaphragmaticasellae is* attached as it covers the Pituitary in its position. The Infundibulum while descending from the hypothalamus passes through the diaphragm and reaches the gland in the Sella Turcica. During dissection, the glenoid processes were severed along an imaginary pentagonal block with the saw blade directed roughly perpendicular to bone surfaces, after detaching the diaphragm to release the tension of the diaphragm in order to avoid squeezing of the contents of Pituitary fossa.[5] The scalpel blade is then rotated all around the pituitary, along the walls of sellaturcica and the gland is finally scooped out and was preserved in 10% Formol saline.[6]

➢ **Histopathological finding:**

After the grossing was done, the pituitary gland tissue was put under standard histologic procedures and with the help of the automated microtome sections were prepared (5mm) and finally were stained with Hematoxylin& Eosin.

The findings on microscopy are as follows:

I. Intense congestion of the pituitary gland **(Fig. 1&2)**
II. Infiltration of leucocytes(mostly Lymphocytes) **(Fig. 1)**
III. Focal areas of Necrosis **(Fig. 2)**

Fig 1: Pituitary HP showing Leucocytic infiltration and congestion (400X)

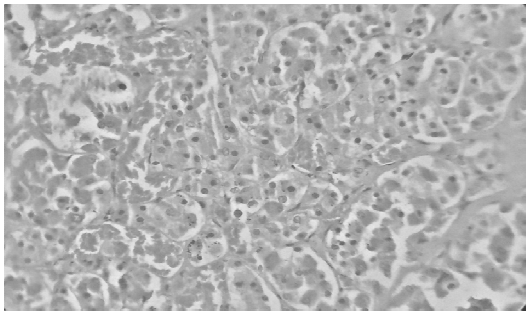
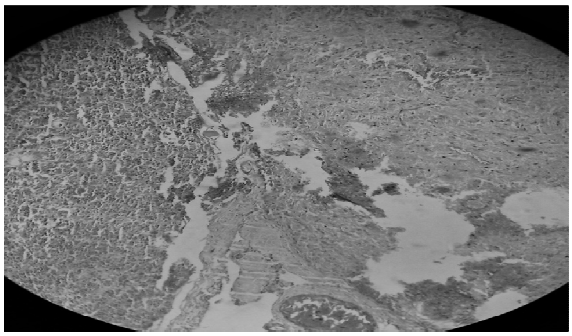


Fig 2: Pituitary HP showing focal areas of necrosis and congestion (100X)



➢ Toxicological finding (SFSL): Presence of Organophosphorus compound detected in the samples of Viscera.

Discussion:

The pituitary gland is about 1cm in diameter, lying beneath the third ventricle in a bony cavity (sella turcica) at the base of the skull. The posterior part of the pituitary has its embryological origins in nervous tissue. The anterior part is derived from an *up growth* from the oral ectoderm of the primitive oral cavity. There are two types of chromophils (cells which take up stain) called acidophils and basophils in the gland.[5,7,8]

Fig 3: HP of normal Anterior Pituitary stained with H&E

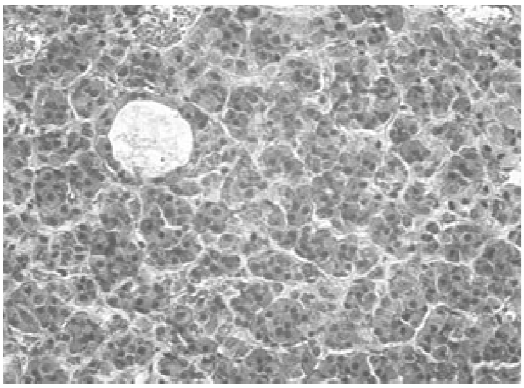
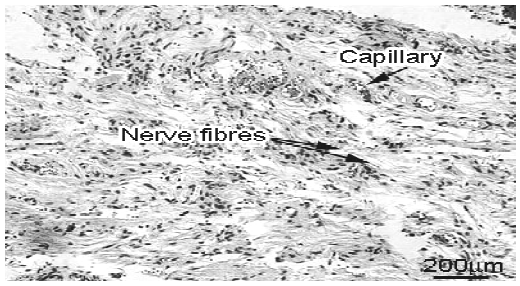


Figure 3 shows a magnified microphotograph of the *anterior pituitary*, stained with H&E showing two types of chromophils; pink - *acidophils*, which are more common, and purple - *basophils*. The *posterior pituitary* **(Fig. 4)** looks very different to the anterior pituitary. It contains non-myelinated axons which are the neurosecretory cells. The cell bodies of these cells are located in the hypothalamus.[5,7,8]

Fig 4: HP of normal Post. Pituitary stained with H & E



OPC poisoning results due to the inhibition of acetylcholinesterase (AChE), by phosphorylation of the serine hydroxyl residue leading to the accumulation of acetylcholine (ACh) in the body. OPC poisoning most commonly results from exposure to insecticides. OPs are one of the most common causes of poisoning worldwide, and are frequently intentionally used in suicides in agrarian societies. AChE is critical for nerve function, so the irreversible blockade of this enzyme, which causes acetylcholine accumulation, results in muscle overstimulation. This causes disturbances across the cholinergic synapses and can only be reactivated very slowly, if at all.[1]

In one prospective study, performed in Medical Intensive Care Unit of Erciyes University Medical School Hospital; 22 consecutive patients (10 males and 12 females aged 28+/-8 years) with OPC poisoning were included in the study. ACTH (P<0.002), cortisol (P<0.0005) and PRL (P<0.005) levels were significantly higher during poisoning than after resolution of poisoning. FSH levels were significantly lower during poisoning (P<0. 05). Sick Euthyroid syndrome was determined in seven patients (31. 8%). Two of them had low fT3 (with normal fT4 and TSH), two had low fT4 (with normal fT3 and TSH) and three had low TSH (with normal fT3 and fT4) levels. Serum levels of these hormones returned to normal values after resolution of the effects of poisoning. Organophosphate compounds may result in sick euthyroid syndrome. These conditions may be related to the effects of acetylcholine and direct effect of organophosphate compounds.[3]

So hypothetically, it can be presumed that there might be some structural changes in the pituitary gland leading to derangement of endocrinal homeostasis. Also our second thought behind the planning of the casework was that there might be such structural changes in the "master gland" which can be accounted as the factor responsible for unusual fatality in some of the cases of Organophosphate poisoning, despite timely treatment with standard protocol. The findings of Histopathological examination in the present study reveals congestion which is very usual. But the other two findings i.e. inflammatory cellular infiltration and focal necrosis are not common or usual finding in such setup. Again these two pathological mechanisms are enough to cause derangement of endocrinal homeostasis and fatality even in persons not suffering from Organophosphate poisoning.

Conclusion:

Fewer clinical and experimental studies were done regarding the effects of OPCs on pituitary, but study regarding the histopathological changes of thegland in fatal cases are hardly found in the literature. We, for academic interest, had focused on the histopathological aspect of the pituitary gland and detected documentable structural derangement which can explain the endocrinal jeopardy. But it will be an overambitious conclusion without performing a good number of studies with series of similar fatal cases in different clinical and epidemiological settings.

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Case Report

Unusual case of inpatient suicide and its psychological review

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Abstract

Hospital suicides create a unique challenge for the administrators, doctors, caregivers, nurses, and other patients in the ward. Risk factors associated with suicide attempt during hospital stay are: feminine gender, borderline personality disorder, earlier psychiatric hospitalizations, shorter duration of the disorder, and earlier age of onset. In India, there is a culture difference among different people and it shows wide variation in the suicide rates. The literature on suicides who are suffering from cancer in a hospital setting is limited. We discuss an inpatient suicidal hanging who had metastatic adenocarcinoma of a liver along with inpatient suicide and its psychological aspects.

Key Words: Hospital Suicides, Risk Factors, Postmortem study, Nursing care Precautions

Introduction:

Hospitals are believed to be safe places for fatal or non-fatal suicides. Hospital suicides create a unique challenge for the administrators, doctors, caregivers, nurses, and other patients in the ward.[1] Bowers L, et al. scientifically reviewed the literature on inpatient suicides consisting of a total of 98 articles covering 15,000 suicides.They found that rates and demographic features varied substantially between articles, which suggest distinct subgroups of patients promising suicide with their elements and patterns. They noted that early period of admission was the high risk of committing suicide. The timing and location related to the absence of support from family, relatives, supervision from hospital staff, and family quarrel. The prevention of suicides, the hospital staff, should be involved with patient's family problems.[2]

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Risk factors associated with suicide attempt during hospital stay are: feminine gender, borderline personality disorder (F60.3), earlier psychiatric hospitalizations, shorter duration of the disorder, and earlier age of onset.[3] Winkler P, in a case-control study among suicidal psychiatric inpatients reported that out of 137,290 inpatients in Czech psychiatric hospitals between 2008 and 2012, 402 committed suicide during the hospitalization or within two months after the discharge. The risk factors for suicides were noted to be - history of multiple hospitalizations, affective, anxiety, or personality disorders. [4]

In India, there is a culture difference among different people and it shows wide variation in the suicide rates. The identification of risk factors for inpatient suicides is of paramount importance for the hospital staff, nurses, and others to motivate the patients with chronic medical illnesses and to decrease the hospital suicides. Most of the literature on suicide in the hospital setting is from psychiatric based hospitals. The literature on suicides who are suffering from cancer in a hospital setting is limited also. We discuss an inpatient suicidal hanging who had metastatic adenocarcinoma of a liver along with inpatient suicide and its psychological aspects.

Case report:

The deceased was a forty year old female resident of a rural area of Tamil Nadu, India. She had a daughter, and her husband passed away recently. She was admitted to our hospital with history of pain in abdomen since three months and episodes of severe vomiting

for a week. Her past history of suicidal behaviours was not significant. No other family member was affected. Drug history was not significant. Her blood parameters showed an increase in liver enzymes:aspartate transaminase (50 IU/L), alanine transaminase (59 IU/L), gamma glutamyl transaminase (185 IU/L) and alkaline phosphatase (36 IU/L). The rest of the parameters were in normal range. There was no history of any past illness and family illness. She was advised fine needle aspiration cytology of the liver due to suspected liver failure. It showed moderately cellular, haemorrhagic background. The cells showed nucleomegaly, nuclear membrane, prominent nucleoli with atypical mitosis. The cytology examination reported metastatic adenocarcinoma. On getting to know the diagnosis, her daughter was reluctant to stay with her and left the deceased one day before the incidence of suicide. She was found hanging with bed linen to the toilet door of the ward in the morning (05.10 am) by the hospital staff and removed.They tried resuscitation, but failed.

On autopsy examination, her body length and weight were 150 cm and 60 kg respectively. She was moderately built and nourished. Back of the body showed post-mortem lividity. Nail beds of both hands showed cyanosis and face was congested. Pressure abrasion or ligature mark (LM) (Fig. 1) was observed over the neck above the level of the thyroid cartilage. It was positioned obliquely upwards and backwards towards the mastoid process on both sides and was absent on the nape. The ligature mark was dark, broad, dry and parchment like. The total neck circumference of the deceased was 30 cm, the total length of LM was 25 cm. The LM was situated anteriorly in the midline, 6 cm below the chin and 9 cm above the suprasternal notch. The maximum breadth of LM were noted in midline (2 cm), right side (4 cm) and left side (2 cm) of the neck. It was located 4 cm and 2 cm below the right angle of the mandible (Fig.2), and right mastoid process, respectively. It was located 3 cm below the left angle of the mandible and at the level of left mastoid process. Posteriorly, the LM was deficient at the back of the neck above the hairline. The subcutaneous tissues were intact under the LM. The examination of jugular vein and carotid arteries did not reveal any abnormality or intimal injury. Examination of hyoid bone, thyroid, and cricoid cartilagesdid not reveal any fractures or deformity.

Peritoneal cavity showed multiple omental deposits with 100 ml of transudate. The liver showedmultiple nodules over the posterior aspect of the right lobe. Stomach contained 100 cc of yellowish coloured fluid, without any peculiar odour and mucosa was congested. Other viscera showed congestion. Histopathological examination of nodular tissue around the liver (Fig.3) showed a tumour with features of adenocarcinoma and central comedo type of necrosis. The tumour was positive for Pan CK, S 100, and VIMENTIN and negative for chromogranin, CK 7, CK 20, AFP. Pancreas, fibro-fatty tissue examination showed intact architecture. The cause of death was given as asphyxia due to hanging in case of metastatic adenocarcinoma, the manner of death being suicidal and the post-mortem interval was calculated as 06 hours.

Discussion

Death by hanging is not uncommon. Hanging is a type of asphyxia, due to a suspension of the body by ligature that encircles the neck, where the constricting force being the weight of the body.[5] Suspension of the body fully with no part touching to the ground is called complete hanging, where whole body weight was acting as a constricting force. Incomplete or partial hanging occurs when the body is partially suspended, and body parts in contact of the floor.[6]Suicidal hanging presents as a medical emergency with some significant morbidity and is common in developing countries among young individuals. It constitutes around < 1% of ICU admissions.[7]

Suicide in a hospitalized medically ill patients is an occasional event. Most of the published reports are derived from psychiatric hospitals and units. There is no accurate data for comparing rates of suicide in medical versus psychiatric settings. Psychiatric inpatients are more prone to Suicide. Hospital-based suicide rates are substantially lower than community-based suicide rates.[8-10] according to Dong JY&Ho TP, in Hong Kong, the suicide rate was 269/100,000 admissions, and these occurred after the first month of admission.[11]

A study by Kodali M&Kilaru K on 150 consecutive attempted suicidesshowed that most of the suicide attempts were in the age group of < 30 years (67%) with a literacy level of up to 7th standard. Men were t5 the more common victims, (62%); most of them were of low socioeconomic status (62%) and were employed (61%). Almost all (97%) used oral agents for suicide. Reasons for suicide were domestic quarrel (48%), followed by relationship issues (23%). Maximum victims suffered from a psychiatric disorder (59%) and a major

depressive episode (28%) was the precipitating factor.[12]

Diaz-Frutos D, et al. studied 202 oncology patients in a Spanish ward who were taking both palliative and curative treatment. They reported that thesepatients were exposed to a higher risk of suicidal behaviours than the general population. For every four patients, one of them (n = 51; 25.24%) presented with high scores of suicidal ideation and they suggested that these patients should receive closer monitoring, especially, when old, retired, or severely depressed.[13] Neuner T, et al., studied the basic German documentation system from (1995-2004) in a state psychiatric hospital and observed 20,453 patients with 40,451 episodes of inpatient care. They found 41inpatient suicides. They recorded risk factors like patients who are resistant to psychopharmacological treatment, more severe side effects, history of previous suicide attempt, suicidal thoughts of admission, female sex, length of stay, schizophrenia, depression. They also observed 214 inpatient suicide attempts.[14]

Cardell R, et al suggested that the use of environmental safeguards is the first step to preventing inpatient suicides. Moreover, inpatient nurses are to be aware of the environmental dangers in their units and of the safeguards that should be implemented, like training programs, environmental tours, etc.[15] Onja T suggested four requirements - administrative, institutional, educational and emotional, to reduce the impact of suicide on the staff. Suicide in a hospital affects relatives of the deceased, hospital staff, workers, social workers, and nurses.[16]

We studied the case of an old lady who had metastatic adenocarcinoma in the liver. The death of her husband and the diagnosis of her malignancy happened in quick succession (within a few months) and were significant acute stressors. Furthermore, her daughter had left her in the hospital. These factors would have led to intense feelings of isolation and a lack of social and emotional support for the patient. Such sudden changes in socio-economic status have been postulated to lead to a sudden loss of meaning in life. This, coupled with a lack of social support makes it difficult for the patient to foresee how she can re-integrate into the society again. Such psychological events may be the cause of “Anomic Suicide” as proposed by Durkheim in 1896.[17] Suicide in this patient may be understandable from a sociological point of view.

While it is commonly held that patients with psychiatric disorders are more likely to attempt suicide as inpatients, there are other high-risk groups including patients with malignancies, refractory epilepsies, and HIV-AIDS.[18,19]

In the acute phase of adjustment, when the diagnosis is broken to the patients and families, there may be a risk for suicide. This can occur in the absence of sustained sadness of mood or clinical depression. Nonetheless, these patients need psychotherapeutic interventions (counselling) which can be delivered by the medical social worker in the oncology centre. In select cases, where persistent anxiety or depression is seen despite adequate counselling, psychiatrist's opinion should be sought for medications that may be required.

Certain precautions that may be recommended in the nursing care are frequent monitoring of patients who have been recently told about their diagnosis, or are known to have prior history of depression, or have poor social and economic support. Routine and regular intervention with the social worker may be a useful strategy to detect suicidal risk early. Revealing of diagnosis may be done after due assessment of all these risk factors, taking care that it is not inadvertently overheard by the patients during doctor's rounds or read from the file. Diagnosis is best revealed during the daytime/morning hours and weekends may be avoided as wards may have lesser staff over the weekends to be able to detect adequately any suicidal behaviour.

The hospital staff and doctor may be charged with medical negligence, if proper care is not taken towards these high risk patients and in revealing the status of the deceased without counselling the deceased and their relatives.

Conclusion

The hospital staff should be careful about disclosing serious illness or cancer to the patient himself or his/her relatives. In such cases, proper counselling of the patient and his/her relatives should be done regarding the status of illness or cancer. This counselling should also include the treatment strategy, support of relatives, and the cost of treatment. They should boost the confidence and morale of the patient and his/her relatives to fight the illness. On other hand, hospital, administration and relatives should monitor the patient in the hospital half an hourly or one hourly. Also the surveillance system like CCTV cameras and monitoring register where details of patient activities maintained on an hourly basis. To prevent the suicides in a hospital the hospital staff, nurses, social workers, etc. should be

properly trained. Proper care in emotional, psychological, motivational aspects, should be taken by the hospital staff and relatives of patients.

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Fig 1: Showing ligature mark over anterior part

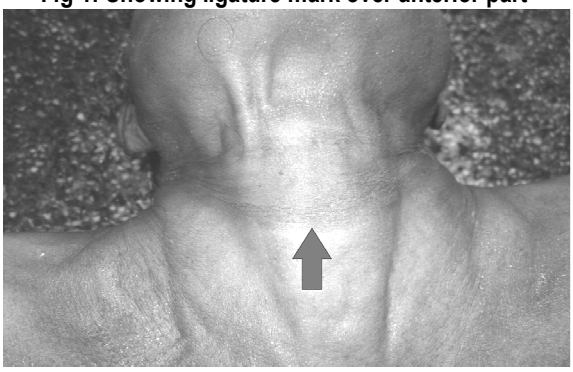
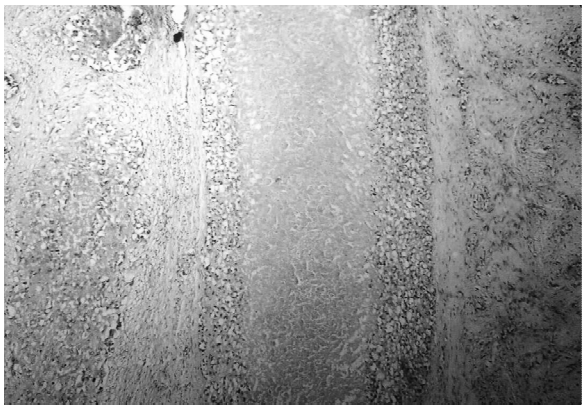


Fig 2: Ligature mark over right side of neck

Fig 3: Section from liver nodule showed cells arranged in lobular pattern with central comedo necrosis. (H&E 200X) - Copy



Case Report

Death Due to Datura Consumption- A Case Report

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Abstract

Datura grows wild all over India. The seeds of the plant are highly toxic with hyoscine, hyoscyamine and atropine as the principle toxins. The alkaloids atropine and hyoscine are used for medicinal purposes like organophosphorous poisoning, etc. Its poisoning is mostly accidental. The use of this plant for suicidal and homicidal purposes is rare. We report a case of 38 year old lady who took datura seeds so as to end her life as she was getting frequent chest pain which was not getting relieved even after medications.

Key Words: Datura, Atropine, Poisoning and suicide.

Introduction:

A poisoning episode may be defined as the exposure of an individual (by ingestion, injection or inhalation) to an amount of substance(s) associated with significant potential to cause harm. Poisoning episodes may be accidental or intentional, fatal or non-fatal. Death may be the result of direct, indirect or even long-term effects of exposure to a particular poison or group of poisons. Accidental poisoning may occur when an individual unintentionally experiences more than an effect from a substance than planned.[1] If the consequence of an episode of intentional poisoning is death, then the diagnosis becomes suicide.

Datura, also called as Jimson Weed, Thorn apple, Poison lily, Moon flower, Devils weed, Angel's trumpet, etc, is a small shrub with unpleasant smell. It grows wild all over India. The seeds of the plant are highly toxic with hyoscine, hyoscyamine and atropine as principle toxins. The alkaloids atropine and hyoscine are used for medicinal purposes like organophosphorous poisoning, etc. Its poisoning is mostly accidental whereas suicidal and homicidal are rare.[2]

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It is mostly used by the criminals as a stupefying agent prior to rape or robbery or kidnapping where it is mixed with food or drink and given to the victim.[3] Sometimes seeds are mixed with incense wood and the victim is exposed to the fumes which cause lethargy. It may be used as abortifacient and love philter.

Case Report

A 38 year old lady was brought for autopsy with the history of taking some seeds. She was admitted to the hospital where she succumbed after 4 hours of admission. During hospital stay, she had fever, dilated pupils, difficulty in eating and breathing and convulsions. ECG showed tachy-arrhythmias. Blood counts were normal. Ultrasonography was within normal limits. On further query, it was revealed that she took the seeds in order to die as she had frequent chest pain which was not getting relieved even after medications. During postmortem examination, lungs were edematous and congestion of gastric mucosa was seen.**(Figure 1)** Heart dissection did not reveal anything significant on gross examination. Histopathology did not show any features of heart disease. Chemical analysis showed presence of atropine in stomach contents, liver, kidney and blood. It wase concluded that death was due to respiratory paralysis as a result of consumption of datura seeds after ruling out all the other causes of death.

Discussion

Suicidal deaths due to datura poisoning are reported very less in literature. It is mostly seen in children who ingest it accidentally. Boumba, et al[4] reported a case of datura poisoning where a 19 year old male had intentionally ingested the seeds to experience its

hallucinogenic effects, but died. High levels of hyoscyamine and scopolamine were detected in postmortem blood and urine. Similarly, Urich, et al[5] reported a case of death due to datura seeds ingestion in a 20year old male in whom high levels of atropine and scopolamine were detected in the urine. Kakkar A, et al[6] reported a case of adolescent male who had intentionally consumed extract of thorn apple with the belief that the extract is taken primarily for its euphoric effects. Amini M, et al[7] reported a case series of 17 patients with acute Datura poisoning, most of whom were children and had ingested accidentally. This highlights that accidnetal poisoning is the most common mode of datura poisoning. Cases of intentional poisoning by datura in order to rob, is a common event as reported by many like Le Garff E, et al,[8] Vishal V Koulapur, et al,[9] and Kit Chan.[10]

Conclusion

Although the bitter taste of datura seeds makes it unsuitable as a suicidal poison but the possibility of datura poisoning as a case of suicide cannot be ruled out.

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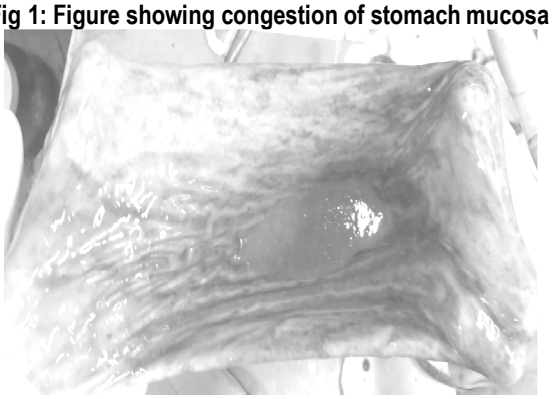
Fig 1: Figure showing congestion of stomach mucosa



Case Report

Pink Teeth and the Dead: A Review with Reports of Two Cases

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Abstract

Pink teeth can occur in the living or as a postmortem phenomenon. In the context of forensic pathology, pink teeth are most commonly found in asphyxial deaths like drowning and strangulation; sudden and unnatural deaths, drug intoxications and carbon monoxide toxicity. However, their pathognomonic value is still doubtful as there is no obvious connection between the cause of death and this non specific phenomenon. The surrounding humid or wet environment appears to be essential in their formation. The process behind pink staining is hemolysis of erythrocytes and subsequent diffusion of hemoglobin pigment and/or its derivatives into the dentine tubules. A time delay is suggested between death and the occurrence of pink phenomenon. Two cases of putrefied corpses are described who died due to drowning and ligature strangulation, respectively. The autopsy revealed pink coloration of all the teeth in both cases which was more marked at their neck and cementum-enamel junction. The current view on the underlying chemical process, relation to the cause of death and the factors affecting the pink teeth phenomenon are explained with the help of both cases.

Key Words: Drowning; pink teeth; cementum enamel junction; asphyxia; hemoglobin; decomposition.

Introduction:

The first description of pink teeth was made in 1829 by Thomas Bell in cases of hanging and drowning, who suggested that the phenomenon is due to an intrinsic or extrinsic increased pressure in the pulp.[1] Pink teeth may occur antemortem due to trauma or iatrogenic injuries to the pulp in dental procedures.[2,3] In forensic pathology, pink teeth have been most commonly seen in cases of drowning/ immersion deaths and other cases such as sudden and unnatural deaths, strangulation, hanging, drug intoxications and carbon monoxide poisoning.[4,5] The prerequisites for formation of pink teeth are congestion prior to death and hemolysis of red cells with subsequent diffusion of hemoglobin into the dentinal tubules.[6] The pink coloration of teeth is more pronounced at the cementum enamel junction and the neck of the tooth.

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The pathognomonic value of pink teeth is doubtful as there is no obvious connection between the cause of death and this non specific phenomenon, but the humid and moist surroundings certainly play a role in the development of pink teeth.[7]

The present two cases are of putrefied dead bodies that died due to drowning and ligature strangulation, respectively. Both corpses were found in the wet and humid surroundings and pink coloration of variable intensity was noticed among all the teeth in each case. No craniofacial trauma, tooth injury or history of dental visit or oral pathology was found.

Case 1:

Putrefied dead body of a 25 years old unmarried male was recovered from a pond two weeks after his sudden disappearance from the home. The body was in bloated stage of decomposition with extensive post mortem bullae, epidermal slippage, washerwoman hands and feet, markedly distended chest and abdomen and bloated facial features. Both jaws were containing all permanent teeth. No antemortem external or internal trauma was found during autopsy. Drowning was opined as the most probable cause of death on the basis of positive diatom test report from forensic science laboratory (diatoms were detected in the sternum and clavicle bones and a positive match was obtained with the water sample taken from the pond) and aspiration of 2 ml of hemorrhagic watery fluid from each sphenoid sinus (obtained after puncturing sella turcica from base of skull)

during autopsy (a positive Svechnikov's sign) **(Figure 1)**. No antemortem craniofacial or tooth trauma was present. All the teeth were showing pink coloration which was more pronounced in anterior teeth and gradually fading towards premolars and molars **(Figure 2)**. The coloration was prominent and limited to the cementum enamel junction and neck of the each tooth. No records of any dental visit or tooth pathology were present.

Case 2:

The dead body of 30 years old married male was found on the outskirts of the village in supine position adjacent to the boundary wall of an abandoned cotton factory during a rainy summer day. Purportedly, the person was missing from home since last 10 days. At autopsy, the dead body was showing changes of putrefaction in the form of large sacs of post mortem bullae, bloated and distended facies of decomposition, degloved hands and feet, purging of frothy blood fluid from mouth and nostrils. Identification was achieved on the basis of clothes and a sacred tattoo mark on left arm. Around the neck, a ligature consisting of a white piece of cotton cloth was found applied transversely with two fixed knots in situ. A faint pale brownish transverse ligature mark was present on the front and lateral aspects of neck at the level of thyroid cartilage **(Figure 3)**. Right superior horn of thyroid cartilage and right lateral surface of cricoid cartilage were found fractured with hemorrhage at the fracture site. The cause of death was given as ligature strangulation. On opening the jaws, all the permanent teeth were pink colored at the crown neck junction and cervical region of lighter intensity **(Figure 4)**. On removal and examination of each tooth, the staining was found to be fading towards root apex and enamel where it was typically absent. No injury to craniofacial skeleton or any tooth was present. No history of dental treatment or oral pathology was present.

Discussion:

Pink teeth may occur during life or as a post mortem phenomenon. During life, pink teeth may be associated with a number of pathological conditions such as typhoid disease,[8] congenital erythropoietic porphyria,[9] pulpitis and pulp necrosis or root resorption due to pathologic granulation tissue accumulation within the dental pulp.[10] They may also be the result of traumatic or iatrogenic injuries to the pulp during endodontic procedures.[2,3] In forensic pathology, pink teeth have been primarily reported in the cases of drowning as occurring in shipwrecks[7] and tsunami.[11] Other cases belonging to sudden and unnatural deaths,[12] strangulation, hanging, knifing, drug intoxication and carbon monoxide poisoning,[4,5,13,14], etc have also been described. Pink teeth have been also observed in cases where the cause of death was not known. The finding of pink teeth in the dead signifies that the dead body or remains have been in a particular environment for a prolonged duration. Although no obvious connection has been found in the occurrence of pink teeth phenomenon and the cause of death, humidity and moist surroundings certainly play a role in their development and are prerequisites for their development,[7] which is evident from the fact that the dead bodies in majority of the cases, as described in forensic literature, were recovered from a wet and moist environment.[15,16] Both the Dead bodies in our case, were found in similar surroundings.

The pink tooth phenomenon has been explained through *in vitro* studies by using cadaver blood and sectioned tooth[17] and also by instilling blood and hemolysed erythrocytes into the pulp chambers.[3,15] Whittaker, et al explained pink teeth in two groups of hamsters, one of which was buried in soil and the other was drowned in sea water, after strangulation and overdosing with barbiturates, respectively. The onset of pink teeth was observed 2 to 3 months later and was intense and faster in strangled hamsters as compared to the poisoned group.[18] Pink staining of the teeth most commonly occurs in cases of sudden death[19] whereby the blood remains liquid after death due to increased fibrinolytic activity.[20] The phenomenon occurs as a result of hemolysis and subsequent diffusion of hemoglobin and/or its derivatives into the dentine tubules. However, the role of hemoglobin derivatives such as hemosiderin, bile and bile related pigments and porphyrins is debatable through various studies.[8,12] The hemoglobin may originate from intravasal erythrocytes or from extrvasated erythrocytes, as a result of congestion bleeding.[12] The diffusion of hemoglobin has been considered analogous to post mortem lividity.[14,18] This is especially true in drowning cases where the head of the cadaver is in dependent position for prolonged time leading to congestion of dependent head. Autolysis or blood congestion play a pivotal role in their development.[6]

Pink teeth are generally found in dead bodies which have been recovered after prolonged post mortem interval such as putrefied corpses in varying stages of decomposition and their formation is a time dependent phenomenon. Almost all researches

have noted a time delay between the death and formation of pink teeth. Van Wyk has explained this on the grounds of narrower diameter of dentine tubules (3 µm) as compare to erythrocytes (average 7.5 µm) so that pink dentine can occur only after breakdown of erythrocytes walls (as after autolysis and decomposition) with subsequent diffusion of hemoglobin and/or its products such as porphyrins into the dentine. In the same study the author tried to correlate the time sequence of pink coloration with the pattern of hemolysis of blood and concluded that the pink staining of teeth can occur only after hemolysis and that discoloration becomes obvious macroscopically at about 6 days.[12] Similarly, pink teeth and a postmortem interval of greater than five days were observed in 21 cases which included deaths due to drowning, stabbing and neck-lacing.[4,12,19] Borrman,. et al mentioned that that the pink teeth phenomenon develops earliest with a post mortem interval of 1 to 2 weeks.[21]

The distribution and number of pink teeth can vary in a mouth from a single to every tooth involved in the phenomenon.[17,18] The pigmentation is more prominent in the anterior teeth with single roots than the posterior teeth with multiple roots.[7] The pink coloration of the tooth is more deep and intense at the cementum enamel junction and cervical part of the root, fading at both ends and rarely found in apical portion of root.[18] Stavrianos, et al have described the pink phenomenon to be an intra tooth variation with some teeth affected in the coronal dentine while the root dentine may be primarily affected in others.[22] It is also not necessary for all the cadavers with prolonged post mortem interval to depict this phenomenon, as even in cases of mass disasters, where the cause of death, surrounding environment and postmortem interval is the same for each dead body, each corpse does not necessarily reflect the pink tooth staining. Thus, the presence and intensity of the pink characteristics vary between different cases and also between different teeth of the same individual.[4,21] This was also evident from the famous Christie (murderer) Case file, in which only one of the eight strangled victims showed pink teeth at the time of analysis.[23] Both of our cases showed pink staining of all the teeth, although the colour was more intense and deeper in the case 1 as compared to case 2, thereby depicting individual variations and effects of surroundings.

This phenomenon has been found more pronounced in younger individuals as compared to the elder. This is due to the fact that the dentinal tubules are reduced in number and become narrower and/or obliterated with advancing age thereby becoming less penetrable by the pigment responsible for postmortem pink staining.[21]

Postmortem occurrence of pink teeth has been explained by a number of biochemical investigations. Presence of hemoglobin and its derivatives have been shown through isoelectric focusing and spectral studies. Ikeda, et al, using electron probe X-ray microanalysis, showed that the pink teeth contained iron derived from hemoglobin and its decay products.[24] However, Campobasso, et al, in 18 drowning cases with pink teeth, did not find any evidence of ferric ion or hemosiderin on microscopic examination of decalcified tooth sections. But a strong positive reaction for hemoglobin was obtained which was further magnified by autoflourescence from argon-ion laser excitation of tissues. From this, they confirmed that the hemoglobin is most likely pigment responsible for pink teeth discoloration.[7]

Pink teeth have been also described in association with archeological cases on many occasions. It has been suggested that the pink coloration of ancient teeth could be a post-mortem process, resulting from the decay process caused by tunneling hyphae of various species of saprophytic fungi. However, the exact cause of pink teeth in archaeological specimens could not be explained.[25] Ortmann and Duchesne have described similar pink discolorations in fingernails of a putrefied female corpse found in a forest and who had died due to combined effect of trimipramin intoxication, hypothermia and pneumonia. The authors further commented that the pink phenomenon depends on special anatomical features such as the existence of porous structures protected by a dense material, which explains the occurrence of a pink discoloration in teeth and fingernails.[6]

None of our cases showed any antemortem craniofacial or dental trauma. Therefore, based on such findings, vitality of pink teeth was excluded. The same results were obtained in a previous study.[7] Additional evidence for the postmortem nature of this staining is the lack of any history of dental treatment or oral pathology in both cases.Most of the forensic pathologists must have observed the pink teeth phenomenon more than occasionally in decomposed bodies, mostly related to cases of asphyxial deaths such as drowning/immersion deaths and strangulation and in poisoning cases but they would have hardly commented about this finding in their autopsy reports.

Conclusion:

Both of our cases depicted pink teeth phenomenon. Although the results of previous studies have also shown that post-mortem pink teeth phenomenon is a common finding related to cases of asphyxia such as strangulation, drowning etc., general consensus has denied any obvious connection between the occurrence of pink teeth and the cause of death. So we can not consider it as a specific forensic finding that may be related to the cause of death in any of our cases. However, the wet and humid surroundings must play a pivotal role in their development which is augmented by prolonged postmortem interval. From the results of the previous studies, a minimum post-mortem interval of about one week seems to be essential for the occurrence of this phenomenon. However, a complete environmental survey and circumstantial evidence must be gathered before concluding the same. Due to varying circumstances in which pink teeth have been discovered and variable results obtained from various experimental and real case studies, no relation can be established with cause of death.

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Fig 1: Aspiration of fluid from sphenoid sinuses

Fig 2: All permanent teeth showing pink coloration at the neck and cementum enamel junction.

Fig 3: Transverse pale ligature mark of strangulation

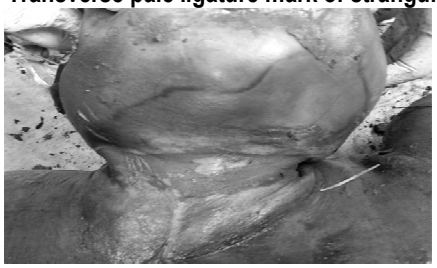

Fig 4: Teeth showing pink discoloration

Case Report

Testicular Trauma Resulting in Death Due to Shock and Systemic Inflammatory Response Syndrome (SIRS): A Case Report.

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Abstract

Male genital trauma can occur by many different mechanisms with the clinical presentation being typically homogeneous, characterized by pain and swelling. This condition of *Acute Scrotum* is treated as a medical emergency with about 20% of the patient needing surgical exploration and rest of the cases are managed by conservative treatment. Any unnecessary delay in management can bring about irreversible damage to the testis making it important to identify the patients who do not need surgery by use of the appropriate diagnostic procedures. Few cases of acute scrotal pain might lead to Systemic Inflammatory Response Syndrome (SIRS), which is a life threatening condition. We report a case of an 18 year old boy who sustained testicular trauma while riding a bicycle and two months post trauma developed severe pain in left inguino- scrotal region, fever and subsequently died. The authors intend to report this unusual case as cases of testicular trauma resulting in shock and SIRS have been reported in literature but were unable to find cases of death occurring due to SIRS.

Key Words: SIRS; Testicular Trauma; Scrotal Injury

Introduction:

Male genital trauma can occur by many different mechanisms, including falls, collisions, straddle injuries, kicks, and equipment malfunction, but, the clinical presentation is typically homogeneous, characterized by pain and swelling. Involvement of scrotal structures is far more common than penile structures. Most injuries can be treated conservatively, but catastrophic testicular injury must first be ruled out.[1] Acute scrotal swelling in children is often associated with testicular torsion, testicular rupture, hernia, epididymitis and direct testicular trauma, although acute scrotum most frequently occurs without a precipitating factor.[2,3] In a study, spermatic cord torsion, torsion of testicular appendages, and acute epididymitis were found to be the cause of acute scrotal pain in 94% of boys under the age of 17 years.[4]

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The acute scrotum presents as a medical emergency because any unnecessary delay in management can bring about irreversible damage to the testis. About 20 % of patients with an acute scrotum need emergency scrotal exploration because of testicular torsion while many other causes require only conservative treatment. It is, therefore, of vital importance to identify the patients who do not need surgery by use of the appropriate diagnostic procedures. A standardized diagnostic approach includes history, physical examination, laboratory tests and Doppler ultrasound. A few cases of acute scrotal pain result in systemic inflammatory response syndrome (SIRS) requiring lifesaving therapy. SIRS can be seen with or without evidence of infection in cases of trauma. [2,5]

Case of testicular trauma resulting in shock and SIRS has been reported in literature. However, a case of death due to SIRS and shock in a case of testicular trauma has not been reported in literature. We report an unusual case of testicular trauma resulting in death due to SIRS and shock in an 18 year old boy.

Case:

An 18 year old boy presented with pain in left inguino-scrotal region, abdomen, and fever to a government hospital. About two months prior, he had sustained testicular trauma while riding a bicycle, after which he complained

of mild pain in left inguino- scrotal region but he did not visit any doctor for same. Two months post trauma, he developed severe pain in left inguino- scrotal region and fever while at home and was taken to the emergency department of a government hospital. On examination the patient's scrotum was swollen and tender, and Prehn's sign was positive. His temperature was 38.2 ^{0}C, heart rate was 98 per minute and blood pressure was 112/70 mm of Hg. His WBC count was 14,500 per mm^3 and ESR was 42 mm/hour. Doppler ultrasound scan was performed and a diagnosis of left epididymoorchitis was made. He was discharged after prescribing doxycycline, diclofenac and proton pump inhibitor. After about 12 hours of discharge, he again complained for severe pain in left inguino- scrotal region. He was rushed to hospital but on arrival he was declared brought dead. The case was registered as medico-legal and the body was sent to mortuary for autopsy.

Autopsy Findings:

The body was that of 18-year-old, male, average built, and 167 cm in length. The brain was oedematous. Pleural cavities contained about one liter of straw colour fluid. The right lung weighed 630g; the left lung 510g. They were bilaterally oedematous and congested. Peritoneal cavity contained about two liters of straw colour fluid. Liver, spleen and kidneys were congested. Scrotum was swollen. Left testis was congested and enlarged with length 8 cm and circumference 12 cm. **(Image 1)** It weighed 42 g. Left epididymis was enlarged and congested. Right testis was of length 6cm, circumference 9 cm and weight 26 g. Microscopic examination of the left testis revealed congestion and hemorrhage. **(Image 2)** There was tubular atrophy with occasional destruction of tubules. **(Image 3)** Microscopy of right testis was in normal limit. The cause of death was given as shock and systemic inflammatory response syndrome as a complication of testicular trauma.

Discussion

Despite the vulnerable position of the testis, severe traumatic injuries to the testis are relatively uncommon due to the mobility of scrotum. But, any scrotal injury deserves careful observation and management, if required, to prevent rare life threatening complications. In cases of testicular injury, blunt scrotal trauma is responsible for 75% of the reported cases; Of these, most result from sports injuries, assault and vehicle accidents.[3] Though most cases of blunt trauma to testis are minor and require conservative management, immediate assessment of genitalia is necessary to rule out testicular rupture and torsion. A retrospective study on 10 patients with history of severe blunt testicular injuries was conducted by Mulhall, et al[6] and suggested that testicular rupture following blunt trauma is universally associated with abnormal ultrasonography scan, although non-specific, and requires early exploration to provide an excellent chances of testicular salvage. Besides testicular torsion and rupture, other conditions of acute scrotal pain like urethral injuries, haematoma and epididymitis should be ruled out as a part of initial assessment. Once ultrasonography rules out the need for surgical intervention, further conservative management can be done with analgesics and rest. While most cases of epididymitis are the result of bacterial infection, some may present 2 to 3 days after trauma due to forceful compression of the testis against the pubic bones.[7]

In our case, the deceased being from poor family and uneducated, did not attend any doctor after testicular trauma and pain until after two months of injury when the pain in inguino-scrotal region became severe and was associated with high grade fever. Diagnosis of left epididymo- orchitis was made. Any surgical intervention was not advised because of absence of torsion, significant haematoma, testis rupture or abscess. He was discharged after prescribing antibiotics and analgesics. After 12 hours of discharge he again complained of severe pain and succumbed to death before reaching hospital. The clinical parameters at first hospital visit were fulfilling the SIRS diagnostic criteria of The American College of Chest Physicians and Society of Critical Care Medicine, a life threatening rare complication of testicular trauma.[8,9]

The American College of Chest Physicians and Society of Critical Care Medicine, requires the presence of two or more of the following conditions to diagnose a case as SIRS.: temperature >38℃ or <36℃; Heart rate >90 beats/minute; Respiratory rate >20 breaths/minute or P CO <32 torr; WBC >12,000 cells/mm^3 or <4000 cells/mm^3 or >10% band forms. In the presence of infection this SIRS becomes sepsis. The outcomes of both sepsis and SIRS in trauma patient are similar as body's over all response is more predictive of clinical course than particular organism or mechanism of injury. [8,9] A case of SIRS following testicular trauma was reported by Kingsley, et al[2], which developed during conservative management, effectively managed in hospital with post

inflammatory scarring after three months of trauma. They also suggested that mortality increases with increasing number of SIRS criteria present in a patient. To match the criteria of SIRS, as laid by The American College of Chest Physicians and Society of Critical Care Medicine, our case had heart rate of 98/ min., temperature of 38.2 ^{0}C and WBC count of 14,500 cells/mm. He had no history of sexual activity, no medical history of urinary tract infection, sexually transmitted disease, acute pancreatitis, and major elective surgery. The history of testicular trauma was also supported by the histopathological findings of testis. Severe trauma to testis can lead to release of proinflammatory mediators like TNF-alfa, IL-1 and TLR (toll- like receptor). These cytokines are highly involved in activation and progression of the inflammatory response. These cytokines are present in sertoli cells and developing germ cells of testis besides macrophages, T-cell and other circulating immune cells. Although the testis is an immune privileged site, it is not completely protected from local and systemic activators of inflammation. A potentially fatal immune reaction could occur following testicular trauma due to a positive feedback relationship between cytokines released from testis and immune cells.[10,11]

Conclusion:

SIRS following a testicular trauma is a rarely reported in literature. Proper history talking and histopathology, aided by proper history collection, can help an autopsy surgeon to diagnose such cases. Also, it is of utmost need to educate public in general about the complications associated with testicular trauma as it mostly ignored as a minor injury. Directing the education flow to high risk group like the sportsman can benefit a lot in prevention, reporting and management of testicular trauma.

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Fig 1: Cut section of left testis showing congestion

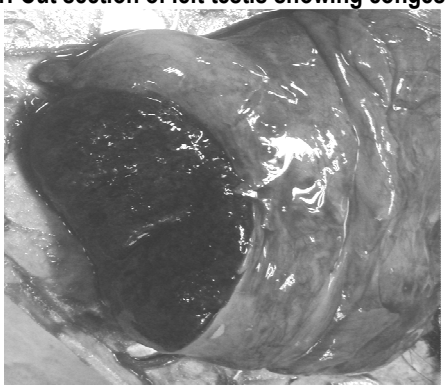


Fig 2: Histopathollogy of left testis showing congestion and hemorrhage

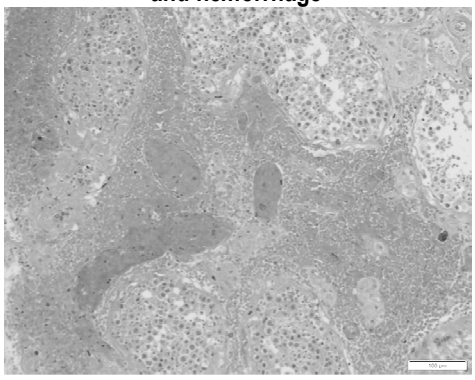
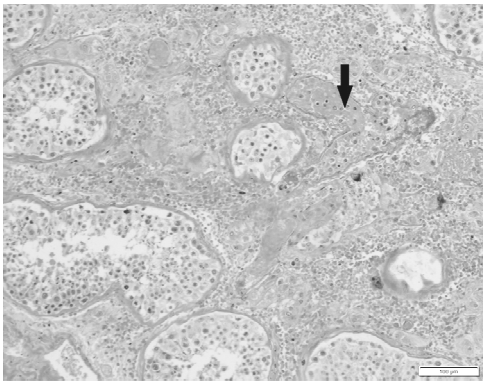


Fig 3: Histopathology of left testis showing destruction of tubules (shown by black arrow)



Case Report

Death of a Child in a Closed Car: An Unknown Danger

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Abstract

The children left unattended in the stationary cars are exposed to many dangers like heat stroke, asphyxia by power windows, fires, carbon monoxide poisoning etc. Heat related fatality of the children is a well recognized problem in developed countries like the United States. In a developing country like India, the dangers associated with children and parked cars are yet to be recognized and conveyed to the normal population, who are seemingly ignorant about this issue. We present a case of a child who was found dead in a car parked in the driveway of a house. The child died due to aspiration of gastric contents which was evident from the histopathology of lungs. This case shows that not only established hyperthermia but also prodromal symptoms can result in death, especially in children. The authors intend to highlight the dangers associated with small children being left unattended or getting locked unintentionally in cars.

Key Words: Forensic Science**,** Hyperthermia, Heat related fatality, Aspiration Pneumonitis, Closed cars, Histopathology of Lungs.

Introduction:

With the advent of industrial revolution, cars have become a necessity for families. Even for buying groceries or visiting a store adjacent to the house, people may prefer to take cars. Leaving children unattended in such vehicles is a common practice. It is also possible that sometimes the child may get accidentally locked in the vehicle. This, however, involves several dangers which are unknown to general population. Causes like heat stroke, asphyxia by power windows, fires, carbon monoxide poisoning, etc, have been reported to be responsible for deaths of children.[1,2] Here, we present a case of a child who was found dead in a car parked in the driveway of a house. The authors intend to highlight the dangers associated with small children being left unattended or getting locked unintentionally in cars.

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Case History

A six years and nine months old child went missing at about 3:30 PM inside a house. The father of the child used to work as a residential cook in the house. A laborer working in the house saw the child lying inside a car parked in the driveway at about 06:30 PM after which the child was taken to nearby hospital where he was declared brought dead. The driver of the car stated that he had parked the car at about 3:00 PM on that day deposited the keys with the owner of house, went back to his home and he didn't know anything about the incident.

Autopsy Findings

The length of the body was 120cm. Bluish discolouration was present over lips and nails. No external injury was present over body. Food particles were found in the larynx, trachea and bronchi. Lungs were congested and edematous, with food particles present till terminal bronchioles. Stomach contained about 150 ml of semi-digested fluid material, correlating with the food particles present in the respiratory tract.

Viscera were preserved for toxicological analysis, which was reported negative for all common poisons. On histopathological examination, lungs showed pulmonary edema, interstitial inflammation with presence of vegetable material and bacterial colonies favoring histological features of aspiration pneumonia. Interstitium of the lungs showed marked congestion. The histopathology of

kidney, spleen, liver and brain showed congestion.

Discussion

Hyperthermia is a condition in which the body temperature rises above 106°F i.e. 41.5 °C. At autopsy, there are no diagnostic anatomical criteria for heat stroke.[3] Children are more prone to develop heat related injuries as they have a higher body surface area and their heat regulating mechanisms are not as developed as adults. The present case occurred in New Delhi, during the last week of August, when the climate is very hot and humid. The highest temperature reported on that particular day was 35°C.[4] The child went missing in the afternoon at about 3:30 PM i.e. when the temperature would have been highest for the day.[5]

The rise in temperature in the standing vehicles is significant even at cool ambient temperatures, with 80% of the rise occurring in the first 30 minutes, putting an individual at risk of hyperthermia.[6] The driver parked the car at about 3:00 PM and the child went missing at about 3:30 PM. There was a gap of about 30 minutes in which the temperature inside the car would have risen significantly due to outside temperature being 35^{0}C. The symptoms of heat stroke are preceded by prodromic symptoms like nausea, vomiting, dyspnea, vertigo, and muscle cramps.[3] The histopathology showed the findings of aspiration pneumonitis in this case **(Figure-1,2)** which corroborated with the presence of food particles in the terminal bronchioles. This highlights the importance of histopathological analysis of the internal organs in such cases. Without the histopathological analysis, the cause of death could not have been ascertained or may have been reported as hyperthermia by exclusion. However, because of the findings on autopsy and histopathological examination, the cause of death was concluded as asphyxia as a result of aspiration. This aspiration was a result of the prodromal symptoms of hyperthermia.

Guard and Gallagher[7] studied 171 cases of heat related death of young children in parked cars and they identified two categories. Firstly, children gaining access to unlocked cars (27%) and secondly, children who were left unattended intentionally or unintentionally (73%). The high temperatures ranged from 63 to 115° F and three quarters of incidents were during the summer months of June, July, and August. The present case took place in the month of August and the temperature was 35^{0}C i.e. 95^0 F.

The issue regarding the heat related fatality of the children has been reported previously in the medical literature and is a well recognized problem in other countries.[8-12] In a developing country like India the dangers associated with children and parked cars are yet to be recognized and conveyed to the normal population who are seemingly ignorant about this issue. So, such kind of fatalities is infrequently reported.[13-17]

Conclusion and Recommendations

1. Parents of small children should not leave them in the locked cars even when the outside environmental temperature is moderate.
2. Cars in the houses having small children should never be left unlocked when not in use.
3. Parents should be particularly vigilant when the child is playing near the cars as they might sneak in, but may not know how to get out of the vehicle, thus endangering their life.
4. There should be proper education of the population through the newspapers, television or other medium about the heat related dangers to the children in parked cars.
5. There should be proper investigation by the police so as to fix accountability about the negligence, if any, which caused the death of a child in such cases.
6. This case highlights that not only established hyperthermia but also prodromal symptoms can result in death especially in children.

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Fig 1: Histopathological picture of the Lungs

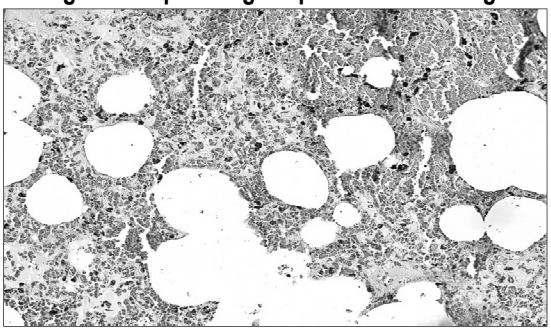
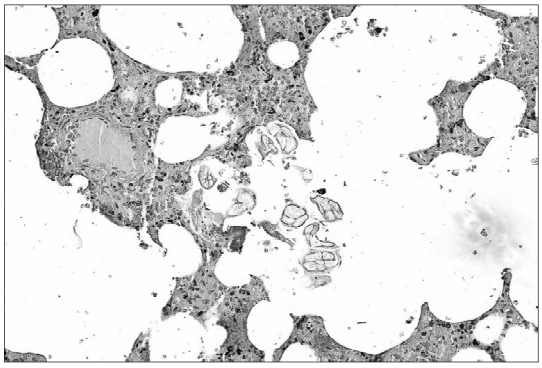


Fig 2: Histopathology showing presence of vegetative material in bronchioles



Case Report

Autopsy detection of café-coronary syndrome in a psychiatric patient

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Abstract

Sudden and fatal choking during eating is a rare phenomenon in healthy individuals due to the reflex evacuation of food by coughing, but it can happen in intoxicated person and psychiatric patient with eating disorders. A case of sudden death is being reported wherein the dead body of a psychiatric patient was brought to the department for autopsy examination with an alleged history of cardiac-arrest. On autopsy, it was found that the death was due to choking. (Café-Coronary Syndrome). The case is presented here with the aim to discuss its medico-legal aspects and clinical implications.

Key Words: Sudden death, Autopsy, Choking, Eating Disorders, Café coronary, Psychiatry.

Introduction:

The incidences of sudden death in people who are having psychiatric problems are common. The morbidity and mortality in these patients can be reduced by doing proper management of the high risk factors associated with cardiovascular disease, metabolite syndrome, diabetes, etc.[1] Death due to choking during eating (Café-Coronary Syndrome) is a less commonly entity, but the chances are higher in patients who are intoxicated or having some psychiatric problems or eating disorders.[2-4] The confirmation of death due to eating disorders during the autopsy examination is a challenging task, as the classic findings of the choking may be disturbed during the process of resuscitation of the patient. In present case, it was possible to opine about the cause of death as due to choking.

Case History:

In May 2015, the dead body of a 69 years old male was brought to the department for medico-legal autopsy with alleged history of sudden death. The clinical record of the deceased showed that he was a diagnosed case of schizophrenia and wasundergoing an eventfree treatment except tachyphagia. The relatives were aware about his tendency to eat very fast and they were providing him a liquid or semi-liquid meal to avoid any complication related to choking, but on the day of fatal event, the victim was having some solid food and suddenly collapsed. To know the exact cause of death, the body was sent for postmortem examination.

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Autopsy findings:

It was the body of a well built, well nourished old aged male with partially open mouth containing impacted food (**Photograph-1**), which was also present right up to the larynx area. The mucosa of the larynx also showed impacted food particles mixed with frothy fluid. Below the larynx, the tracheal lumen was found blocked by a yellowish rounded foreign body of about 1 cm diameter, which was confirmed as a *Pea* (**Photograph-2**). The lumen of the trachea-bronchial trees below the level of foreign body was also found blocked with lumps of chewed food and mucous plug (**Photograph-3&4**). The respiratory mucosa and lungs were congested and showed patechial hemorrhages over the external surface. The lungs were edematous and nails were cyanosed. Routine viscera were preserved and sent for the chemical analysis to the Forensic Science Laboratory. The whole heart and samples from brain, lungs, kidneys, liver and spleen were sent for histopathology examination, which showed non-significant findings. The gross and microscopic examination of the heart did not show any significant findings and the reports of chemical analysis were also negative. The cause of death was concluded as choking as a result of food asphyxia (Café-coronary syndrome).

Discussion:

Eating disorders are commonly seen in the male patients of schizophrenia as a

comorbidity.[5,6] Choking during eating is commonly seen in these patients and if not taken care of, it can be fatal also. In the present case, the deceased was a known case of schizophrenia with associated eating disorders, who collapsed while eating. Though the cases of choking are also reported in individuals who are intoxicated with alcohol or any other drugs,[7] but in this case negative reports of chemical analysis of viscera suggest that the deceased was not intoxicated before the fatal event. The histopathology examination of the heart also did not show any significant findings and there were no findings of myocarditis, which is common in such cases, due to the use of antipsychotic therapy like Clozapine.[8]

The positive history regarding the tendency to eat very fast (Tachyphagia) and circumstances of death with autopsy findings of choking by food in the form of a blockage of the larynx, trachea and bronchi with solid food lumps mixed with frothy mucous plugs was indicating the death due to choking during eating (Café-coronary syndrome). Dried solid and impacted food inside the oral cavity also suggests that the deceased was having food at the time of death. The agonal aspiration of gastric contents in this case can be ruled out easily by the circumstances of the death and the presence of antemortem findings in the form of sticky mucous plugs and food particles with frothing in the respiratory tract and edematous lungs with cyanosis of nails. Autopsy approach in such cases has been studied by Wick, Gilbert and Byard[9] but many a times it becomes difficult to demonstrate the significant findings of choking during autopsy because the respiratory tract may have been cleared during the process of resuscitation.

Conclusion:

Choking during eating is avoidable and neglecting the patients who are at risk of it may be fatal. Though such cases are challenging to the forensic pathologist, but the clinical history about the circumstances of death and autopsy findings of blockage of the respiratory tract with impacted food particles with negative reports of chemical analysis and histopathology can help to conclude the death due to choking by food asphyxia and to differentiate it from the other possibilities of death.

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Fig 1: Showing mouth containing Impacted food material

Fig 2: Showing yellowish rounded foreign body in the lumen of trachea.

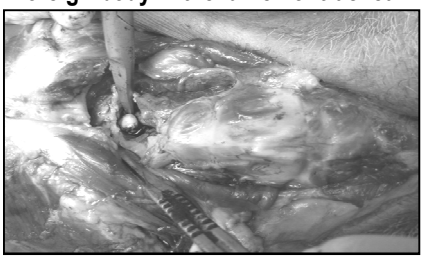


Fig 3: Right lung bronchus containing lumps of chewed food

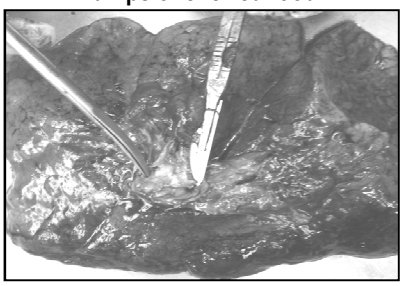
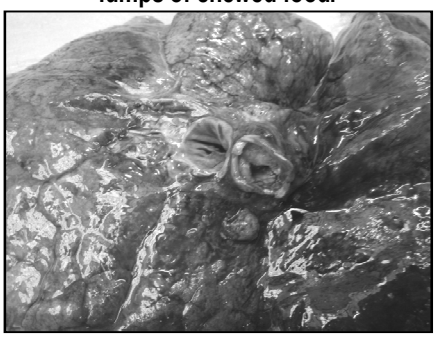


Fig 4: Right lung bronchus containing lumps of chewed food.



Case Report

Skipping History Invites Trouble

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Abstract

Age estimation is an integral part of the biological profile employed by Forensic Expert in order to assist in achieving an identification of an unknown deceased individual. Age estimation can be done by several ways like radiological, dental examination and skull suture examination etc. However, in infants, age estimation can be done from radiological and dental examination, pediatric assessment, weight and height estimation. In infants, age estimation is of paramount importance as charge of infanticide comes into play. It is also important for identification purposes.

An infant was referred to Forensic Medicine dept., Govt. Hospital for age estimation, by child welfare committee. On dental and radiological examination along with pediatric assessment, the age of the infant appeared to be 2-3 months, but on taking previous detailed history, we found that the infant was suffering from Downs's syndrome, so as per his clinical history, age was more than our dental and radiological observations. Considering all aspects, his age was given about 1 yr with the margin of error of 2 months on either side. This highlights the importance of history taking for the purpose of age estimation.

Key Words: Age, History, Down syndrome, Infant

Introduction:

Age has to be determined not only for identification purpose but also for various other civil and criminal cases. It is an integral part of the biological profile employed by forensic experts in order to assist in achieving an identification of an unknown deceased individual. Its estimation is of paramount importance and requires special attention in cases where bodies are found in decomposed, mutilated or only fragmentary remains are discovered.[1] In infants, age estimation is of paramount importance as the charge of infanticide comes into play; for purposes of identification; as documentary evidence for school admission for future medico-legal purposes.[1]

Age estimation can be done in several ways by macroscopic examination of dental development and eruption, epiphyseal union of long bones, degeneration of pelvic articular surfaces, sternal rib ends, and cranial sutures, as well as microscopic examination of bone in histological analysis.[1]

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Analysis of the pubic symphysis and auricular surface of the pelvis is considered the most reliable macroscopic individual methods of aging for adults.[1] However, in infants, age estimation can be done from radiological, dental examination, pediatric assessment, weight and height estimation. Detailed history taking also plays a crucial role in age estimation.[1]

In infants following criteria helps for age estimation:

- Ist fortnight – changes in umbilical cord [12-24 hrs: portion of cord attached to infant shrinks & dries , 36-48 hrs: reddening at base and adjacent skin. 3rd day: shrivels up, 5th/ 6th day: mummifies & falls off, 10-12thday: healing & cicatrisation occurs.] Changes in skin [At birth: bright red, 2nd/ 3rd day: darker, 3-6th day: physiological jaundice, 7th day: normal skin color] [2]
- Ist 6 months - weight & height, partial closure of anterior fontanelle, ossification centre in capitate and hamate, fusion of two halves of mandible. Ossification of pterion and asterion.[3]
- 6 months to 2 yrs- Eruption and calcification of temporary teeth, ossification centres of head of humerus, femur, carpal bones.[3]

Pediatric assessment also plays a crucial role in estimation of age in infants. By taking into consideration various milestones like gross motor, fine motor, language etc., achieved by infants, age can be estimated with a margin of few months on either side.[4]

Detailed history also forms a pivotal role as per as age estimation in infants is concerned. Various congenital anomalies like Down's syndrome affect the skeletal and mental growth of the infants. In this case paper we have traced on importance of history taking in infants while estimating age of infants.[5]

Case history:

A child was referred by child welfare committee for age estimation to JJ Hospital, which is a tertiary care centre. The child was referred to radiology dept for x-ray and pediatric dept for developmental age. As per the radiological opinion, age was greater than 4 months and less than 3 yrs. While, as per pediatric opinion, developmental age was 1 to 2 months.

On examination, there was no eruption of any teeth, x ray wrist showed complete eruption of capitate and hamate bone. Developmental age appeared to be 3 – 4 months. On the history given by the accompanying lady, there was no congenital abnormality. Hence, on the basis of above findings we were of opinion that the age would be about 4 to 5 months. However, the person giving history didn't have knowledge about his past history, so on the following day, a person having details about past history of infant was called. On detailed history, the infant was found to be admitted for cough and fever in a private hospital 5 months back and his age at that time was given as 7 months. Also he was diagnosed to be suffering from Down's syndrome. On examination of the child, there were no classical signs of Down's syndrome like upward slant of eyes, Flat facies, small dysplastic ears, clinodactyly, simian crease, sandle gap etc.[4]

Considering clinical history, radiological, dental examination and pediatric assessment, his age was given about 1 yr including margin of error of 2 months on either side.

Discussion:

Age estimation in infants requires combined approach i.e. radiological examination, dental examination, pediatric assessment for developmental age, detailed history and general examination. Following features help in age estimation in infants: Ist fortnight- changes in umbilical cord and skin, x-ray of knee. Ist 6 months – weight, height, ossification centre of capitate and hamate, partial closure of anterior fontanelle. 6 months to 2 yrs : eruption and calcification of temporary teeth, ossification centres for head of humerus, ossification centre for head of femur.[3]

For radiological purpose , in newborns, x-ray of knee is advised, in 3-9 months x-ray of shoulder and x-ray wrist, in 1-13 yrs x-ray wrist is advised for age estimation.[4] Radiological fusion of epiphysis occurs earlier than anatomical fusion by 6 months to 1 yr.[3].Skeletal age is more advanced in girls compared with boys by 1 yr in early childhood and by 2yrs in mid-childhood.[4]

Dental examination - lower central incisor is first teeth to appear at the age of 6-8 months followed by upper central and lateral incisor at the age of 7- 9 months. Lower lateral incisor appears at the age of 10-12 months and Ist molar at the age of 12-14 months. Canine and 2nd molar at the age of 17-18 months and 20-30 months respectively. In males dental and osseous ages are almost similar while in females osseous age is in advance of the dental age.[3] In our case study, there was no eruption of lower central incisor teeth indicating dental age less than 6 months.

Pediatric assessment for developmental age: As the age advances he/she acquires better coordination of motor activity and reacts to his/her environment in willful manner until he/she blends into a fully integrated and autonomous individual. Children accomplish maturation of different biological functions(level of development) at an anticipated age with a margin of few months on either side.[4] Child development is assessed in four segments namely gross motor, fine motor, language, personal social by the Denver Development Screening test. (DDST)[4]

- **Gross motor :** Up to 1 yr, milestones like neck holding, Sitting with support, sitting without support, standing with support, walking with support, crawling , standing without support, Walking without support, are achieved. (**Table no-1**.)
- **Fine motor:** Up to 1 yr, milestones like grasps a rattle or ring when placed in hand, intentional reaching with bidextrous grasp, palmar grasp, pincer grasp are present. (**Table no-2**.)
- **Language :** Up to 1 yr milestones like turns head to sound, cooing, monosyllables like ma, ba, bisyllables like mama, baba and two words with meaning are present. (**Table no-3**.)
- **Personal social:** Up to 1 yr milestones like social smile, recognizing mother, smiles at mirror image, waves bye-bye, plays a simple ball game are present. (**Table no-4**)

In our case study, grasp reflex and social smile were present, cooing was achieved. However, there was no neck holding. So the

development age was opined to be about 3-4 months.

Height and weight also helps in age estimation. At birth height is 45-50 cm and weight is 2.5 to 3 kg. At 6 months height is 54 cm and weight is 5 to 6 kg. At 1 yr height is 58-60 cm and weight is 7.5 to 9 kg.[1] In our study, height of the infant was 68 cm and weight was 6.9kg. So age as per height and weight was about 1 yr.

On gross examination, there was no evidence of any abnormality externally. In Down's syndrome, features like upward slant of eyes, flat facies, small dysplastic ears, clinodactyly, Simian crease, sandle gap etc. are present.[4] In our case no such classical features were present.

So on the basis of all above findings, we were of the opinion that age of infant would be about 4-6 months, before considering previous past history. All the above findings were so contrasting like delayed achievement of milestones, no eruption of teeth, delay of occurrence of ossification centres, near normal development of height and weight.

However on taking detailed medical history and going through medical records, to our surprise, we found that infant was admitted in hospital for fever and cough 5 months back and his age was mentioned as 7 months old in IPD papers and was diagnosed to be suffering from Down's syndrome.

In Down's syndrome, developmental milestones are delayed, however, relative sparing of social development, dentition is delayed.[5] Children with Down's syndrome do have poor skeleton growth with delay in appearance and fusion of ossification centres.[6]

In our case, there was delay in milestone achievement, dentition, and appearance of ossification centres, corroborating with features of Down's syndrome, which was found only on detailed medical history and medical records. (**Table no- 5**)

This traces the importance of detailed history taking while estimating age of infants.

Conclusion:

A detailed medical history should be taken into consideration while giving opinion about age in infants. Disease conditions should be taken into consideration while giving opinion about age in infants. A comprehensive combined approach should be there while estimating age in infants. An estimated age provides an documentary evidence in civil cases as well as for future medico legal cases.

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Table no-1: Gross motor milestones

Age (Months)	Milestone
3	Neck holding
5	Sitting with support
8	Sitting without support
9	Standing with support
10	Walking with support
11	Crawling (Creeping)
12	Standing without support
13	Walking without support
18	Running
24	Walking upstairs
36	Riding tricycle

Table no-2: Fine motor milestones

Age (Mths)	Milestone
4	Grasps a rattle or ring when placed in hand
5	Intentional reaching with bidextrous grasp
7	Palmar grasp
9	Pincer grasp

Table no-3: Language

Age (Months)	Milestone
1	Turns head to sound
3	Cooing
6	Monosyllables like ma, ba
9	Bisyllables like mama,baba.
12	Two words with meaning
18	Ten words with meaning
24	Simple sentence
36	Telling a story

Table no-4:Personal social

Age (Months)	Milestone
1	Social smile
3	Recognising mother
6	Smiles at mirror image
9	Waves bye-bye
12	Plays a simple ball game
36	Knows gender

****Table 5 and Figure 1 & 2 on page no. 337**

Case Report

Undigested gastric content in autopsy revealing the story: A Case report

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Abstract

The examination of gastric contents in an autopsy is an underestimated tool for determining the time since death. We are reporting a case of a 25-year-old married female, who died due to "*putting pressure over neck"* as suggested by the post-mortem report. Two FIRs were lodged, one from the husband and another by the brother of the deceased, both claiming the different story regarding the event of death. Detection of 300ml of undigested rice food stuff in stomach in the postmortem examination and its correlation with the time of meal eventually revealed the mystery of death.

Key Words: Autopsy, Gastric content, Postmortem examination

Introduction:

The examination of gastric contents is a crucial element of any forensic autopsy and the revelation of pathology including ingested food particles and poisons may be of obvious significance.[1] It can serve as a crucial evidence while determining the time since death (post-mortem interval), which is one of the most difficult problems confronting forensic experts. This measure may provide the scientific evidence to the medical jurisprudence for time since death, during the investigation of any suspicious death.[2] The gastric emptying time depends on variables such as; size and composition of meal, fear, pain as well as the possibility of subjective variation in the gastric empty rate.[3] However, matching the stomach contents with a particular meal eaten at an identifiable time is a controversial issue, the accuracy of estimations of this nature are dependent upon the reliability of data on gastric emptying.[4]

The Case:

One morning, the dead body of a 25-year-old married female, house wife by occupation, was subjected to autopsy at the mortuary of Nalanda Medical College, Patna, from Khusrupur Police station under Patna district. The dead body was brought and identified by the constable, husband of the deceased and brother of the husband of the deceased. In the inquest report, the case was lodged under Section 302, 394, 34 I.P.C. The opinion in the inquest report regarding the cause of death was *"the death was due to putting pressure over neck."*Another case was lodged by the brother of the deceased on the same day under section 304B, 120B, 34 I.P.C. in the same police station.

Autopsy findings

External examination: An abrasion of 4x 0.75cm size was found on the left side of the upper portion of neck, placed transversely 4 cm below the root of left ear. Eyes were congested and rigor mortis was present all over the body.

Internal examination: On dissection, all the viscera were found congested. Lungs were voluminous due to emphysema. Right chamber of the heart was full. Stomach contents were about 300ml of undigested rice food stuff. Tracheal wall was deeply congested and it contained froth. Muscles of upper most portion of neck were bruised. The cause of death was determined as asphyxia caused by pressure over neck.

As per the F.I.R. filed by the informant (husband of the deceased), on the day of event, he and his wife (deceased) went to sleep at about 8-9 pm, after having dinner on the eve of their marriage anniversary. At 2 to 3 am (same night), four unknown persons entered their

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bedroom forcibly compelling the informant to go downstairs. There after, the keys were snatched from him, the almirah was opened and Rs.60,000 and other valuables were taken away. One of the gang member, who was guarding his wife came downstairs when called by the gang and departed from his house after threatening him to stay silent. When he reached his bedroom after their departure, he found his wife dead with mark of injury over the neck.

Second case was registered on the basis of F.I.R. filed by deceased's brother who told a different story that his sister had been murdered by her husband and brothers-in-law for dowry.

Two F.I.R.s filed in this case on the same day were contradictory in nature. One F.I.R. was about robbery and murder filed by the deceased's husband who was also the informant. Another F.I.R. was about conspiracy and murder by the deceased's husband and his brothers which was filed by deceased's brother. In both the cases murder was not in dispute and this was accepted in both the F.I.R.s. In the P.M. report also, the cause of death was due to asphyxia caused by pressure over the neck.

Discussion:

The investigating officer who contacted the author came to know from the P.M. report that the content of the stomach was undigested rice. The semi digested identifiable food particles are found more commonly in those persons who died 0-2 hours after last meal.[4] It meant that the deceased had taken meal within 2-3 hours prior to her death. This gave the vital proof to the investigating officer that the death had taken place in between 8:30 pm to 11:30 pm.Considering the rural background of the deceased where taking meal in night after 9.00 pm is very uncommon. So the informant's story that a robbery had taken place between 2am to 3 am was nothing but a lie. Finally, the first F.I.R. in course of investigation was proved to be false and concocted and so the second F.I.R. was found to be correct and a case against the husband of the deceased was instituted.The determination of time since death in this case was crucial in mala fide intension of husband and in laws of victim.

Although availability of new biological parameters like Malondialdehyde and total thiol are one of the best available markers for determining the post mortem-interval but there availability, applicability and expertise to use in resource constraint setting like India is still questionable.[5] Hence, though arguably, using stomach contents as a guide to time since death involves degree of imprecision and is thus liable to mislead the investigator and the court,[6] in this particular case, it was proved that when other evidence did not give much clue, the time of the last meal and the contents of stomach, finally led to the correct interpretation of the case and revealed the mystery of death.

Conclusion:

Despite ambiguity in establishment of time since death by gastric contents in the PM examination, its interpretation in context of cultural background, crime scene and motive may provide important evidence to the court, especially in the resource constraint setting like India where biochemical or molecular analysis of all the case of PM is not possible**.** Hence, we re-emphasize that the examination of gastric contents in PM examination and should be an integral component in autopsy especially the death of suspicious circumstances.[7,8]

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The case reports could be supported with up to 10 references. Case Reports could be authored by up to four authors.

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   It less than six authors, list all the authors.

   Halpern SD, Ubel PA, Caplan AL, Solid-organ transplantation in HIV – infected patients. N Engl J Med. 2002;347:254-7

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   Rose ME, Huerbin MB, Melick I, Marion DW, Palmer AM, Schiding JK, et al. Regulation of interstitial excitatory amino acid concentrations after cortical contusion injury. Brain Res. 2002;935: 40-6

2. **Books and other monographs**

   Personal author(s)

   Murray PR, Ropsenthal KS, Kobayashi GS, Pfaller MA, Medical Microbiology. 4th ed. SI.Louia: Mosby; 2002

   Chapter in a book

   Meltzer PS, Kallioniemi A, Trent JM, Chromosome alterations in human solid tumors. In : Vogelstein B, Kinzler KW, editors. The genetic basis of human cancer. New York : McGraw-Hill; 2002.p. 93-113.

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