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From Editor's Desk

JIAFM

A Quarterly Publication

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I feel immense pleasure to present before you the Fourth issue of 2012. I would like to inform all of you that our esteemed Journal of Indian Academy of Forensic Medicine which is published quarterly since 1991 has been started gaining wide recognition not only in India but globally among the scientific community. I am trying to maintain your faith and trust in me to bring this journal to highest level of its achievements.

I have received many requests from other countries about inclusion of many papers in their indexing data base, including USA Government agencies. JIAFM is indexed not only in **IndMed** and **MedInd Indian indexing** agencies but also in the **SCOPUS**, **IMSEAR** informed by the **Information Management and Dissemination (IMD)**, **World Health Organization, Regional Office for South-East Asia, Indraprastha Estate, New Delhi, India**. It is hoped that once this journal indexed in IMSEAR it would be automatically indexed in the **Global Index Medicus managed by WHO Headquarters in Geneva as informed**.

The title mentioned above has been evaluated for inclusion in **SCOPUS by the Content Selection & Advisory Board (CSAB)**. The review of this title is now complete and the CSAB has advised that the title will be **accepted** for inclusion in Scopus. For your information, the reviewer comments are copied below:

This is a well produced journal in an important subject field with interesting content, which deserves a wide readership. The editors are to be commended on their efforts.

I assure you about the quality of research papers and quality of printing in future issues. Your valuable suggestions are always encouraging me and I heartily welcome for future suggestions.

Professor [Dr.] Mukesh Yadav
Editor, JIAFM

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Editorial

Substance Abuse/Misuse: A Matter of Public Health, Concern for Court and Government

Drug abuse is a major medical problem with extensive legal, social, moral, ethical and even political problems. A person made tolerant to a large dose of one narcotic is also cross tolerant to many of the effects of another narcotic. Most persons use drugs of dependence with certain discrimination, and in such cases little harm result. Indiscriminate use of any of these drugs becomes dangerous, and produces a gradual mental, physical, and moral deterioration of the individual and sometimes also sexual perversions or crime. The majority of drug victims are neurotic individuals who are mentally unbalanced.

Substance abuse arises out of a maladaptive pattern of substance use, manifested by recurrent and significant adverse consequences related to the repeated intake of the substance. These problems must occur recurrently during the same 12 months period. The criteria do not include tolerance, withdrawal, or a pattern of compulsive use, and instead include only the harmful consequences of repeated use.

Substance intoxication refers to unwanted physiological or psychological effects that cause maladaptive behaviour. It must produce disturbances in the level of consciousness, cognition, perception, affect, or behaviour that are clinically significant.

The issue related to substance abuse and misuse was raised in the writ petition being sensitive and serious because the correction fluid/thinner is being used by the children as an intoxicant. Banning of production and sale of **bottled Correction Fluids** as well as **bottled Thinners**, through court intervention, of any chemical composition, both for ink erasing purposes as well as for use as Nail Polish removers and similar other purposes for retail sale.

Mandatory warning should be made on the application devices (pens or otherwise) of correcting fluids/thinners regarding the effects on health.

Issue of Public Health / Interest and Prayer:

A writ petition had been filed before the Punjab & Haryana High Court (P&H HC) under Article 226 of the Constitution of the India, with a prayer for issuance of directions to the respondents (Govt. of India and Ors.):

- To take effective steps for prevention of abuse of **Typewriter Correction Fluid (TCF)** and
- For rehabilitating the abusers of the thinner/diluter and also
- To put complete ban on the production and sale of correction fluid in bottles

Pursuant to the various orders passed by the P&H HC, on the last date of hearing i.e. 18.7.2012, the following order was passed: This matter pertains to **misuse of typewriter correction fluid/thinner by the children**.

Constitution of Task force:

On 10.5.2012, counsel for Union of India placed on record a letter dated 26.4.2012 issued by the Under Secretary to Government of India, Ministry of Health & Family Welfare to the following effect:

“(1) On the orders of the P&H HC in the matter relating to **framing of policy guidelines for regulating the use of correction fluid/thinner**, which are chemical substances generally used in offices but reported to being **widely misused by children/street children as intoxicating substance/drug by inhaling** them to get stimulating effects like drugs, a **Task Force** was constituted by this Ministry to deliberate the matter. The Task Force had **members** from the Department of Chemicals and Petrochemicals, Ministry of Social Justice & Empowerment, Department of Industrial Policy & Promotion, Department of Legal Affairs, Governments of Punjab, Haryana and UT of Chandigarh and technical experts from the National Drug De-addiction Treatment Center (AIIMS, Ghaziabad), Drug De-addiction Centre (PGIMER, Chandigarh) and the Office of Drugs Controller General (India).

On the basis of the deliberations in the Task Force in its two meetings, the written comments of the Department of Industrial Policy & Promotion and in consultation with the Cabinet Secretariat, this Ministry proposes to proceed with the following measures through a **Gazette Notification for controlling/banning sale** of the aforesaid chemical substance, since there is no separate statutory framework for their enforcement.

- (a) Banning of production of **bottled Correction Fluids** as well as **bottled Thinners**, of any chemical composition, both for ink erasing purposes as well as for use as Nail Polish removers and similar other purposes for retail sale.

- (b) Banning of sale of **bottled Correction Fluids** as well as **bottled Thinners**, of any chemical composition, both for ink erasing purposes as well as for use as Nail Polish removers and similar other purposes.
- (c) **Permitting sale** of Correction Fluids as well as Thinners, of any chemical composition, both for ink erasing purposes as well as for use as Nail Polish removers and **similar other purposes** in the form of **pens** or **similar devices** which **allow limited amounts of the chemicals to come out of those devices when used**.
- (d) **Mandatory warning** should be made on the application devices (pens or otherwise) of correcting fluids/thinners regarding the effects on health on inhalation of vapor/consumption of the chemicals contained therein."

Need for Notification:

Taking note of that letter, the following order was passed by the P & H HC on 10.5.2012:

"According to letter dated 26.04.2012, which has been placed on record on the last date of hearing, a notification was required to be issued with regard to banning of sale/production of thinners in the bottles. The Government of India, Ministry of Health & Family Welfare has proposed to issue a notification with regard to banning of production of bottled correction fluids as well as bottled thinners of any chemical composition, both for ink erasing purposes as well as for use as nail polish removers and similar other purposes for retail sale. In paragraph Nos.(a), (b), (c) and (d) of the letter dated 26.04.2012, the aforesaid **suggestions** have been given....."

Delay in Notification:

Court observed it's annoyed that "Today again, counsel for respondent No.1-Union of India states that the notification has not yet been issued. **Despite the Court order dated 10.5.2012 notification for implementation of the measures suggested in the letter dated 26.4.2012 has not been issued till date**". Court further observed that "The issue rose in the present writ petition being sensitive and serious because the correction fluid/thinner is being used by the children as an intoxicant. Non action on the part of the Union of India is not justified. In the circumstances, the matter is adjourned to 8.8.2012. If notification is not issued before the next date of hearing, Secretary to Government of India, Department of Health & Family Welfare, shall come present in the Court."

Measures taken to overcome the problem:

Pursuant to the strict order, Special Senior Standing Counsel for Union of India has placed on record a copy of notification dated 17.7.2012 stating therein that the suggested measures will be taken to overcome the problem.

Need for Strict Implementation and Penal Action Recommended:

Court felt that with the issuance of **notification dated 17.7.2012 by the Ministry of Health and Family Welfare, Government of India**, all the grievances raised in this writ petition stand redressed. Court further directed that however, the Director, Health & Family Welfare of both the States of P & H and UT, Chandigarh are directed to strictly implement the measures as suggested in the above notification and if anybody is found violating the same, the **products be confiscated immediately and necessary penal action be also taken against the culprits**.

Responsibility for Rehabilitation:

Rehabilitation is a continuous process of weaning away the victims of drug dependency. It requires strong family support and follows up to prevent relapse. Social rehabilitation and training for gainful employment are the most important components after weaning addicts away from drug depending to prevent relapse.

Court made it clear that in case any of the petitioners identifies an abuser of the above products, the **matter be brought to the notice of Civil Surgeon of the respective districts in the States of P & H and Director, Health & Family Welfare, UT, Chandigarh, who shall take remedial steps to rehabilitate the said abuser even by taking him to De-addiction Centre**.

Summary & Conclusions:

There is urgent need to create awareness among masses and especially among stakeholders responsible for implementation of these directions of the Hon'ble court. Researchers working on these issues need to see the impact of these directions in larger public interest. Organization of workshops, seminars and conferences to create awareness on these guidelines is the need of the hour.

Mukesh Yadav
Editor

Original Research Paper

Estimation of Stature from Shoe Print Length While Walking In Females

*Raju G M, **Vijayanath.V, ***Anitha M.R

Abstract

In Forensic Anthropology, estimation of stature from feet dimensions plays an important role in establishing individual's identity. The foot length reflects a biological correlation with height suggesting that height may be estimated from shoe print length also. Various anthropometric studies have been conducted on foot in relation to growth and development, ergonomics, evaluation, orthopedics and other medical sciences. However, there is only little investigation, which focused on forensic importance of shoe print. Analysis of shoe prints can reveal very important clues, which can be used as forensic evidence in crime scene investigation. To study the relationship between Stature and Shoe Print length while walking, total 500 females from Karnataka in the age group of 18 to 21 years were examined. The stature estimation was done with linear and multiple regression equations. Recorded shoe print length was measured along parallel axis. The multiplication factors were also computed. The regression formula was checked for their accuracy and reliability. Highly significant and positive correlation was observed between stature and Shoe Print length while walking.

Key Words: Female; Shoe length; Stature; Identification; Investigation

Introduction:

In Forensic Anthropology, estimation of stature from feet dimensions plays a significant role in establishing personal identity.[1] The foot length displays a biological correlation with height suggesting that height may be estimated from shoe print length also.[2]

Various anthropometric studies have been conducted on foot in relation to growth and development, ergonomics, evaluation, orthopedics and other medical sciences.[3] However, there is only little investigation, which focused on forensic importance of shoe print. Analysis of shoe prints can reveal very important clues, which can be used as forensic evidence in crime scene investigation. Apart from giving idea about the bare foot morphology and individualistic characteristics, [4] the shoe prints were also indicative of height of the person.

Height determines size and shape of the shoe prints and thereby making it unique data to establish human identity.

Estimation of stature forms a major domain of medico-legal investigations and helps in estimating approximate height of an individual.[5] On this basis relationship, it is possible to predict the stature from shoe prints also. Keeping all these things in view, the present study was undertaken.

A Forensic investigator usually attempts to achieve the following objectives when he/she processes a shoeprint;

- (i) To determine the make and model of a shoe;
- (ii) To determine if a particular shoeprint belongs to
- (iii) To match the shoeprint with other shoeprints, possibly from other crime scenes. To perform this task, an image of the shoeprint is first obtained using photography, gel or electrostatic lifting or by making a cast when the impressions is in soil, snow or sand.

A comparison of the shoeprint is then made against specific image databases containing current and previous shoeprint images and/or images of shoeprints found at other crime scenes. [6]

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Materials and Method:

Materials: Glass plate, Printer black ink, Manual Roller, Pencil, Measuring scale, Vertical steel scale, Proforma and Calculator.

Methods: The study was conducted in the Department of Forensic Medicine S.S. Institute of medical science and Research center Davanagere, Karnataka; India. 500 Females in the age group of 18-21 years were randomly selected from Karnataka of South India. The subjects from Western, Eastern, and Northern India were excluded along with non-residents of India.

The aim and objectives of the intended study was properly explained to the subjects and informed consent was taken on the Proforma sheet. A plain glass plate of about 24 x 24 Cm. was cleaned and uniformly smeared with a thin layer of black printer ink by using the manual roller. The subjects were then asked to walk casually with shoes on the smear glass plate, so that the prints of left shoe print will be transferred to the duly prepared shoe print Proforma keeping in the mind the need to minimized possible technical source of dimensional artifact.

The height of the each subject was recorded by asking them to stand erect with bare foot on the ground plate attached to the vertical steel scale of two meters (vertical anthrop meter and the subjects were asked to stand without support, the arm on the side, head in steady position. Then height was measured on the vertical distance from the standing surface to the highest point of the head (vertex) with the head orientated in the Frankfurt plane. [7]

The height of individual was measured in centimeters to the nearest millimeter. Traditional anthropometrics, such as Hrdlicka [8] and Olivier [9] seem to favor measuring the left side, as is recommended in old anthropometric efforts at standardization's recorded length of left shoe print was measured along the parallel axis. The length of left shoe print measured from the heel to the tip of the shoe which was recorded in centimeters to the nearest millimeter. This length was taken as the walking left shoe print length of that particular individual. In this every individual left shoe print was collected and recorded.

Observation:

A linear correlation and regression analysis were done on 500 female subjects for assessing the relationship between shoeprint. Length with height and estimation of stature for different levels of shoeprint length in this study the maximum shoeprint length of 24.1-25.99 cm falls 122. Female subjects and their mean height is 166.cm with standard deviation of 5.8 cm.

Average heights of female subjects corresponding with various levels of shoeprint length is represented. Shoeprint length among these subjects ranged from 21.0 -29.99 cm. It can be seen that height of an individual is increased as the shoeprint length increases, showing positive correlation between the two parameters. E.g. Average height was 160.5 cm for shoeprint length of 21.0 -22.99 cm this increased to 188.cm with maximum shoeprint length 28.0-29.99 cm. (Table 1)

We watched correlation between, shoe print length, and height among female subjects. Present study 500 female subjects of shoe print length while walking and their actual height are presented. From analysis it was revealed that there was a significant positive correlation between shoe print length and stature ($r = +0.69$) with this significant correlation an attempt was made to estimate stature based on any given shoe print length. Stature could be predicted from shoe print length in females by using regression equation. $Ht = 91.4 + 3.09$ (SPL) (Table 2)

Discussion:

Shoeprints are often found at crime scenes and provide valuable forensic evidences. It has been estimated that more than 30% of all burglaries provide shoeprints that can be recovered from the crime scene. [10] Because of the pattern of repeated offences, rapid classification of such shoeprints would enable investigating officers not only to like different crimes, but to identify potential suspects while the crime is still 'hot.' [11]

Since shoeprint length is highly correlated with shoe size and increases linearly, in principle shoe size should yield an estimation of height. There are two main difficulties one is variation in the style of sole and heel, which substantially increases the variability of the imprint left by shoes of the same shoe size. [12] If shoe size information, however determined, is used for height calculation, one way of coupling it with our regression equations for estimating female height. Shoeprint lengths correlate with a person height is borne out by results reported in the anthropological literature for more than a century. [13] Suggestions made over the years for putting that interdependence to practical forensic use has been reviewed in the context of an examination.

If present, foot prints, either of more commonly as shoeprints, provide an opportunity for estimating height as one characteristic helping to identify or eliminate a suspect. Bodziak [14] is one of the leading authorities in

the area of manual human shoeprint classification. He described the process of detection, recovery and examination of footwear impression evidence. Evaluating and weighing all the factors involved in shoeprint examination may cause different experts to reach completely different conclusions based on the same facts this happens often because of the lack of common standards in shoeprint examination.

The standards forensic science reference in North America for assessing height from shoeprint data is Michael J. Cassidy's [15] Footwear Identification manual. Cassidy in tropes the shoe size of four types of footwear between the "impression measurements". As Cassidy points out, some shoe styles have the size molded into the sole, and although this information may be discernable in the trace such instances must be rare. Otherwise, however, inserting shoe size between the shoeprint length measurement and the estimate of height adds another potential source of variability. In the Netherlands, [16] all experts routinely use a guideline for shoe print analysis. Even though a shoe print examination is based on the visual comparison of features, or cues in psychological terms, it requires much knowledge of the task at hand.

In an automated shoeprint classification and retrieval system, [17] several practical difficulties exist hindering the effectiveness of shoeprint classification, such as device-dependent noise, distortions, and incompleteness. [6] This makes it desirable to estimate the quality of a shoeprint image before it is fed into the process of feature extraction. It helps the system decides the types of image demising, enhancement, and restoration required. [18] Also, a hierarchical decomposition based on image quality measure can provide the position information for feature descriptors and the weights for different sections in feature matching. An image related database classification system was developed for shoe sole pattern designs. Sole designs are stored with shoe information (brand name, size, style, material, etc). Pattern types and certain features existing on shoe soles and they are used as searching criteria. [19]

A shoeprint collection could be developed by taking footwear impressions of known criminals and/or by visiting shoe stores. In a case, in which there are shoe impressions taken from suspects, crime scene impressions and shoe designs with their brand names in the same database, it is possible to link crime scenes by a single search as well as to get a

suggestion of a possible suspect, and to find a brand name of the shoe. [20]

In the study by Eugene Giles [3] et al the sample sizes was restricted to US Army which may not reflect the normal population.[Includes variables] As normal population includes all types of individuals. Whereas selected, healthy and most often even heighten / above the prescribes height individuals are appointed in army and the age group considered for the above study was not applicable to fewer than 17year or elderly. [Age is not mentioned accurately for elderly]

In present study, the samples collected were from normal population and the origin and birth of parents and grandparents to Southern India was doubly confirmed. And the subjects were of different height. The age group covered in our study was 18 -21 years, which in mostly all the bones are either fused/getting fused in their final step of fusion. In the earlier study the sample collected for shoe print length was in standing position, where as we effected to take the shoe print samples while walking which is unique in our study. The correlation between foot length and height underlies estimating height from shoeprint length, but complications arise from variations in shoe style, fit, and the relationship of shoe sizes to shoeprint length. The regression equation derived from our study is comparable with the Eugene Giles et al as the deviation in their earlier study was +5 and in our study it is + 3.09. So narrowing the gaze has minimized and a maximizing the accuracy.

Conclusion:

Even though trace evidences becoming more and more important in legal cases, only little is known about the influence of task and context factors on comparative judgments. From the forensic point of view, the proposed retrieval method is considered as a method to determine a linkage between suspects only. Nonetheless, the experiments presented are useful to understand the faculty of the method to find the correct image in the database. For forensic scientists, it is often interesting to establish whether the investigated shoeprint has already been photographed and we can also estimate the stature of the individual by applying regression formula.

The confirmation of validity of linear regression equations to reconstruct stature from walking shoeprint length on a fresh sample provides excellent norm grams for the population of this area. Although these norm grams would seem to be applicable in younger adults only, the application of correlation of correlation

factors derived with similar characteristics could, however, enable us to use for older subjects, provided the rate of structural loss is known. Moreover the estimation of stature from walking shoeprint length is easy, economical and convenient. Besides, as it is brought out in this study, the results obtained in laboratory studies can be duplicated under field survey conditions. Anthropologists, forensic experts and investigating officers should be able to use this method to their added advantage. Thus this study has been able to add another method to estimate stature from shoeprint length while walking.

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Table 1: Shoe Print Length and Actual Stature of Female Subjects (N=500)

Shoe Print length (cm)	Subjects	Height (cm) Mean	SD
21.0 -22.99	48	160.5	2.4
22.0-23.99	116	161.0	4.9
23.0-24.99	56	162.6	3.3
24.0-25.99	122	166.0	5.8
25.0-26.99	96	165.7	9.3
26.0-27.99	16	168.8	3.8
27.0-28.99	30	186.0	0.0
28.0-29.99	16	188.0	0.0

Table 3: Prediction of Stature for Given Shoe Print Length FEMALE [Ht=91.4+3.09(SPL)]

Shoe print length (cm)	Predicted Ht (cm)	Range *	
		Min	Max
20	153.2	146	160
21	156.3	149	163
22	159.4	153	166
23	162.5	156	169
24	165.6	159	172
25	168.7	162	175
26	171.7	165	179
27	174.8	168	182
28	177.9	171	185
29	180.0	174	188
30	184.1	177	191

Mean: \pm SD Reg: \pm 6.8 (This formulae is to calculate the stature of an individual by available Shoe print length)

Table 2: Correlations between Shoe Print Length and Stature among Female Subjects

Variable (cm)	N	Mean \pm SD	Range	Corr. * Coeff. 'r-value'	Reg. Coeff. 'b-value'	Reg. equation (Prediction of Ht.)
Shoe print length	500	24.12 \pm 1.75	21.0-28.2	+0.69	3.09	Ht = 91.4+3.09(SPL)
Actual height	500	165.87 \pm 9.05	149-188			

*Diff. in corr. Co.eff. Statistically significant, *SPL-Shoe prints length

Original Research Paper

A Preliminary Molecular Study on Protein Profile of Vital Organs: A New Direction for Post Mortem Interval Determination

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Abstract

Estimation of the postmortem interval (PMI) is one of the most important tasks in Forensic Medicine. Six autopsy organ tissues such as brain, lungs, heart, liver, pancreas and kidney were taken at the time of forensic autopsy. All the proteins present in the tissues were extracted and the protein profile was analyzed on the sodium dodecyl sulfate polyacrylamide gel electrophoresis (SDS-PAGE) starting from 0 day to 10th day after death. The protein profiles showed a consistent degradation pattern which was consistent and reproducible in all the samples with respect to the time interval. In conclusion, the protein profile of the vital body organs appears to be a useful method for estimating the post mortem interval up to 10th day. Advantage of this approach over others is that it can detect the post mortem interval over a long interval (0 - 10 days) with an easily detectable pattern of protein profile.

Key Words: Post mortem interval, Forensic medicine, Protein profile, Vital organs

Introduction:

Post mortem interval (PMI) is the time that has passed since a person has died. The significance of determining the time elapsed since death is critical for Forensic cases. Recently, the methods used to estimate PMI have been algor mortis [1-3]; rigor mortis [4]; vitreous humour changes [5-7]; entomology [8-10]; signs of decomposition and nature of stomach contents. [11-13]

In the last few years, there have been attempts to investigate newer techniques which could accurately determine the post mortem interval. In several studies, estimation of cellular changes [14-15] and estimation of some proteins like Cardiac Troponin I [16] have been correlated with the time of death.

In yet another study, non-protein nitrogen on total soluble protein, aspartic amino transferase activity and creatinine concentration were found to have significant correlation with the time of death. [17] However, so far, there is no study reported in literature which correlates the protein profile of vital organs with time of death. In the current study, a differential degeneration of the proteins in all vital organs has been analyzed. This technique appears to be generating reproducible results and may be indicative of a new direction in the estimation of post mortem intervals in the field of Forensic Medicine.

Materials and Methods:

1. Protein Extraction from Tissues:

Pieces of tissues of heart, pancreas, brain, lungs, liver and kidney were obtained from the autopsy cases of Department of Forensic Medicine, All India Institute of Medical Sciences, New Delhi. Conditions for exclusion were bodies whose time of death was unknown, cases of infective conditions and vital tissue failure.

20 different subjects were taken for analysis. A portion of each of the tissue (25 mg) was partially thawed, trimmed of fat and thoroughly washed with ice-cold homogenate buffer (50 mm Tris-HCl, pH 7.4, 150 mm NaCl, 2 mm MgCl₂). It was cut into small pieces in 1.0 ml of the same buffer. The tissue was then homogenized with a Dounce homogenizer (30 strokes) thoroughly in the buffer keeping the homogenizer in ice. The homogenate was

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centrifuged at 10,000g for 15 min and the pellet containing cellular debris and particulate matter was discarded. The supernatant was collected and kept at 4°C. [18]

The procedure was repeated every second day (after 48 hrs) for all the tissues starting from 0th day till 10th day. (The 0 day represents the day of the death of the subject). The experiments were performed on these 6 tissues for each of the 20 different subjects.

2. SDS-PAGE Analysis of the Proteins

Equal volumes (10 µl) of all the tissues were taken and proteins were separated using a SDS-PAGE. A 10% gel was cast with the thickness of the gel kept at 1 mm by using appropriate spacers using appropriate buffers of Laemmle. [19] The gel was run using a mini vertical gel electrophoresis system (Amersham Biosciences). Samples were mixed with equal volume of sample buffer (62.5 mM Tris-HCl, pH 6.8, 2% SDS, 10% glycerol and 0.01% bromophenol blue) and boiled for 5 min over a boiling water bath. The samples were loaded onto the wells and proteins separated on the gel at a constant current of 20 mA using tank buffer (25 mM Tris-HCl, pH 8.8, 192 mM glycine and 0.1% SDS). The bands were visible by staining the gel in 0.2% Coomassie Blue staining solution. The SDS-PAGE of all the tissues was compared at different time points.

Results:

Similar SDS-PAGE profiles at respective time points were obtained for the respective tissues from 20 different subjects and the best is shown in Fig. 1(A - F). In all the tissues, the major bands that were seen were: Transferrin (75 kDa), Albumin (66 kDa), α -1 antitrypsin (54 kDa), Haptoglobulin (40 kDa), Glyceraldehyde dehydrogenase (35 kDa), Glutathione S-transferase (23 kDa) and Hemoglobin subunits alpha and beta (12 kDa). Though all bands showed a gradual degradation with time, the bands of Albumin and Hemoglobin subunit alpha and beta were the last to degrade. In fact protein profiles of day 10 of all the tissues show significant bands of only these two proteins. In the heart, the protein profiles of the 2nd and the 4th day were similar, but the major change was seen in terms of protein degradation from the 6th day onwards, while on the 10th day, almost all proteins were in a negligible amount. Similarly in the pancreas and lungs, there is a decrease of protein concentration after 6th day.

In case of liver tissue, all the bands started showing a significant decrease in concentration right on 4th day itself and further

degradation occurred at every interval. In case of brain tissue, there was decrease in protein concentration of low molecular weight bands after 2nd day and slight increase in concentration around 6th day, probably due to degradation of high molecular weight bands to low molecular weight subunits. The proteins of kidney tissue, like in the case of liver, showed decrease in concentration from day 4 onwards.

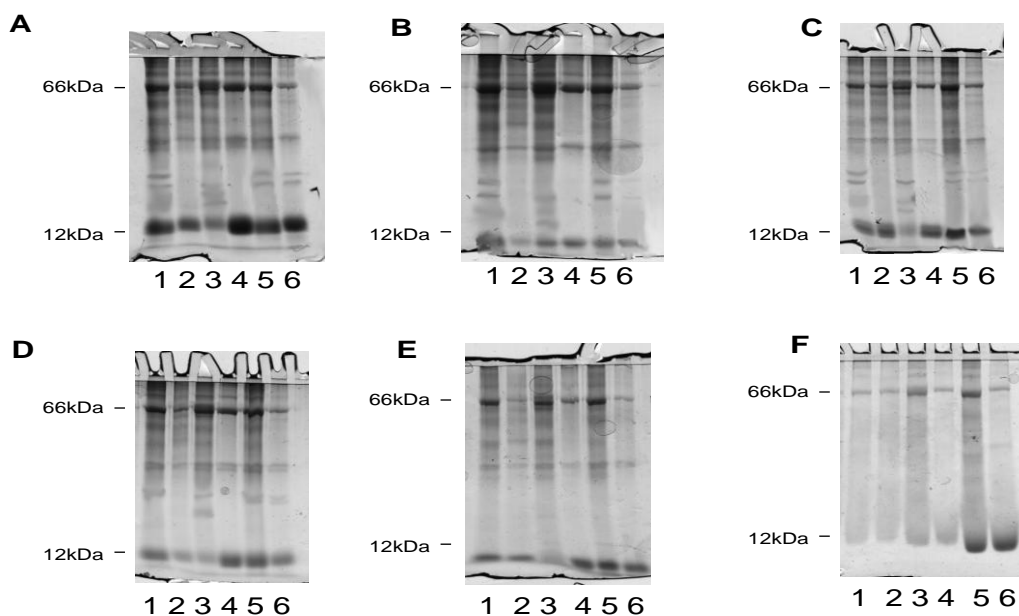
Discussion and Conclusion:

In conclusion, there is complete degradation of all the proteins, except Albumin and Hemoglobin subunit (alpha and beta) in all the tissues after the 10th day. With time, the protein concentration per weight of tissue sample decreased. It was also clear that Albumin and Hemoglobin subunit beta were the last proteins to get degraded. In all the samples tested, the protein profiles were consistent with time. However, among all tissues, liver and kidney showed the most consistent profiles as well as the earliest response in terms of degradation of proteins with time. These results indicate a mechanism of relating the protein profiles measured by SDS-PAGE with the post mortem interval. This technique could be a reliable molecular index for determining the post mortem interval in the future.

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Original Research Paper

Patterns of Fatal Scald Burns In Central Delhi A Retrospective Study

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Abstract

Thirty six unselected autopsy cases of fatal scald burn received from Central Delhi were studied during the period from July 1998 to June 2010 at Department of Forensic Medicine, Maulana Azad Medical College and associated Hospitals, Delhi. The data was analyzed with regard to age, sex, place of occurrence, pattern of injury, mode of infliction, survival period, cause and manner of death. The cases represented approximately 0.31% of all autopsy received during the same period. There were 24 males (66.7%) and 12 females (33.3%) with male to female ratio 2:1. The age range of the victims was 10 months to 70 yrs with mean age of 16.93 years and Standard deviation of 19.32. Domestic accidents were attributed to 72.2% of all deaths. All except one case were accidental in nature. Hot water splashing from the cooking utensils/ falling over to boiled water in kitchen (68.75%) was the most common mode of injury. Thorax (86.1%) was the most common body region involved. The average total body surface area (TBSA) burn was 50.83%. The mean survival period of all victims was 3.83 days. All the victims were hospitalized after the incident and in majority (75%) of them died due to septicemia.

Key Words: Scald; Hot Liquid; Children; Septicemia; Accidental

Introduction:

Deaths arising from application of heat often constitute a major medico-legal problem. The most common type of burns is thermal burns. These may be divided into two groups-those due to hot liquids & steams and those due to dry heat and fire. [1] A 'scald' refers to tissue damage from hot liquid; usually water. [2] Other hot fluids include oils, molten rubber, liquid chemicals and steam. The scalds are usually not as severe as burns because the hot liquid, while applied on the body run off the surface and rapidly cool on accounts of their evaporation. [3]

Most scald burns are not life threatening, but many of times it is dangerous to life especially for children and the elderly. The extent of damage depends upon the temperature of the liquid, ability of the body surface to conduct away the excess heat, duration of the heat applied. In this article the pattern of scald burn and methods of prevention are discussed.

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Material and Methods:

Between the years from July 1998 to June 2010, thirty six cases of death due to scald burn were autopsied within the jurisdiction of Central Delhi, amounting to about 0.31% of all autopsied cases and 1.05% of all burn cases received in the mortuary of Maulana Azad Medical College and associated Hospitals during the same period. Detailed analysis of cases was based on the medical records and evaluation of autopsy reports.

Results:

The majority of the victims (n=24, 66.7%) were male as compared to female (n=12, 33.3%) with a male to female ratio of 2:1. (Fig.1) The commonest age group involved was 0-10 years (58.33 %) followed by 31-40 years (16.66%) and 21-30 years, 11-20 years (8.33%) each. There was no case reported in the age group of 41-50 years. Only one case (2.33%) was reported in the age group of more than 60 years. (Fig. 2) The mean age was 16.93 years with Standard deviation 19.32.

The majority of the incident occurred at home (72.2%). (Table 1) The thorax was involved in 86.11% of cases followed by the abdomen (83.3%), upper limb (80.55%), lower limb (72.22%), head & neck (50.0%) and genitalia & perineum (22.22%). (Table 2) Average percentage of total body surface area (TBSA) burn was 50.83. The burn range was from 20%

to 90%. Only one case of homicidal scald burn injury was reported, and rest of cases were accidental in nature (97.2%). (Table 3)

The mode of injury in the descending order were, falling over to boiled water or hot water splashed from the cooking utensil in kitchen (68.75%), fall into karahi full of hot sugarcane juice (16.66%) and spillage of hot milk/tea while playing (8.33%). (Table 4) All persons died in the hospital. The range of survival period was 4 hours to 9 days. Average survival period was 3.83 days. (Table 5) Most of the victims (75% cases) were died due to septicemia. (Table 6)

Discussion:

There is paucity of article regarding the autopsy study of fatal scald burn, though patients with scalds burns constitutes a large number of all patients hospitalized for burns. This may be because of the number of fatal cases reported due to scald burn is less in comparison to other mode of burns like flame burns and electrical burns. However many articles related to the scald burn in children, attending to the emergency services are available in biomedical literature. Burns and scalds are the fifth leading cause of death in the European Union for children. [4]

Scald burns make up more than 75% of the pediatric burns patients in New Zealand. [5] It constituted 50% of all burns, a study reported from Netherland. [6] Scald was counted for 33%-58% of all patients hospitalized for burns in USA. [7] Between January to August 1990, scald burn constituted 16.4% of total burns, reported from a tertiary care hospital of Jaipur. [8] The incidence of scald burn death was 3.3% of all burn deaths reported by Singh D et al from Chandigarh. [9] Fatal scald burn constituting about 2.8% of all burns reported from KMC, Manipal, India. [10] Burns was among the 15 leading causes of death in India; however the exact data regarding fatal scald burn is not available. [11]

Majority of the victims in the present study were male (66.7%, n=24). Similar results were reported by, Rimmer RB et al, which showed incidence of scald burns more in male (52%) as compared to female (48%). [12] Al B et al studied 816 cases of scald and flame burns in which 43.5% female and 57.5% male were found. [13] Light TD et al showed that the incidence of flame burn was more in female (55 vs. 47%) as compared to males under 16 years of age; however the scald burn was more common in male. [14] The male predominance is due more cases reported in male child age

group of this study. The personal and behavioral characteristics of male child susceptible them for more scald burn.

In our study, maximum cases of fatal scald burns were in the age group of 0-10 yrs, which is consistent with the study conducted by Gurol Berber et al in Diyarbakir city, Turkey. [15] It was reported that scald burns are important reason of mortality and morbidity, frequently seen at home and mostly affect 0-4 years of age group. [16, 17] Hertog PC et al revealed that among the children admitted to hospital, in Netherlands for burns, 75% suffered scalds. [6]

Scald was the leading cause of burns (67%) in the age group of 0-14 years, found in a study from Kuwait. [18] Most of burning cases between 0-10 ages were scalding, reported in a study from Israel. [19] A study from Turkey revealed that 70% of burning cases in childhood were scalding. [20] The incidence of scalds was greatest in the age group 0-2 years. Scalds were the most common type of burn among children below 4 years age, revealed in a study from Chennai, India. [21, 22] Young children are at especially high risk for scald burns.

It is because they may not perceive danger as readily, less control over their environment and lack of ability to escape a life-threatening burn situation. The fatal cases reported more because they have thinner skin than older children and adults, their skin burns at lower temperatures and more deeply.

This study revealed that in one case there was allegation of upper body part a young female was forcefully dipped into a container full with hot water. She sustained scald injuries over her head, face, neck, front of chest, upper abdomen and front of right upper limb amounting about 35% of body surface area. She was taken to a hospital where she died after two days due to septicemia. Scalds are usually accidental in nature. [9, 10, 15, 23] However sometimes boiling liquid may thrown with intent of inflicting injury. Scalding of suicidal origin is rare because it is very painful and there is no guarantee of death.

Falling over to boiled water /hot water splashed from the cooking utensil in the kitchen (68.75%) was the most common mode of scald injury in our study. The children usually play inside the kitchen unsupervised, resulting in accidental spillage of cooking pots or beverages over them. A similar study reported from Kuwait, where hot water from pans/pots in the kitchen was the most common etiologic factor (59%). [24] Hot water in kitchen was the chief causal factor for scald. [25] A study of scald burn in the age group of 0-5 yrs revealed that most

accidents took place in the dining/living room and most were caused by coffee. [26] In western countries, scald injuries commonly result from tap water that is too hot for safe use. [27] In India, there is no provision for supply of running hot water in domestic use. Hence we are not getting these types of cases. In our study six cases of death reported due scald burn resulted from fall into karahi full of hot sugarcane juice. Jaggery burns were more associated with higher mortality.

The hot jaggery, a sticky liquid, adheres to skin and the contact time will increase resulting in more damage. The victims are usually older children, more likely male, and have larger burns, reported from south India. [28] Most of the incidents occurred in domestic circumstance which is supported by the study from Bang et al. [24] In the majority of patients, less than 10% total body surface (TBSA) burn was involved. The mean TBSA was 8% with mean length of stay of 8 days, as shown by Rimmer RB et al [12]

The average total body surface area involved was 64% in scald burn reported in a study from Vellore, India. [14] The upper limbs were the most commonly affected body region (51.8%), both isolated and in association with other locations followed by the head and neck revealed by Reig A et al in a study from Spain. [29] In our study the victims were sustained injuries mainly on the upper part of the body.

The localization of scald injury is explained by the mechanism that when a curious child pulled a container filled with hot water placed at a higher position resulted in spillage mainly on the upper body part. The reason for frequent localizations of scalding on the face, head, neck, trunk and upper limbs is when the child pulled a cloth or electric cable attached to a coffee machine, thereby upsetting a container of hot water, described by Guzel A et al. [30]

Septicemia was the major cause of death, revealed in our study. Scald burn resulted in loss of functional skin barrier which is susceptible to infection. Infection is the major cause of morbidity and mortality in burns. Infections acquired from hospital or from the patient's own endogenous flora have a significant prevalence after burns. [31, 32]

Conclusion:

In an attempt to plan preventive strategies, we studied the factors leading to pediatric scald burn injury. Prevalence of scalds can be attributed to the fact that children are often left unattended at home and they are too

small to understand the dangers of being in the vicinity of injurious agents. It is the child's natural curiosity and inability to understand that certain things are dangerous to them, which leads to scald injury. These factors are further substantiated by the lack of supervision, lack of awareness about injurious agents and carelessness on part of parents. If dangerous objects are kept out of the reach of children, these injuries can be avoided. Greater awareness and parental education will help in preventing pediatric scald burn injury.

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Fig.1: According to Sex

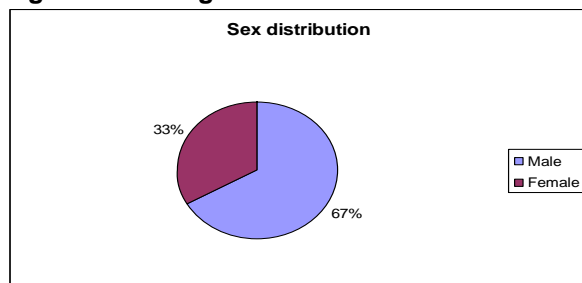


Fig. 2: According to Age

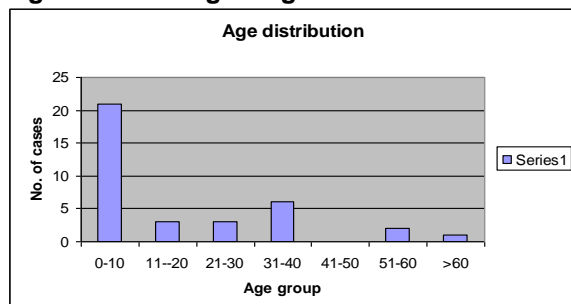


Table 1: Place of Occurrence

Place	Total	%
Domestic	26	72.2
Non domestic	10	27.8

Table 2: Injury to Body Region

Body region	Total	%
Head & Neck	18	50
Thorax	31	86.1
Abdomen	30	83.3
Upper limb	29	80.5
Lower limb	26	72.2
Genitalia & perineum	8	22.2

Table 3: Manner of Injury

Manner	Total	%
Accidental	35	97.2
Homicidal	1	2.8

Table 4: Mode of Injury

Mode of injury	Total	%
Falling over to boiled water /Hot water splashed from the cooking utensil	22	68.7
Fall into karahi full of hot sugarcane juice	6	16.7
Pouring of hot oil from pan	1	2.8
Spillage of hot milk/tea while playing	3	8.3
Falling over hot molten soldering metal	1	2.8
Unknown	1	2.8
Hot water from bursting of boiler	1	2.8
Falling in hot water tank	1	2.8

Table 5: Survival Period

Survival Period	Cases	%
< 24 Hrs.	7	19.4
1-7days	26	72.2
>7days	3	8.3

Table 6: Cause of Death

Cause of death	Total	%
Septicemia	27	75
Shock	9	25

Original Research Paper

Toxicology Unit in Department of Forensic Medicine Emphasis from a Study from North East India

*Yogender Malik, **Ritu Raj Chaliha, ***Pushendra Malik, ****Munish Jaswal

Abstract

In suspected poisoning cases the final opinion as to the cause of death is generally kept pending till receipt of the chemical analysis report from the Forensic Science Laboratory (FSL). Cases of suspected poisoning deaths from Kamrup district coming to the GMCH morgue were studied from 1st August 2008 to 31st August 2009 with aim of analyzing the time consumed at various levels. A total of 2592 autopsies were performed during study period and in 160 cases viscera were preserved. Viscera Report of 60 is awaited as on 1st November 2009. 31 cases gave positive results for poison and 69 cases gave negative report. In 21.9% of cases police took more than a month to take the samples to SFSL and in more than 47.5% cases SFSL took >2 months to convey report. In nearly all cases the final opinion as to the cause of death was given the same day on which the report was received. So, establishment of Toxicological Laboratories in Dept of Forensic Medicine and Toxicology can minimize this delay.

Key Words: Poisoning, Autopsy, Forensic Science Laboratory, Viscera report

Introduction:

In suspected poisoning cases, viscera preserved follow a long tortuous route from Forensic Medicine dept, through police, after taking permission from magistrate or Deputy Superintendent of police, to FSL and back to the department for final report. This study aims at analyzing the delay of viscera report at various levels. Such knowledge gives us proper view of handling of such cases by police and load of cases in FSL.

Material and Methods:

160 cases of suspected poisoning cases were retrospectively studied between 1st august 2008 to 31st august 2009 in the mortuary of Gauhati Medical College, Guwahati, Assam. Records of these cases were studied at various levels.

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These included forwarding letter of officer in charge, inquest, dead body challan, certificate issued by hospital where treatment was received before death. It also include post mortem report, SFSL report communicated to department and final report issued by department for cause of death.

Observations:

In 37.5% cases report of chemical analysis of viscera was not received from SFSL till 1st November 2009. (Table 1)

Organochlorine is most common poison followed closely by Organophosphorus. (Table 2) Our study showed that in 21.9% cases police took more than a month to take viscera to SFSL. (Table 3)

In 47.5% of the cases there was delay of more than two months to convey chemical analysis report of viscera from SFSL to Department of Forensic Medicine. (Table 4)

Cause of death could not be ascertained in 43% of the cases in final report and poisoning was given as cause of death in 31% of the cases. (Table 5)

Results:

In 21.9% cases police took more than a month to take viscera to SFSL. There was delay of more than 2 months in 47.5% cases in conveying result from SFSL to Dept of Forensic Medicine. 37.5% of cases are still pending with FSL as on 1st November 2009. 31 cases gave positive result for poisons in FSL report. Organochlorine is most common poisoning in

this study (45.16%), followed by Organophosphorus (41.9%). Cause of death could not be ascertained in 43% of cases.

Poisoning was given as cause of death in all cases where poison was reported by SFSL in viscera analysis.

Discussion:

Failure to preserve and dispatch the exhibit/samples at the earliest to the FSL, by the doctor concerned, renders him/her liable to be charged with causing destruction of evidence under sections 201-204 of the Indian Penal Code. It is well known that India has a high incidence of poisoning, being the 4th most common cause of mortality in rural India. [1]

Despite high number of poisoning cases low priority is assigned to these cases by the police. This could be due to mostly suicidal or accidental nature of poisoning and shortage of

manpower in police stations. There are few forensic laboratories in India which have to cater needs of a large population. In Assam there is only one forensic science laboratory which naturally has huge load of cases from all over the state and hence delayed viscera reports.

In all the cases, the doctor gave the opinion as to the cause of death on the same day of the receipt of chemical examiner's report. This study makes a strong case of attaching a toxicology unit with department of forensic medicine. This will help in giving final opinion at the earliest to help next kin of the deceased in completion of paper work and judiciary in timely disposal of cases.

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Table 1: Report Status

Report status	Report received from FSL		Report not received	Total cases
	Positive	Negative		
Cases	31	69	60	160

Table 2: Types of Poison Reported in Final Report from FSL

Type of poisoning	OP	OC	Carbamate	Alcohol	Propane	Acid	Phenol	Total
Cases	13	14	2	0	1	1	0	31

Table 3: Time lag b/w Viscera in Morgue and FSL (Police)

Days	<5 days	5-15 days	16-30 days	>30 days	Total
Cases	96	14	15	35	160

Table 4: Time lag b/w Viscera in FSL and Receiving of Report in Department

Days	<15	15-30	31-45	46-60 days	>60	Total
Cases	26	22	16	20	76	160

Table 5: Causes of Death in Final Opinion

Cause of death	Poisoning	Other than poisoning	No opinion	Total
Cases	31	26	43	100

Original Research Paper

Pattern of Road Traffic Accidents in Imphal

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Abstract

In recent years the incidence of Road Traffic Accidents is increasing at an alarming rate throughout the world posing itself as a major epidemiological as well as medico-legal problem. In a study of 205 cases of Road Traffic Accidents brought to the mortuary of Regional Institute of Medical sciences, Imphal during September 2007 to August 2009, it was noted that males (75.13 %) outnumbered the females (24.87%). Majority of the victims were in the age group of 21 - 30 years (24.89%). It was also noted that majority of the accidents happened in the National Highways (59.51%) and pedestrians were the commonest victims (37.56%). Trucks were the most frequent offending vehicles (34.63%) followed by Buses (22.94%) The commonest cause of death was due to shock and haemorrhage (34.64%). large number of human lives can be saved if trauma centres are established along the National Highways equipped with well trained medical personnel and complete infrastructure of emergency care.

Key Words: Road Traffic Accident, Injuries, Death, National Highways, Pedestrians

Introduction:

Everywhere in the world, a growth in the transport system has naturally been one of the reflections of economic development. More and more people are making investments in vehicle and transport infrastructure. Hence, in recent years the incidence of RTA is increasing at an alarming rate throughout the world posing itself as a major epidemiological as well as medico-legal problem. This has resulted in an increase in morbidity and mortality in our country as well.

According to the National Crime Record Bureau (2010) [1], the number of vehicular accidents was 430600 resulting in 133938 deaths and 470600 injuries thereby accounting for 37.2% of all accidental deaths due to unnatural causes. Therefore, the present study has been aimed at analyzing the various factors related to RTA in Manipur (topographically different from mainland, India). This may help in formulating preventive measures to reduce the burden caused by such accidents.

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Materials and Methods:

The present study was conducted at the Department of Forensic Medicine, Regional Institute of Medical Sciences (RIMS), Imphal, Manipur. It included all cases of RTAs brought for autopsy to the mortuary of RIMS during the period of September 2007 to August 2009. Information regarding the particulars of the victim, the date, time and place of accident, type of offending vehicle, and the survival time of the victim following the injuries were collected by examining the police papers, hospital records, and also interviewing the relatives of the victim. Decomposed bodies were excluded from the study.

Observations:

Out of 1257 medico-legal autopsies conducted during the study period, 205 cases (16.31%) were of RTA. Males (75.13 %) outnumbered the females (24.87%) and the male/female ratio was approximately 3.02:1. The maximum number of RTA fatalities was recorded in the age group of 21-30 years (24.89%) and the least in persons above 70 years of age (3.42%). (Table 1)

The maximum number of cases (32.2%) occurred in the winter season. (Table 2) In this study, it was observed that the maximum numbers of vehicular accidents (49.27%) were reported between 12 noon to 6 P.M. followed by the period of 6 A.M. to 12 noon (31.71%). (Table 3) It was noted that majority of the accidents happened in the National Highways (59.51%) followed by link roads (21.95%) and State roads (18.54%). (Table 4)

Among the various types of road user, the pedestrians constituted the maximum number of victims (37.56%). It was followed by vehicular occupants (28.29%) and two wheeler riders (18.06%). (Table 5)

In the present study, trucks were the frequent offending vehicles (34.63%) followed by Buses (22.94%) and Light motor vehicles (LMV) (20%). (Table 6) Following the accidents, most of the victims (36.10%) died on the spot. Among those who died sometime after the accident, 23.41% survived for varying periods between 1-6 hrs. (Table 7) The commonest causes of death were due to shock and haemorrhage (34.64%), injury to the brain (30.73%) and intracranial haemorrhages (18.54%). (Table 8)

Discussion:

Out of a total of 1257 autopsies, 205 cases were due to RTA. This incidence is second only to firearm injuries which can be attributed to the problem of insurgency and counter insurgency in the state of Manipur. In the present study, males outnumbered females. [3] This male predominance is also observed by other authors. [4-6] it could be due to the fact that being the bread earners, males spent most of their times outdoor, hence exposing themselves to the hazards of roads.

It was also observed that the age group 21–30 years was the most vulnerable group (24.89%). [7-10] Gupta S et al [8] and Menon A and Nagesh KR [10] reported that the least affected group were those above 70 years (2% and 1% respectively) which is consistent with this study (3.42%). Majority of these accidents occurred in the National Highway (59.51%). [2, 11-13] This can be explained on the fact that Manipur even though a small state has three National highways and these are the busiest roads with vehicles travelling at high speeds, the roads being wider and majority are in good driving conditions. Maximum number of cases (32.20%) was recorded in the winter months, which is in concurrence with Dhillon S et al [11] who reported 32%. [2, 13] In this study, the maximum number of accidents occurred during day time with a peak period between 12 Noon–6 PM (49.27%) followed by period between 6 AM – 12 Noon (31.71%). [14] However; this finding is in contrast to the observations made by other authors [5, 15] who recorded a peak incidence between 6 PM–12 Midnight. This difference can be attributed to the fact that the busiest period in Manipur is between 6AM–6 PM where the majority of the people travel for work, school etc, with a sense of urgency to reach their destinations. Moreover, because of the

prevailing law and order problem in the state, most of the people prefer to stay indoors and do not venture out after dark, thereby, the low incidence of accidents in the night. Pedestrians (37.56%) were the commonest victims of fatal RTAs. This is followed by occupants of vehicles (28.29%) and two wheeler riders (18.06%). Similarly, Singh H and Dhatarwal SK [13] observed that pedestrians were the frequent victims (28.7%) followed by vehicular occupants (25.8%) and motorcyclists (23%). [7, 16-17]

This can be explained by the fact that there is a lack of proper footpath, lack of traffic sense, presence of vendors by the road side and ignorance of traffic rules by the pedestrians.

In this study, trucks and buses were the offending vehicles in 57.57% of the cases followed by LMVs with 20%. [6, 13, 15] Most of the victims succumbed to their injuries within 1 hr (56.59%). Of those who survived after the accident, 43.9% died within 6 hrs. This is slightly higher compared to Singh H and Dhatarwal SK [13] who reported 39.5% deaths within 1hr.

According to Sharma BR et al [3], 51% died within 6 hrs, out of which 27% were spot death. Singh H et al [16] observed that 54.4% of the victims died within 6 hrs. The higher incidence of early deaths may be due to inadequacy of early transport and management of trauma patients in the state. These findings also reflect the severity of the injury where the majority of the victims who succumbed early were those with head injuries. In this study, the commonest cause of death was shock and haemorrhage (34.64%) followed by injury to the brain (30.73%) and intracranial haemorrhages (18.54%). This is consistent with the findings of Singh H and Dhatarwal SK [13] and Biswas G et al [5] who also noted that shock and haemorrhage (36.9%) was the common cause of death followed by severe brain injury (19.6%) and intracranial haemorrhages (14%). These findings indicate that there was a delay in the transportation of victims from the accident site and lack of emergency medical care on the spot. This also emphasizes the need for emergency ambulance and well trained medical personnel for emergency services.

Conclusion:

RTA continues to be a growing menace, hugely affecting the country's economic development as many precious lives are lost in the most productive age group. This stresses the need for an urgent national policy on road safety, constructing road networks conforming to the volume of traffic, ensuring proper scrutiny of

individuals before issuing their driving licenses, educating the public on road safety, etc.

As evident from the study undertaken, majority of the accidents happened in the National Highways. This not only emphasizes the requirement of ambulances stationed along the stretch of national highways, but also to create awareness among the common people on first aid so that precious life can be saved within the crucial first few hours period. Lastly, large number of human lives can be saved if trauma centers are established along the National Highways equipped with well trained medical personnel and complete infrastructure.

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Table 2: Seasonal Variation

Months	No	%
Winter (Dec to Feb)	66	32.20
Spring (Mar to May)	50	24.40
Summer (Jun to Aug)	30	14.63
Autumn (Sept to Nov)	59	28.77
Total	205	100

Table 1: Age and Sex Incidence of Victims

S.N.	Age grps (yrs)	Males		Females		Total	
		No (%)		No	%	No	%
1	0-10	8	3.91	5	2.43	13	6.34
2	11 –20	14	6.82	7	3.42	21	10.24
3	21 –30	45	21.96	6	2.93	51	24.89
4	31 –40	27	13.18	9	4.39	36	17.57
5	41 –50	26	12.68	5	2.43	31	15.11
6	51 –60	21	10.24	11	5.37	32	15.61
7	61 –70	9	4.39	5	2.43	14	6.82
8	>71	4	1.95	3	1.47	7	3.42
Total		154	75.13	51	24.87	205	100

Table 3: Diurnal Variation

Time	No	%
12 Midnight – 6 AM	7	3.41
6 AM – 12 Noon	65	31.71
12 Noon – 6PM	101	49.27
6 PM – 12 Midnight	32	15.61
Total	205	100.00

Table 4: Types of Roads

Types of Roads	Cases	%
National Highways	122	59.51
State Highways	38	18.54
Link road	45	21.95
Total	205	100

Table 6: Types of Offending Vehicles

Types of vehicles	No	%
Truck	71	34.63
Bus	47	22.94
Tractor	2	0.97
Two wheeler	36	17.56
LMV (car, gypsy, van, sumo, jeep)	41	20.00
Three wheeler (Auto rickshaw, Rickshaw cycle)	8	3.90
Total	205	100

Table 5: Types of Victims

Types of Victims	No	%
Pedestrian	77	37.56
Occupant	58	28.29
Two wheeler rider	37	18.06
Cyclist	17	8.29
Pillion rider	13	6.34
Rickshaw puller	3	1.46
Total	205	100

Table 7: Period of Survival of Victims

Survival Period	Cases	%
Spot	74	36.10
Within 1hr	42	20.49
1 – 6 hrs	48	23.41
6 – 12 hrs	15	7.32
12 – 24 hrs	3	1.46
1 – 3 days	19	9.27
3 – 7 days	4	1.95
Total	205	100

Table 8: Cause of Death

S. N	Cause of death	Cases	%
1.	Shock and haemorrhages	71	34.64%
2.	Intracranial haemorrhages	38	18.54%
3.	Injury to vital organs		
	Brain	63	30.73%
	Heart alone	8	3.90%
	Lung	14	6.82%
	Heart + lung	6	2.93%
	Brain + lung	5	2.44%
	Total	205	100

Original Research Paper

Patterns of Cause of Death in Unknown Dead Bodies A Three Year Study in a Tertiary Care Hospital

*Ajay Kumar, **Dasari Harish, ***K.H. Chavali, *Amandeep Singh

Abstract

Opinion about the cause of death in unknown dead bodies is a test of ability of the Forensic expert and on many occasions yields little or no results. The reasons may be inadequate/no history, disinterested Investigating officers unwilling to properly work out the case, partial/complete decomposition/destruction/mutilation of the body, etc. In such cases, identification of the body as such poses problems; rest aside the opinion regarding the cause/manner of death. The present 3 year study was undertaken to find the cause of death and the pattern of causes of death in unknown dead bodies, as well as the efforts made to establish the identity in these cases.

Unidentified bodies comprised 4% of the total 1577 cases brought for postmortem examination to the department. Maximum number of cases belonged to the age group 41 -50 years, 35%. Majority of the opinions regarding the cause of death were given as cranio-cerebral damage, 30%, followed by "no definite opinion", 28%. Viscera for chemical analysis were sent in 24%, histopathology in 8% and for both chemical analysis and histopathology, in 27% cases.

Key Words: Identity, Forensic identification, Unidentified bodies, Dead, Cause of death

Introduction:

Identification means determination/establishing the individuality of a person.[1,2] The process of identification is an everyday occurrence in life, both in civil and criminal cases; be it joining a school/college/job, opening an account/getting a license, etc. In fact, almost every activity in our social life hovers around "identification".

For the purposes of law, identification has to be carried out both in the living and in the dead. [2] Though this is primarily the domain of the investigative agencies; the forensic experts, both medical and non-medical, play an important role in the said process. This is achieved through numerous parameters, both conventional and scientific. [3-7] However, the problem gets aggravated and taxes the resources of most experienced forensic expert when the bodies are recovered in skeletonized form or in a mutilated state. [8]

This mutilation may be intentional by the criminals in an effort to destroy all traces of identity or to facilitate disposal of the body. [1]

In our country, a dead body can be mutilated and the soft tissues completely devoured by various animals and vultures in a very short span of time, when disposed off in isolated lonely places. Mass disasters like earthquakes, bomb explosions, air-crash, railway accidents, etc. are other common instances where bodies can be found in a mutilated state. [1, 9] Establishing identification and the cause of death in such cases can become a Herculean task.

It has been said with a considerable measure of truth that the postmortem examination reveals the disease and lesions that the person lived with, and not necessarily those that killed him. [9] So, in these cases, after ruling out physical injury, one has also to rule out poisoning and disease. In order to do so, the usual viscera are sent for routine chemical analysis and histopathology, and an interim report handed over to the police personnel. The final opinion regarding the cause of death is given after receiving the said reports from both the quarters and after incorporating the findings.

As far as possible, an attempt is made at giving a definite opinion; however, when this is not possible, "no definite opinion" is mentioned in the report as regards the cause of death and

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one should not venture to guess "some opinion", just for the sake of giving opinions. [9]

Aim and objectives:

1. To study the cause of death, and the pattern of cause of death in unknown dead bodies.
2. To analyze the various efforts made on part of the investigating officer and the autopsy surgeon to establish the identity of the unidentified bodies.

Material and Methods:

Unidentified bodies brought for postmortem examination to the mortuary of the Department of Forensic Medicine & Toxicology, Government Medical College & Hospital, Chandigarh; during the three year period 2008 – 2010 comprised the material for the study. Data regarding these cases was compiled from the postmortem reports, inquest papers; detailed history elicited from the concerned police officials at the time of autopsy, etc.

Observations and Results:

A total of 1577 bodies were brought for postmortem examination to the mortuary of the department during the period under study. Of these, unidentified cases comprised 4% (60 cases). There were only two females (3%).

Maximum number of cases belonged to the age group 41-50 years, 35%; followed by the age groups 31-40 & 21-30 years, 20% each. The age groups <10 years and 11-20 years accounted for the least number of cases, 3% each. (Table 1)

Overall, the maximum number of cases were encountered in the month of June, 15%; followed by May, 13%; while the least number of cases was seen in the months of March and November, 3%, each. However, year-wise, there was no such pattern – the months when maximum cases were brought to the mortuary being: January in 2008, April & May in 2009 and June in 2010. (Table 2)

Opinion regarding the cause of death was given at the time of autopsy in 41% of cases while in the remaining cases additional investigations were requested. Viscera for chemical analysis were sent in 24% cases, histopathology in 8% and for both chemical analysis and histopathology, in 27% cases. (Figure 1)

Majority of the opinions regarding the cause of death in these cases was given as 'cranio-cerebral damage', 30%. Opinion regarding the same was reserved in 28% cases for want of the reports of the toxicological and histo-pathological analysis of the viscera sent for the same to the concerned quarters. Coronary insufficiency/ cardiac disease were responsible

for 11% deaths, while multiple organ failure/disease was responsible in 7% cases. (Table 3)

The police had completed their formalities regarding photograph and publication of notice in dailies in all the cases. They had, however, taken fingerprints in 40% cases only. The autopsy surgeon, on the other hand, had handed over clothes in 63% cases (to facilitate the process of identification), finger pulps of all the ten fingers in separate sealed packets in 53% cases, noted the marks of identification/deformities/tattoos in 55% cases and preserved sternum for DNA analysis/blood for cross matching in 7% cases. (Table 4)

Discussion:

Unidentified bodies brought for postmortem examination comprise a small but a very significant and important group of cases in every autopsy surgeon's career. These cases really test the skill and expertise of the specialist and the investigative agencies, to the limit. Most of the cases require time consuming formalities, as required by the law, viz., a waiting period of about 72 hours, publication of photographs and details of the deceased in the leading dailies, interactive pooling of data from various agencies all over the country, etc., to name a few. A forensic medicine specialist can contribute very much by giving detailed data gathered from a thorough examination and dissection of the body. It is also his duty to opine regarding the cause, manner and nature of death, based on his findings, reports of the investigations sought by him from different laboratories, etc. It is here that his skill and expertise come in to play.

A thorough search of the literature did not yield much information regarding the identification of the unidentified dead in the Indian context. Mostly, they were devoted to individual body identification or identification of victims of mass disasters. [10-12]

In the present study, unidentified bodies comprised 4% of the total autopsy load of the department during the period under consideration. In a previous study, it was observed that they account for about 10% of the total autopsy load. [13] Males were predominant, accounting for 97% of the cases. Similar findings were observed in a study in Maharashtra. [10] This could be due to the predominantly patriarchal society of our country, where a female's main domain is her home; be it parental or in-laws, and her absence is usually enquired in to; while a male is free to go about where ever he wants. The average Indian male, being the bread-winner of his family is usually forced to

leave his home and venture to far off places for better opportunities of earning his livelihood. Sometimes, the family is even unaware of the place of employment of the person and at times, people work at different places each day as manual labour. In case of his death at such places, his body is brought to the morgue as "unidentified", where legal formalities dictate a postmortem examination.

The age group 21-50 years was responsible for 75% of the cases. This is the most mobile age group for various reasons, both economic and social and hence also the age group prone to unnatural deaths suicidal, accidental or homicidal. However, taking the decadal distribution in to consideration, it was found that the group belonging to 41-50 years was the single most involved in these cases. This is in contrast with our previous studies where we observed the most common age group to be 16-25 years in cases of hanging [14], 21-30 years in cases of poisoning, burns and vehicular accidents [15-19] Though the socio-economic data of these cases could not be compiled for obvious reasons, usually a majority of these cases are from the lowermost rungs of the socio-economic ladder.

Viscera were sent for analysis in 60 % cases. In the other 40% cases, the cause of death was obvious – cranio-cerebral damage, 30%; hemorrhage and shock, 8% and hanging 3%. Of the 36 cases in which viscera were sent for analysis, reports were not received in about 47% cases till finalization of this paper. This is a very sizeable percentage of cases and speaks volumes of the delay taken by the various laboratories in processing the cases. [20]

This has become a routine in our present medico-legal set-up where it takes several years sometimes for the reports to reach the autopsy surgeon. Even when they are received, they may be inconclusive in a majority of cases, making the task of giving a definite opinion regarding the cause of death very difficult. In about a third of the cases, head injury was responsible for death and in combination with hemorrhage and shock; mechanical trauma was the principal cause of death in 40% cases.

This could be because of vehicular or rail accidents where sometimes because of the magnitude of the damage caused the bodies may remain unidentified. This could be in instances such as a) hit and run accidents with crushing of head and face, b) body being dismembered when being run over by a heavy vehicle or train, c) a person being involved in a fatal accident just on arrival in a completely new

place, d) beggars, destitutes, etc. being involved.

Incidentally, homicidal manner of death with firearms/sharp weapons did not find mention in any of the cases in the present study. One of the probable reasons could be that the police make sincere efforts to trace the victim in order to solve the crime on priority basis and thus the body no longer remains unknown. Moreover, homicide of unknown persons is a rarity unless it is done with the motive of robbery, or when the body is so mutilated by the criminals that identification may become very difficult or sometimes impossible.

Taking and preserving fingerprints, publishing photographs in dailies/ newspapers, pasting pamphlets outside mortuaries/ hospitals/ police stations/railway stations, etc. are some of the routine steps undertaken by the police in a bid to trace the unidentified bodies.

Besides these, advertisements in the local TV channels are aired and a thorough enquiry is made in the locality in which the body was found. All this is a time consuming process and the police usually requests a postmortem examination only after completing the above mentioned formalities. This postponement of request by the police for autopsy till all efforts at identifying the body are exhausted is usually done to avoid unwanted allegations by the relatives at a later date when the body is identified.

As regards the data collected by the autopsy surgeon to facilitate the process of identification of the victim, clothes were given unsealed to the IO (to help in easier and quicker identification) in 63% of the cases. This was so because many a times, identification is based on the personal artefacts of the victim and it may be the only means of identification by the relatives.

Noting of the tattoo marks were done in all the cases which had tattoos engraved on them, 22%, so that some clue as regards the positive identification of the victim is made. Relatives easily recognize the tattoos on the person of their near and dear ones, and in these cases, even the description of the tattoos help in identification. Visible marks of identification were recorded (at least two) in 28% cases. Fingerprints are the gold standard for identification and hence, the pulps of the finger were removed and preserved in separate labeled bottles in formalin in 53% of the cases on the request of the police.

Though this method might seem barbaric and amounts to mutilation of the dead body, it is in vogue in this part of the country. Sternum bone for DNA analysis/ blood for cross

matching were sent in 7% of the cases, again on the request of the police officials.

Conclusion:

Unidentified dead bodies were only 4% of the total dead bodies coming to the autopsy in the mortuary of the Department of Forensic Medicine & Toxicology, Government Medical College & Hospital, Chandigarh, during the study period of three year. The highest no. of unknown case was in the middle age group (21-50 yrs) followed by age group (51-60). Maximum number of death was in summer months of the year. The cause of death in majority of the victims were given as 'cranio-cerebral damage', 30%, followed by 'Opinion reserved' in 28% cases for above mentioned reasons whereas coronary insufficiency/ cardiac disease were responsible for only 11% deaths, though in day to day life cardiac conditions are the first cause to be blamed for deaths, whether in known or unknown cases.

As regards the efforts for identification much more is to be done by the police personnel. Bodies that are unknown/unclaimed should be presented for autopsy forthwith without any delay so that decomposition and other artifacts do not set in and obscure the findings of the postmortem examination. The rule for preservation of an unknown body for 72 hours applies for its disposal and not for its postmortem examination.

Thus valuable data regarding the cause of death can be established. Active investigation and modern investigative techniques are to be used, workload of the police officers needs to be redistributed, and accountability of the police has to be fixed to get the body identified. Simple colour photography of the body, especially of the clothes, the tattoo marks, scars, deformities, etc will help the police in identifying such bodies.

Dental records of the deceased should be maintained, which was not done in cases under study, if a probable relative comes with a dental record. In all cases of unknown bodies, whole body radiographs may be useful for establishing the identity, which may reveal an old fracture or an implant (in the presence of a surgical orthopedic scar).

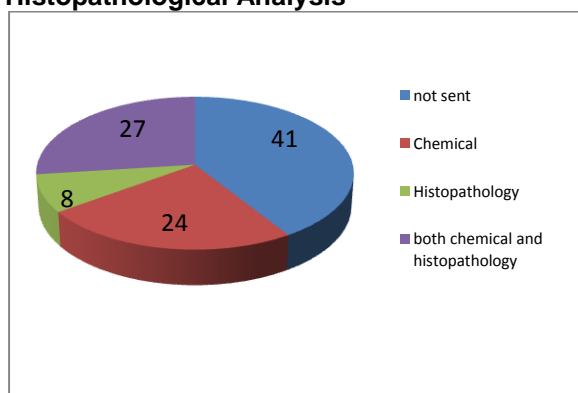
DNA analysis and fingerprinting should be done in each and every case so that proper records will be there for identification of the deceased years after the death or postmortem.

With a little effort on the part of the doctor and the investigation officer, in many cases, surprisingly, a large amount of information can be obtained even in the presence of advanced state of decomposition.

Such information can be of use to the doctor and the investigation agencies both in establishing identity and in forming an opinion about the cause and manner of death.

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Fig. 1: Cases Sent For Chemical/Histopathological Analysis**Table 1: Age-Wise Distribution of Unidentified Cases**

Age Grps (Yrs)	2008(n=19)	2009(n=18)	2010(n=23)	Total(n=60)
	No. (%)	No. (%)	No. (%)	No. (%)
<10	0(00)	2(11)	0(00)	2(03)
11-20	0(00)	0(00)	2(09)	2(03)
21-30	4(21)	5(28)	3(13)	12(20)
31-40	7(37)	2(11)	3(13)	12(20)
41-50	7(37)	6(33)	8(35)	21(35)
51-60	1(05)	2(11)	4(17)	7(12)
> 60	0(00)	1(06)	3(13)	4(07)

Table 2: Month-Wise Distribution

Month	2008 (n=19)	2009 (n=18)	2010 (n=23)	Total (n=60)
	No. (%)	No. (%)	No. (%)	No. (%)
Jan	4(21)	0(00)	0(00)	4(07)
Feb	2(11)	2(11)	1(04)	5(08)
Mar	0(00)	1(06)	1(04)	2(03)
Apr	2(11)	3(17)	1(04)	6(10)
May	1(05)	3(17)	4(17)	8(13)
June	2(11)	1(06)	6(26)	9(15)
July	1(05)	1(06)	3(13)	5(08)
Aug	2(11)	2(11)	0(00)	4(07)
Sep	2(11)	1(06)	2(09)	5(08)
Oct	2(11)	2(11)	2(09)	6(10)
Nov	1(05)	1(06)	0(00)	2(03)
Dec	0(00)	1(06)	3(13)	4(07)

**Table 3
Cause of Death-Wise Distribution of Cases**

S No.	Cause of Death	2008 (n=19)		2009 (n=18)		2010 (n=23)		Total (n=60)	
		No.	%	No.	%	No.	%	No.	%
1	Cranio-cerebral damage	5	26	6	33	7	30	18	30
2	Opinion reserved	6	32	4	22	7	30	17	28
3	Coronary insufficiency	3	16	1	06	1	09	5	08
4	Hemorrhage & shock	0	00	2	11	2	09	4	07
5	No Definite opinion	2	11	2	11	0	00	4	07
6	Cardiac disease	0	00	0	00	2	13	2	03
7	Rupture aortic aneurysm	0	00	0	00	2	13	2	03
8	Hanging	1	05	1	06	0	00	2	03
9	Cirrhosis of liver	0	00	1	06	0	04	1	02
10	CO poisoning	1	05	0	00	0	00	1	02
11	Multiple disease conditions	1	05	1	06	2	13	4	07

**Table 4
Efforts Put into Establish Identity**

Type of efforts	2008 (n=19)		2009 (n=18)		2010 (n=23)		Total (n=60)	
	No.	%	No.	%	No.	%	No.	%
Efforts of the police								
Fingerprints	7	37	7	39	10	17	24	40
Photographs	19	100	18	100	23	100	60	100
Advt. In dailies	19	100	18	100	23	100	60	100
Inquiry from people	19	100	18	100	23	100	60	100
Data/material retrieved by the autopsy surgeon								
Clothes handed over	12	63	10	56	16	70	38	63
Noting: Tattoos	4	21	3	17	6	26	13	22
Deformities	1	05	0	00	2	13	03	05
Marks of identification	5	26	4	22	8	35	17	28
Finger pulps preserved	8	42	10	56	14	61	32	53
Sternum For DNA/ Blood For Cross Match	0	00	1	06	3	13	04	07

Original Research Paper

Determination of Sex from Fragment of Hip Bone In Indian Bengali

*Partha Pratim Mukhopadhyay

Abstract

The present study was designed to derive a model for determination of sex from fragment of adult hip bone (distal ischio-pubic portion) in a population specific sample using Discriminant function analysis. The following discriminant function was obtained: $DF = .76*SYL + 1.60*SYW + 4.36*DOF - 24.88$

Overall 90.0 % of the cases could be correctly classified in to the two sexes from the three predictors [maximum vertical length of symphyseal surface (SYL), maximum width of symphyseal surface of pubis (SYW) and maximum diameter of the obturator foramen (DOF).] in the model. Cross-validated results showed correct classification in 86.7% cases. The results of this preliminary study show that these three variables contribute to discrimination between the two sexes in the study population. This investigation also reiterates that discriminant functions are population specific. Sexing of the adult human hipbone is thus possible with reasonable accuracy using the discriminant function on a sample obtained from the Indian Bengali population. This metric analysis can be used for fragmentary remains of hipbones of the population under study.

Key Words: Forensic Anthropology, Human Identification, Sex Determination, Discriminant Function Analysis, Fragment, Hipbone, Indian Bengali

Introduction:

Human pelvis is highly dimorphic. Sex determination from the innominate bone is a well-studied and extensively documented subject. Determination of sex is the essential step in the process of establishing the biological profile of human remains. This aspect has great forensic as well as anthropological importance.

Several methods have been successfully employed to determine the sex of skeletal remains. Of these, osteometry with discriminant function analysis has been most objective and precise. Several earlier investigations have shown that osteometric differences exist between different population groups. [1, 2]

Similarly, discriminant function equations derived for the determination of sex from bones are population specific. A study aimed at assessing the morphologic sex differences in the pelvis of South African whites and blacks indicated that overall, pubic bone shape was the easiest to assess

It was the most consistently reliable morphological indicator of sex in both sexes and population groups also.

The researchers found at 88% average accuracy, the most discriminating traits in whites were pubic bone shape and sub pubic concavity form. [3] A total of 122 adult human pubes (66 males and 56 females) were used in another study of a discriminant function analysis for determining sex from four pubic measurements. [4] The angle formed by the middle line of the superior ramus and inferior ramus of pubis, sub pubic angle, the minimum distance from the symphyseal surface to the obturator and the minimum thickness of the ischio-pubic ramus were used as variables. The researchers achieved an accuracy of 100%.

Another earlier study [5] was conducted on 100 human hipbones of Indian origin taking twelve measurements and five indices. The results of discriminant function analysis showed that the acetabular height (vertical diameter) and indices (total pelvic height/acetabular height), (mid pubic width/acetabular height) and (pubic length/acetabular height) were very good measures for discriminating sexes.

The present investigation was designed to derive a model for determination of sex from fragment of adult hip bone (distal ischio-pubic portion) in a population specific (Indian Bengali) sample applying discriminant function analysis

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using a new combination of three variables namely maximum vertical length of symphyseal surface (SYL), maximum width of symphyseal surface of pubis (SYW) and maximum diameter of the obturator foramen (DOF).

Materials and Methods:

The sample of bones consisted of 30 adult fully ossified innominate bones from the museum collection of the Department of Forensic Medicine. The bones with documented sex belonged to the population of the area and were supplied from cadaver dissection for routine teaching purpose. Osteometric measurements were taken by caliper, technical quality divider and metallic (steel) graduated scale with readings up to one millimeter.

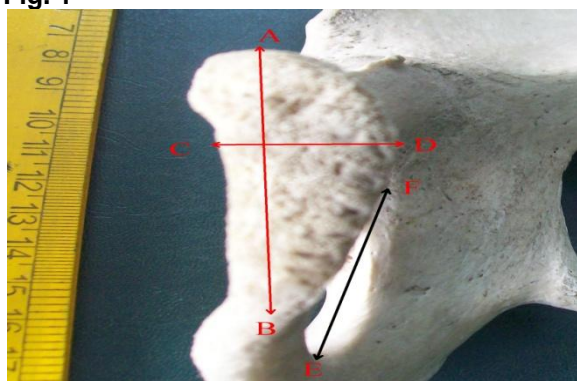
All measurements were taken keeping the bone in the anatomical positions. To test the intra observer differences and repeatability of those measurements ten randomly selected hipbones were measured after one week and the values of the two groups were tested by a paired t test. No significant difference was found in the two measurements of all the three variables.

The following measurements (in cm) were taken. (Fig. 1)

1. Maximum vertical length of symphyseal surface (SYL),
2. Maximum width of symphyseal surface of pubis (SYW)
3. Maximum diameter of the obturator foramen. (DOF).

Metric data was summarized as mean and standard deviations. One-Sample Kolmogorov-Smirnov Test was used to examine the normality of the distribution. Discriminant function analysis was carried out to examine the dimorphism in fragment of hipbone and how the three variables could correctly assign them to the proper sex. Statistical analysis was performed using SPSS software version 17.0 for windows. A two-tailed P value of less than 0.05 was considered significant.

Fig. 1



Results:

In the present study sample of 30 intact adult bones 14 were male and 16 female. From the summary of univariate and multivariate analysis, (Tables 1) It was observed that the hipbones were larger in males regarding all the three variables used in the study. Table 2 shows the result of test of equality of means. A direct discriminant function analysis was performed using three variables as predictors of sex. All the variables were entered together. The Predictors were maximum vertical length of symphyseal surface (SYL), maximum width of symphyseal surface of pubis (SYW) and maximum diameter of the obturator foramen (DOF).

The classification groups were male and female. One discriminant function was calculated with Wilks' Lambda equal to 0.391 chi square (χ^2) equal to 24.86, degree of freedom 3 and P value of .000. Because P value was less than .05, we could say that the model was a good fit for the data (Table 3). The following Discriminant Function (DF) was obtained:

$$DF = 0.76 \cdot SYL + 1.60 \cdot SYW + 4.36 \cdot DOF - 24.88$$

The Cut Score was 0.080 [Calculated from group centroid (Table 4) by obtaining the arithmetic mean of the values]. Those cases where the D F score was less than 0.080 the bone was female. For values of discriminant score above 0.080, were male. Overall 90.0% of the sample was correctly classified into their group by this model. At the individual group level, 81.3% of females and 100 % of male were correctly classified. (Table 5)

In cross validation each case is classified by the functions derived from all cases other than that case. Cross-validated results showed 86.7 % of the cases correctly classified by this tri variable model.

Discussion:

Earlier works have shown that osteometry is a helpful technique in the determination of sex from human hipbone. [1, 2, 6, 7, 10] The present sample was not homogenous as to sex and age. Discriminant function analysis is used to determine which continuous variables discriminate between two or more naturally occurring groups. In this study the method of discriminant function analysis was used to evaluate how a linear combination of those three variables can discriminate between male and female. These three variables were considered for the distal fragment of hipbone as fragmentary remains are often encountered in Forensic practice as well as archeology.

The analysis showed that this model could correctly classify overall 90.0% of original grouped cases. This result in the population specific sample (Indian Bengali) is comparable with those of a north Indian study [5] where correct classification was possible using several different predictors. The 90.0% accuracy of the present series is in consonance with the results of another work on a different population. [3] The present results are however less accurate than an earlier study [4] where 122 bones were used leading to 100% correct classification of sex. Our contention is that morphometry and sexual dimorphism in adult human hipbones is population and race specific despite some earlier studies [7, 8] vehemently supporting the contrary views.

Discriminant functions too are population specific which prompted the present investigation. This would have anthropological, archeological and forensic applications especially in cases of determination of sex of unknown mutilated bodies or grossly decomposed human remains with fragmented pelvic bones. The study was on a sample of only thirty human hipbones. Linear measurements were taken for the variables and we could not afford digital instruments for osteometry.

These shortcomings can be overcome in future study designs. The present work was conducted with osteometric analysis of only three variables obtained from the distal fragment of hipbone. Also the age related changes in the pubis [9] is a well-documented factor that needs to be considered in future studies. Further research with a larger study design and a greater number of measurable variables should be performed to discriminate between male and female hipbone fragment (distal part).

The results of this preliminary study show that these three variables contribute to discrimination between the two sexes in the Indian Bengali population. Sexing of the adult human hipbone, especially the distal fragment, is possible with reasonable accuracy using the linear discriminant function on skeletal remains obtained from Indian Bengali population.

This approach can also be applied to supplement other methods [10] of sex determination from hipbone in Indian Bengali skeletal remains. This will be of practical importance in Forensic osteology work when fragmentary human skeletal remains are examined to establish identity and construct a biological profile of the subject.

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Table 1: Descriptive Statistics

	SEX	N	Mean	Std. Deviation	95% Confidence Interval For Mean
SYL	Male	14	3.8214	.32148	3.63-4.00
	Female	16	3.5750	.34545	1.55-1.73
SYW	Male	14	1.8214	.17619	1.71-1.82
	Female	16	1.6438	.17500	1.55-1.73
DOF	Male	14	4.6643	.12774	4.59-4.73
	Female	16	4.2188	.25091	4.08-4.35

Table 2: Tests of Equality of Group Means

	Wilks' Lambda	F	df1	df2	Sig.
SYL	.874	4.052	1	28	.054
SYW	.785	7.648	1	28	.010
DOF	.438	35.884	1	28	.000

Table 3: Results of Discriminant Function Analysis

Eigen value	% of Variance	Cumulative %	Canonical Correlation
1.556 ^a	100.0	100.0	.780
Wilks' Lambda	Chi-square	Df	Sig.
.391	24.868	3	.000

Table 4: Functions at Group Centroids*

Sex	Function
Male	1.288
Female	-1.127

*Unstandardized canonical discriminant functions evaluated at group means

Table 5: Classification Results

		sex	Predicted Group Membership		Total
			Male	female	
Original	Count	male	14	0	14
		female	3	13	16
	%	male	100.0	.0	100.0
		female	18.8	81.3	100.0
Cross-validated	Count	male	14	0	14
		female	4	12	16
	%	male	100.0	.0	100.0
		female	25.0	75.0	100.0

Original Research Paper

Epidemiology and Outcome of Burn Injuries

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Abstract

Burn injury is a serious public health problem in developing countries. The causes vary in different communities and so this study was done to know the epidemiology and outcome of burn injuries. A one year cross sectional study was done of all the burn injury patients admitted during April 1st, 2004 to March 31st, 2005. Data was collected using a pre designed and pre tested proforma from the patients themselves or their relatives and analyzed using chi square test and percentages. A total of 76 burn injury patients were admitted. Majority were females (52.63%) and sustained burn injuries at home (p=0.000). Maximum number of females were wearing synthetic clothes (p=0.000) and suffered from flame injuries (0.006). The case fatality rate was 31.58%. Burn injuries can be reduced by bringing about regulations to develop safer cooking appliances, promoting less inflammable fabrics to be worn at home and educating the community especially women.

Key Words: Burn injuries, Accidental, Flame Injuries

Introduction:

Burns constitute a major public health problem, especially in low and middle income countries where over 95% of all burn deaths occur. Fire related burns alone account for over 3 lakh deaths per year. However, deaths are only part of the problem, for every person who dies as a result of their burns; many more are left with lifelong disabilities and disfigurements. For some this means living with the stigma and rejection that all too often comes with disability and disfigurement. [1] India is moving forward industrially and technologically but this development creates awareness about the lack of safety measures in all walks of life.

The causes for burn injury differ in various communities and understanding this is necessary before preventive action can be planned and implemented.

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So, the study was done to understand the epidemiology and outcome of burn injuries.

Materials and Methods:

A one year cross sectional study of all burn injury patients admitted in Sri Dr. Prabhakar Kore Hospital and Medical research centre, Belgaum, Karnataka, India was conducted between April 2004 to March 2005 period. Ethical clearance was obtained from Institutional review board. Data was obtained on a pre designed and pre tested proforma from the patients themselves or their relatives and analyzed by chi square test and percentages. For the purpose of the study, burn injury was defined as a body lesion due to an external cause resulting from mechanical, electrical, thermal, chemical or radiant heat.

Results:

A total of 76 burn injury patients were admitted during the study period. More than 50% of the patients were females (52.63%) and 10% were pregnant at the time of burn injury. The male to female ratio was 0.9:1. The mean age was 29.32 years ranging from 4 months to 95 years? (Table 1)

Majority (40.00%) was educated up to secondary level and 44.62% were housewives. One third patients belonged to Class II socio-economic status under modified B. G. Prasad classification. Maximum number of females (97.5%) sustained burn injuries at home compared to 36.11% males sustaining injuries outdoors. (p=0.000). Majority (97.37%) were Hindus and from rural areas (56.58%).

Many (47.37%) were from nuclear families followed by 35.53% from extended joint families. Majority of the patients (80.32%) were married. Almost one third injuries (30.26%) occurred between 4 pm to 8pm followed by 25% between 8 am to 12 noon. Synthetic clothes were worn by 65% of females at the time of injury whereas 50% of males had worn mixed clothing ($p=0.000$).

Majority (81.59%) were allegedly accidental injuries followed by 15.79% suicidal and 2.63% homicidal. Flame injuries contributed to 92.5% of burns in females ($p=0.006$). A cooking appliance was responsible for 45.0% injuries in females. Electrical injuries (19.44%) were significantly more in males ($p=0.005$). (Table 2) In almost 39% of males, total burn surface area was $<19\%$ whereas in 40% females, total burn surface area was $>61\%$. ($p=0.004$). (Graph 1) It was observed that 31.58% victims were doused with water after the incident, 28.95% responded by shouting and running and 25% were doused with cloth.

In alleged accidental cases, the cause for burn injury was ignition of clothes in 67.74% females and in 35.48% males, it was due to an attempt to save other burn injury victims ($p=0.000$). The case fatality rate was 31.58%. Majority of the males (58.33%) recovered whereas 47.50 % females succumbed due to their burn injury. ($p=0.001$). (Graph 2)

Discussion:

Epidemiological studies are a prerequisite for effective burn prevention programs, as each population seems to have its own epidemiological characteristics. In the present study, majority of the patients have been housewives in the age group of 21-40 years. Most of them have sustained injuries at home. These results are similar to other studies [2-7] and suggest one's own home can become a death trap as heat generating appliances are regularly used. One third injuries have occurred between 4 pm to 8 pm and were similar to a study conducted in India. [5]

This is the period when evening meals are cooked and lighting equipment are used. It was noted that 65% of females were wearing synthetic clothes at the time of burn and was identical to other studies. [8, 9] Indian women wear loose flowing synthetic garments which can catch fire easily and cause extensive burn injury. Alleged accidental burns contributed to 81.58% of the injuries. This finding indicates the caution needed when using equipment causing burns. Flame was the most common agent in 92.5% of the females and similar results have

been seen in various studies. [2, 4, 10] Cooking appliance was the most common source of injury in females and this finding indicates that women should be very careful all the time.

In this study, only 31.58% victims were doused with water. This finding suggests the necessity of education with regard to emergency steps at the time of an incident.

The stated cause for alleged accidental burn injury in 67.74% females was ignition of their clothing and 35.48% males had burn injury while attempting to save other victims and are consistent with other studies. [5, 6, 9] This indicates the need for women at home to be extra careful with their clothes properly tied and the males to know the way to rescue other victims from fire.

In this study, 40% of females had total burn surface area $>61\%$ and indicates the gravity of the situation. The case fatality rate was 31.58%. More than 50% of the males recovered whereas nearly 50% of the females died as a result of the burn injury. This is similar to other studies [2, 10] and indicates the need for aggressive measures to decrease the mortality due to burns.

Conclusion:

Burn injuries can be reduced by bringing about regulations to develop safer cooking appliances, promoting less inflammable fabrics to be worn at home and educating the community especially women on safer first aid practices.

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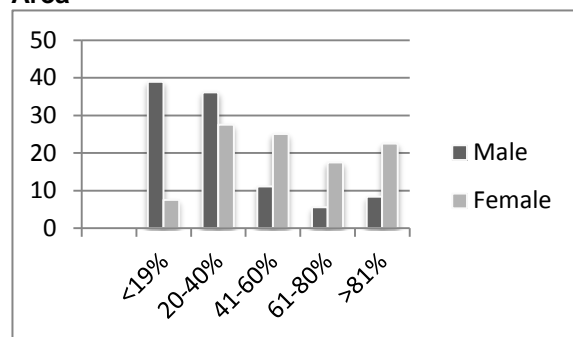
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Table 1: Age and Sex Distribution of Burn patients

Age	Male		Female		Total	
	No	%	No	%	No	%
<20years	11	30.6	9	22.5	20	26.32
21-40Years	22	61.1	23	57.5	45	59.21
41-60Years	1	2.78	3	7.5	4	5.26
61-80Years	2	5.55	4	10	6	7.89
>81Years	0	0	1	2.5	1	1.32
Total	36	100	40	100	76	100

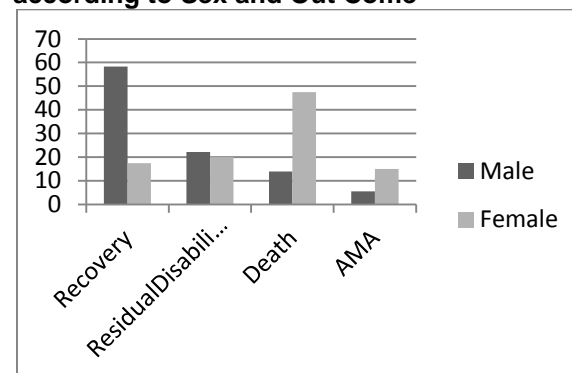
$\chi^2=2.291$ DF=2 P=0.318

Graph 1: Distribution of Burn Patients according to Sex and Total Burn Surface Area



$\chi^2 = 15.466$ DF=4 P= 0.004

Graph 2: Distribution of Burn Patients according to Sex and Out Come



$\chi^2=17.003$ DF=3 P=0.001

**Table 2
Type and Source of Burn Injury**

Type and Source of Burn	Male		Female		Total	
	No	%	No	%	No	%
Flame						
Cooking Appliance	8	22.22	18	45.00	26	34.21
Kerosene oil & matches	9	25.00	14	35	23	30.26
Warming Appliance	1	2.78	0	0	1	1.32
Petrol/Diesel Explosion	3	8.33	0	0	3	3.95
Kerosene Lamp/Lamp	1	2.78	3	7.5	4	5.26
Matchstick Ignited Mattress	0	0	1	2.5	1	1.32
Candle	2	5.56	1	2.50	3	3.95
Total	24	66.67	37	92.5	61	80.26
Scald						
Hot water	2	5.56	3	7.5	5	6.58
Hot Oil	3	8.33	0	0.0	3	3.95
Total	5	13.89	3	7.5	8	10.53
Electrical						
Livewire/Short circuit	7	19.44	0	0	7	9.21
Total	36	100	40	100	76	100

Original Research Paper

Study of Septic Abortion Cases at a Tertiary Centre of Uttarakhand

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Abstract

Aim of this study was to evaluate the incidence, maternal morbidity & mortality, clinical features, management in cases of septic abortion in a tertiary centre. This study included 37 cases of septic abortion admitted during 5 years from January 2007 to January 2012 in the Department of obstetrics & Gynaecology in Government Medical College, Haldwani. All patients were evaluated with special reference to incidence, etiological factors, clinical features, surgery & maternal morbidity & mortality. The incidence of septic abortion was 1.08%. Common age group was between 26-30 years. Most of the cases were from lower socioeconomic status. Septic abortion following spontaneous abortion was present in 5 cases. Unwanted pregnancy was the indication for termination of pregnancy in 32 cases. 4 women were admitted in state of septic shock. 12 cases required laparotomy for drainage of pus, 3 had hysterectomy, 3 had resection anastomosis & uterus repair was done in 4 cases. Overall maternal mortality was 5 (13.5%). The incidence of illegal and septic abortion can be reduced by increasing awareness about family planning services and making legal abortion services easily available to the women and that too at a cheaper cost.

Key Words: Septic Abortion, Maternal Mortality, Morbidity, Unwanted pregnancy, Septic shock

Introduction:

In India each year about 1, 25,000 women die from pregnancy related causes. [1, 2] At least 1/5th of these deaths are caused by induced abortion, sepsis being one of the causes. In the majority of cases the infection occurs following illegal induced abortion but can occur even after spontaneous abortion. Abortion was legalized in our country through MTP act in 1971, still the incidence of septic abortion ranges from 2 – 10%. [3, 4]

Septic abortion is the major life threatening complication that could be tackled significantly through good quality health care. The common cause is abortion by untrained personnel, dais and quacks. Poverty, ignorance and non availability of trained personal contribute to high incidence of septic abortion. These cases are mostly referred to hospitals very late after occurrence of complications leading to high maternal morbidity and mortality

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Material & Methods:

The present study comprised of 37 cases of septic abortion over a period of 5 years from January 2007 to January 2011 admitted in the Department of obstetrics and gynecology in Government Medical College, Haldwani. This is the only referral centre of the Kumaon region of Uttarakhand. All cases were analyzed with respect to various demographic factors, clinical features, management, complications, maternal morbidity and mortality and surgical intervention.

Result:

During the period of the study there were 3411 abortions of which 37 women had septic abortions giving an incidence of 1.08%. Majority of the patients were between the age of 26 -30 years. There were 4 primigravida and 33 multi-gravida cases. (Table 1) Most of the cases (29) belonged to lower class, 6 were from lower middle class and 2 from upper middle class. (Table 2) 27 patients came from rural areas and 10 were from urban areas. 30 were referred cases.

The period of gestation at the time of abortion was between 7–12 weeks in maximum no. of cases (24). (Table 3)

Out of total 37 cases 5 patients had sepsis after spontaneous abortion and the remaining 32 it followed instrumental termination of pregnancy. Untrained persons like quacks or

ANMs performed termination in 34 cases and in 3 it was performed by doctor. The indication for termination of pregnancy was unwanted pregnancy in 32 cases. 5 patients had spontaneous incomplete abortion at home and came later on to the hospital with features of sepsis. The common symptoms seen in these patients were pain in abdomen, fever, distension of abdomen, foul smelling vaginal discharge. (Table 4) Examination showed tenderness of abdomen with distension and fever in majority of cases. On USG retained products were present in 15 cases, fluid in abdomen and pelvis was present in 19 and both in 3 cases.

Clinically the patients are categorized in 3 grades-

- Grade I – infection localized in the uterus.
- Grade II – infection spreads beyond the uterus to the parametrium, tubes and ovaries or pelvic peritoneum.
- Grade III – Generalized peritonitis and / or endotoxic shock or jaundice or acute renal failure.

Grade I is the commonest and is usually associated with spontaneous abortion. Grade III is almost always associated with illegal induced abortion. Grade I, II, III consisted of 9, 5, and 23 patients out of which 2 developed varying degree of renal failure while 1 developed disseminated intravascular coagulation.

Intensive management, broad spectrum antibiotics, dopamine infusion, blood and blood components transfusion, dialysis and ventilator support was required. Evacuation of uterus was done in 15 (Table 5), colpotomy in 4, laparotomy with drainage of pus in 12, uterus repair in 4, hysterectomy in 3 and resection anastomosis of bowel in 3 patients (Table 6)

Out of 37 patients, 5 died (13.5%), 2 left against medical advice and one had a relaparotomy. Septic shock, renal failure and disseminated intravascular coagulation contributed to maternal mortality. 30 patients had complete recovery.

Discussion:

Although abortion services were liberalized in India more than 4 decades ago, access to safe services remain limited for the vast majority of women. Majority of women seeking abortion still turn to uncertified providers for abortion services because of barriers to legal abortion. Women with access to fewer resources, for example low income, rural women, adolescents are among those most likely to turn to unsafe abortions and have complications.

A septic abortion is a form of abortion that is associated with a serious uterine infection. The infection carries risk of spreading infection to other parts of the body and causing septicemia, a grave risk to life of a woman. Septic shock may lead to kidney failure [6, 7], bleeding diatheses and DIC. Intestinal organs may also become infected, potentially causing scar tissue with chronic pain, intestinal blockage and infertility. If not treated quickly and effectively the woman may die so early referral of septic cases is important. Once the patient progresses to septicemia complication rate becomes very high. Complications like fever, wound infection and wound dehiscence, pelvic thrombophlebitis are seen in post operative period. [3- 5]

Besides intensive management, broad spectrum antibiotics, dopamine, blood transfusion and early surgical intervention can significantly improve the outcome. Surgery in the form of evacuation, laparotomy, hysterectomy was done to remove the source of infection as early as possible. Role of early surgery is controversial but studies by Singhal et al and Rivlin and Hunt [8, 9] have shown that early surgical intervention can significantly improve the outcome. Our study also showed similar results. A similar study by Shailesh Kore, et al [10] showed that mortality was 100% in conservative group as compared to 20% in the surgery group.

Although abortion has been greatly liberalized, the annual number of legal abortions are about 0.6 million, which contribute hardly 10% of the abortions done in the country. In other words, illegal abortions are still rife although it is now more than 40 years since the MTP Act has been promulgated. Experts opine that facilities for safe, legal abortion should be made universally available. [8-10]

Septic abortion, a complication mainly due to illiteracy and unawareness can be prevented by increasing education and awareness about availability of family planning services and MTP services free of cost in the government hospitals. To reduce mortality and morbidity from unsafe abortion several broad activities require strengthening, decreasing unwanted pregnancies, increasing access to safe abortion services and increasing the quality of abortion care including post abortion care.

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Table 1: Age and Gravida

Age (yrs)	Primigravida	Multigravida
20-25	2(5.4)	4(10.8)
26-31	1(2.7)	19(51.3)
31-35	1(2.7)	9(24.3)
36-40	0	1(2.7)

Table 2: Socioeconomic Status

Socioeconomic Status	Cases	Percentage
Lower Class	29	78.4
Lower Middle	6	16.2
Upper Middle	2	5.4

Table 3: Period of Gestation at Abortion

Period of Gestation (wks.)	Cases	Percentage
<6	11	29.7
7-12	24	64.8
13-18	2	5.4

Table 4: Clinical Features at the Time of Admission

Clinical Features	Cases	Percentage
Pain in abdomen	32	86.4
Fever	18	48.6
Distension of abdomen	12	32.4
Foul smelling vaginal discharge	6	16.2
Something coming out of vagina	3	8.8

Table 5: Medical Treatment

Medical Treatment	Cases	Percentage
Broad spectrum Antibiotic	37	100
Dopamine Infusion	4	10.8
Blood Transfusion	22	59.4
Dialysis	2	5.4
Ventilator Support	2	5.4

Table 6: Surgical Treatment

Surgical Treatment	Cases	Percentage
Evacuation	15	40.5
Colpotomy	4	10.8
Laprotomy with drainage of pus	12	32.4
Laprotomy with repair of uterus	4	10.8
Laprotomy with hysterectomy	3	8.8
Laprotomy with resection anastomosis	3	8.8

Original Research Paper

A Role of Digital Imaging in Identification of Unidentified Bodies

*Pravir Bodkha, **Bishwanath Yadav

Abstract

Unidentified and unclaimed bodies for medico-legal autopsy has shown increased trend. Relatives of unidentified bodies suffer a lot of psychological trauma and also suffer in settling insurance, inheritance and pension claims. When an unidentified body has injuries on face, then photograph of such deceased is not accepted by print or electronic media for publication as such photograph may cause distress to the viewers.

This study was conducted on three cases of unidentified and unclaimed bodies brought for medico-legal autopsy with facial injuries making their photographs unfit for publication in print or electronic media. Photograph of the deceased face was taken; image was transferred to a computer and by using Adobe Photoshop software CS2 and the injuries present on face were removed. The result showed that in all the three cases we could establish the identity by digital imaging. Relatives of the deceased could identify their missing relative by photograph shown to them after removal of injuries. Later on police confirmed the identification by using other methods of establishing identity. This method can be an aid in identification of unidentified bodies presented with facial injuries.

Key Words: Digital Imaging; Identification; Missing Persons; Unclaimed Bodies; Unidentified Bodies

Introduction:

The number of unidentified dead bodies recovered in India and inquest conducted has increased from 33,656 in 2003 to 37,282 in 2007. [1] The number of missing persons in country is also increasing and it is felt by the high court judges that since the number is increasing and the present mechanism is not able to trace the missing persons, a new mechanism is necessary to be set up. [2] Around 15 per cent of 38,670 people who went missing from Delhi in the past three years are yet to be traced. Police has been instructed to register FIRs in case of a missing person reports lodged in the past three years. [3]

Law in Relation to Unclaimed Bodies:

- **Presumption of Death:**

The question of presumption of death may arise at the time of inheritance of property.

It also arises in obtaining insurance money or for pension claim when a person is alleged to have been dead and body is not found. Under section 107 of the Evidence Act of India, a person is presumed to be alive, if there is nothing to suggest the probability of death within 30 years. But if proof is produced that the same person has not been heard of for seven years by those friends and relatives who would naturally have heard from him had he been alive, death is presumed (S108 I.E.A.). [4]

- **Disposal of Unclaimed Bodies:**

The Human Organs Transplantation Act (THOA) provides for the regulation of removal, storage and transplantation of human organs for therapeutic purposes. Sec.5 defines an 'unclaimed body' as one in a hospital or prison and "not claimed by any of the near relatives of the deceased person within 48 hours from time of death of the concerned person. [5]

The Punjab police rule [6] states that if a body is unidentified, the officer making the investigation shall record a careful description of it, giving all marks, peculiarities, deformities, other distinctive features and shall take the finger impressions. In addition to taking all other reasonable steps to secure identification he shall, if possible, have it photographed. In cases where such action appears desirable, a description should be published in the criminal intelligence Gazette. Unidentified body should

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be handed over to any charitable society which is willing to accept them, and if no such society comes forward, they should then be buried or burnt. In Delhi, the police sends telegram message called 'Hue and cry notice' to various police head quarters of the country.

The 'Hue and cry notice' contained brief description of the identification features of the deceased. The body is preserved in the mortuary for 72 hours from the time telegram message is sent. If there is no one to claim the body after 72 hours the police is legally authorized to dispose off the body. But if the police think that the body maybe identified by the relatives, it should be preserved for longer time till relatives comes and claims the body. [7]

• **Unidentified Bodies Preventing Conviction:**

It is essential for a dead body to be thoroughly identified and the proof of corpus delicti to be established before a sentence is passed in murder trials, as unclaimed, decomposed bodies or portions of a dead body or even bones are sometimes brought to support false charges. However, there have been cases where the death sentence was passed even when the body was not identified, if the facts of the cases were proved beyond any reasonable doubt. [8]

Agony of Missing Person's (Deceased) Family:

If a person is missing and untraced, the entire family members suffer psychological trauma and lives in dilemma whether the person is still alive or not. If a missing person dies and his identity remains undisclosed, the family members of that missing person can't perform the rituals which are normally done in event of death of a family member.

In issues related to the insurance/ inheritance/ pension claim, the nominee/ concerned person has to legally prove that the missing person has died, but as they don't have any clue about the whereabouts of that missing person, such issues remain unsolved unless they provide sufficient evidence so that court presume that the person has died.

The present Law Enforcement Scenario:

Generally a 'missing person' entry is made in General Station Diary (GD) and no FIR is registered, except in certain states where a 'Zero FIR' is registered. In a zero FIR, no crime number is assigned because a missing person complaint is not prima facie considered crime. The follow up for the zero FIR and the GD entry is same.

The Station House Officer (SHO) forwards information to the superintendent of police or to the deputy commissioner of police who in turn forwards it to the office of the chief of police. At the field, local police officials publicize the particulars of the missing persons in the media by circulating the available identification details and photographs.

The message that reaches the police headquarters in the state is normally lodged with the Missing Persons Bureau (MPB), which often is a wing of the CID of the state police. They, in turn, forward the message to the missing persons wing of the National Crime Record Bureau (NCRB) at New Delhi. NCRB, at best, forwards this message to the chief of police in other states. The police stations generally do not give any feedback to the NCR when the missing person is rescued or returned and, therefore, the NCRB is unaware both of traced persons and those who remained untraced.

The NCRB, under the TALASH information system, maintains a national level database of unidentified persons and unidentified dead bodies. In the NCRB, inputs to the TALASH system are received through wireless messages fax, magnetic media, periodical statements and e-mails from state/ UT police and central police organizations (CPOs). The NCRB database is regularly updated and monthly reports are generated. NCRB is also in the process of procuring a 'facial recognition system' based on biometrics, which incorporates the body measurements of the person concerned. The 'facial search' will be integrated with the 'attribute search' of TALASH. [9]

Materials and Methods:

This study was conducted on three cases of unidentified and unclaimed bodies brought for medico-legal autopsy. In all the three cases facial injuries were present making their photographs unfit for publication in print or electronic media for identification purpose. Photograph of the deceased face was taken with a digital camera of 4.2 mega pixel.

The image was transferred to a computer and by using Adobe Photoshop software CS2, the injuries present on face were removed with the help of dodge, burn, sponge, blurs, sharpens, clone stamp and smudge tools. While using various tools of Adobe Photoshop care was taken so that the basic anatomical features of face (size, shape, eyebrows, mouth ear etc.) facial symmetry and anthropometric measurement are not disturbed or to the minimum. The purpose of removing the injuries from face was to convert the photograph of the

deceased to make it more presentable for print and electronic media.

Case one:

An unidentified and unclaimed body of 33 year old male was brought for medico-legal autopsy. On face blood stains were present at few places with left black eye. Internal findings of cranio-cerebral injuries were present. Facial injuries were removed by using various tools of adobe Photoshop software. (Fig. 1 & 2)

Case Two:

An unidentified and unclaimed, decapitated body of 29 year old male was brought for medico-legal autopsy. Several images of the deceased face were taken after placing the head in anatomical position with the remaining part of the body and the most appropriate image was selected for editing by using various tools of adobe Photoshop software. (Fig. 3, 4 & 5)

Case Three:

An unidentified and unclaimed body of 2 year old male was brought for medico-legal autopsy. Forehead was showing skull fracture with brain tissue visible at the site of fracture. The image was edited by using appropriate tools of adobe Photoshop software to remove the head injury from the image. (Fig. 6 & 7)

Fig.1: Left black eye and few blood stains on face



Fig. 2: After Removing Facial Injuries



Fig. 3: Decapitated Body



Fig. 4: Head in Anatomical Position with the Remaining Part of the Body



Fig. 5: After Removing Facial Injuries



Fig. 6: Head Injury



Fig. 7: After Removing Facial Injuries**Result:**

Photograph of the deceased, after removing the facial injuries, were shown to the deceased relatives who came for identification of their missing relative. In all the three case relatives identified the deceased from the photograph shown to them with no facial injuries. Care was taken that prior to showing these photographs no personal belongings or photograph with injuries were shown to the relatives by the police.

In our study we found that relatives of the deceased could identify their missing relative with the help of photograph shown to them after removal of injuries and in all three cases later on police confirmed the identification by using other methods of establishing identity like personal belongings, fingerprint matching etc.

Discussion:

In our study of three cases we were able to establish identity in all the three cases. We found that if such an attempt is made in unidentified bodies to convert the photograph of the deceased to make it more presentable for print and electronic media by removing injuries on the face by digital imaging it can help in establishing the identity of such unidentified bodies. This can, to some extent, lessen the agony of the deceased relative by performing the rituals and settling the insurance, pension, and inheritance claims.

It can add in identification of those unidentified bodies where due to early postmortem changes or injuries on face, the photograph could not be used for publication in the newspaper or for electronic media.

This technique have few limitations as bodies in which face is distorted due to putrefaction or due to extensive injuries of skull cannot be edited by preserving the person's facial characteristics.

Further study on large sample is required and then such photographs can be used by law enforcing agencies for print and electronic media as a tool to establish identity of unidentified bodies. In a country like India where number of unidentified bodies found every year is quiet high and a large number of migratory population is residing in metro cities, such an attempt can help to some percentage of relatives of unidentified bodies.

Conclusion:

In our study we found that use of digital imaging in establishing identification of unidentified bodies is highly significant, therefore such digitally edited photographs can be used by the police for print and electronic media in order to establish identity of unidentified bodies presenting with facial injuries.

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Original Research Paper

The Anthropometric Measurements of Tibia

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Abstract

Anthropometry provides scientific method and technique for taking various measurements in different geographic regions and races. The Tibia itself is a complex anatomic unit so anthropometric study was devised on the same. In the present study 60 (26 right and 34 left) intact adult tibia were obtained from the bone bank of Anatomy Department of MGIMS, Sevagram. For this purpose a digital vernier caliper, osteometric board and measuring tape were used.

The study was aimed at determining measurements for obtaining Cross-Section Index in middle, Cnemicus Index and Length-Thickness Index for both right and left Tibia. The details of data obtained with relevant review of literature will be discussed. The mean of Cross Sectional index for Right tibias was 102.90 ± 22.78 . Similarly mean of Cross Sectional index for left tibias was 124.31 ± 25.06 . The mean of Cnemicus Index for Right tibias was 66.17 ± 10.68 and for left side these values came out to be 67.31 ± 7.35 . These are not statistically significant. The mean of Length-Thickness Index were 24.21 ± 0.96 and 24.43 ± 1.78 for right and left Tibias respectively.

Key Words: Anthropometry, Tibia, Cross-Section Index in middle, Cnemicus Index, length-Thickness Index

Introduction:

Anthropometry is a series of systematized measuring techniques that express quantitatively the dimensions of the human body and the skeleton. Anthropometry is often viewed as a traditional and perhaps the basic tool of biological anthropology, but it has a long tradition of being used in forensic sciences and in medical sciences especially in the discipline of Forensic Medicine.

It is highly objective and reliable in the hands of trained anthropometrists. The significance and importance of somatometry, cephalometry, craniometry and osteometry in the identification of human remains have been described and a new term of 'Forensic Anthropometry' is coined. Some of the recent studies which employ various techniques of anthropometry are discussed. The ultimate aim of using anthropometry in Forensic Medicine/Science is to help the law enforcement agencies in achieving 'personal identity' in case of unknown human remains' [1]

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Objectives:

- To evaluate the morphometry of dried tibia of central Indian population;
- To use the obtained osteometric data to estimate the bilateral differences between the right and the left bones.

Materials and Methods:

In this study, 60 (26 right and 34 left) intact human adult tibia were obtained from the bone bank of the Anatomy Department, MGIMS Sevagram. In the study, a total of 07 parametric variables were obtained from the shaft of the Tibia according to standard anthropometrical method. [2, 3] The number of nutrient foramina for Tibia on both sides was also noted. Instruments Used for the study are Digital Vernier Caliper, Osteometric Board, Measuring Tape.

Formulae Utilized:

- **Cross-Section Index in Middle= (Transverse diameter in middle of Bone/Maximum Diameter in middle of Bone) X 100**

In this formula Transverse diameter in middle of Bone is calculated as straight distance from the medial tibial border to the interosseous crest at the level of nutrient foramen. Maximum Diameter in middle of Bone measures the straight distance of anterior crest from the posterior surface in the middle of the bone.

- **Cnemicus Index= (Transverse Diameter at level of Nutrient Foramen/ Sagittal Diameter at level of Nutrient Foramen) X100**

Transverse Diameter at level of Nutrient Foramen is straight distance from the medial border to the interosseous crest at the level of nutrient foramen. Sagittal Diameter at level of Nutrient Foramen measures straight distance of anterior crest from the posterior surface at the level of nutrient foramen.

- **Length - Thickness Index = (Maximum Girth of shaft/Total length of Tibia) X100**

Where Maximum Girth of shaft is maximum circumference of shaft wherever found. Total length of Tibia measures straight distance from the cranial articular surface to the fibular condyle of Tibia i.e. lateral condyle to the tip of medial malleolus.

Results:

The data obtained in this study has shown remarkable difference between Right and left tibias. Only one Right tibia possesses two nutrient foramina else whole of the tibias studied were having single nutrient foramina. The mean values of various parameters were shown in Table 1. The mean of Cross Sectional index for Right tibias was 102.90 ± 22.78 . Similarly mean of Cross Sectional index for left tibias was 124.31 ± 25.06 . On applying statistical analysis (t test) on it came out to be $p < 0.05$ (0.029) which is statistically significant.

The mean of Cnemicus Index for Right tibias was 66.17 ± 10.68 and for left side these values came out to be 67.31 ± 7.35 . These are not statistically significant.

The mean of Length - Thickness Index were 24.21 ± 0.96 and 24.43 ± 1.78 for right and left Tibias respectively. This too was not significant statistically.

Discussion:

The presence of single nutrient foramen throughout the samples studied (except one) is remarkable difference compared to other long

bones of human body. [4, 5] The values of various indices calculated shows remarkable difference with that of humerus and femur. [5, 6] This is of immense point of utility for medico-legal aspect where sometimes identity is to establish from part of bone only. [7, 8]

The discrepancies could be a result of factors such as age, sex, race and also environmental factors affecting bone growth, such as nutrition, physical development and genetic factors.

Conclusion:

The knowledge of the morphometric values of tibia segments is important in forensic, anatomic and archeological cases in order to identify unknown bodies and stature. Therefore our study supplies the mean values of the different morphometric measurements from the tibia. As a result, these measurements may help to indicate the characteristic morphological features of tibial segments in our population and also help the orthopedic surgeon to place the various implants in the reconstruction of tibial fractures. Presence of single foramen throughout our study, place the tibia separately from other long bone of human.

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Table 1
Various Parameters obtained from the Present Study

S.N	Parameters	Right Mean \pm SD	Left Mean \pm SD
1	Transverse diameter in middle of Bone	18.21 ± 3.87	18.89 ± 2.23
2	Maximum Diameter in middle of Bone	17.86 ± 1.74	15.85 ± 2.82
3	Transverse Diameter at level of Nutrient Foramen	18.19 ± 3.87	18.86 ± 2.20
4	Sagittal Diameter at level of Nutrient Foramen	27.51 ± 2.78	28.26 ± 2.29
5	Maximum Girth of shaft	90.01 ± 7.23	92.52 ± 6.14
6	Total length of Tibia	371.30 ± 23.20	379.41 ± 18.90

Original Research Paper

Analysis of Cranio-Cerebral Injuries by Blunt Force

*Puttaswamy

Abstract

Despite current advances in public education and in automobile safety requirements, cranio-cerebral injuries continues to be a major cause of morbidity and mortality and accounts for significant portion of health care costs today. Trauma respects neither geography nor body systems. Consequently head injury occurs every 15 seconds and a patient dies from a head injury every 12 minutes, a day doesn't pass that an emergency department physician is not confronted with a head injured patient.

The present work is based on the observation and study made on 117 cases collected. These cases include 39 cases who died before being admitted to any hospital and were sent directly by the police to postmortem, Mysore Medical College, Mysore, and 78 cases that died in the hospital under medical care. Clinical data are available for 78 cases that died in the hospital after undergoing some treatment. An attempt is made in these cases to correlate clinical findings with the autopsy findings.

Key Words: Cranio-Cerebral Injuries, Trauma, Clinical Findings, Autopsy, Automobile

Introduction:

Patients with head injury constitute a major health problem throughout the world. A day doesn't pass that an emergency department physician is not confronted with a head injured patient. [1] Head injury is one of the leading causes of death in Mysore, among the total deaths due to trauma. The incidence of acute "cranio-cerebral" injuries due to blunt forces in the city of Mysore is rather high. Out of 2175 cases of acute head injuries were admitted to the surgical wards of the Krishna Rajendra Hospital, Mysore, Karnataka, 370 of these proved fatal, accounting for 17% of the total admissions.

The subject of cranio cerebral injuries has assumed paramount importance in recent times owing to the enormous mechanization of various aspects of life, increasing instances of brutal assault and innumerable and variegated accidents on earth, in the air, in water and so on. Mostly head injuries are the result of blunt force, either local or general. Head injuries are most common and account for about one fourth of all deaths due to violence and are responsible for 60% of all fatal road accidents. [2]

As head is the most prominent of the exposed part of the body by virtue of its situation, it bears the brunt of violence accidental, suicidal or homicidal.

The diagnosis, treatment and mechanism of cranio-cerebral injuries are challenging to the medical men. The location of the lesion due to injury and the treatment of the same is an enigma to a Neurosurgeon, but the evaluation of mechanism is a puzzle to the Forensic Pathologist. [3]

The importance of the subject of cranio-cerebral injuries in Forensic medicine lies not only in the understanding of the path-morphology of the lesions, but lies also in their medico-legal implications that arise in connection with these injuries like time of survival, act of volition, correlation of interpretation so vital to accurate reconstruction, legality of liability and compensation settlements etc. [4] The rapid increasing incidence of head injuries may be attributed to population explosion, tremendous growth in road transport sector without adequate traffic planning or control, lack of traffic sense among the road-users, a large percentage of violent crimes, industrial accidents, fall from height etc. [5]

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Materials and Methods:

The data to be presented concern head injuries due to blunt forces only. All of them were investigated to determine the various epidemiological demographic, medico legal and forensic aspects of cranio-cerebral injuries. In the present study, the autopsies were conducted by the Department of Forensic Medicine,

Government Medical College, Mysore, Karnataka, during the period of April 1993 to the end of March 1994. 854 bodies were referred by the police, of whom 117 cases had died as a result of "Cranio-cerebral injuries by blunt force". (Table 1A) These cases include 39 cases that died before being admitted to any hospital or on the way to the hospital or declared dead at the emergency room and 78 cases that died under medical care.

Table 1 A: Cases Analysed in the Present Study

Total no. of PM's conducted from April 1993- March 1994	854
Total no. of Fatal Blunt Force Injuries from April 1993- March 1994	217 (25.4%)
Total no. of Fatal Head Injuries	117(13.7%)

The primary object of this work is to analyze 117 cases, because in the literature, reports concerning head injuries are based on clinical study and are primarily concerned with clinical problems. To our knowledge there is no satisfactory analysis of all post mortem findings in a sufficiently large number of cases.

Here in this study it is intended to determine the sources and causes of acute cranio-cerebral injuries that occur in a provincial city like Mysore, to set on record a statistical statement of the conscious, unconscious was recorded. Time of survival was also recorded after estimating the age of injuries and was confirmed by history, hospital and police records. An attempt was made to inquire and to appreciate any bodily deformities or defects like corneal opacity, cataract, pelvic deformity and spine which may have contributed to the injury.

A complete top to bottom general physical examination of each and every dead body is carried out and the Injuries on the body, their size and shape if any, and location besides fractures were noted in detail.

Observation, Results and Discussion:

• Age Incidence:

Detailed post mortem study was conducted on 117 dead bodies, which died of "cranio-cerebral injuries", of which 78 from the clinical series and 39, which died before being admitted to any hospital.

In the autopsies studied, there were cases that belonged to every decade up to ninth decade age group. The mean age was 36.5 years with a standard deviation of 18.6 years. (Table 2) we find the largest number of cases 26 (23.2%) in the age group 30–40 years, followed by 20–30 and 40–50 years 19 (16.3%). In 50–60 years, 0–10, 60–70, 10–20, the number of cases were gradually decreasing to 18 (15.3%); 15 (12.8%); 8 (6.8%); 7 (5.9%);

respectively and least 4 (3.4%) in the age group 70 and above. (Table 2)

The differentiation in deaths in different age groups depends upon the activities of the persons of different age groups. It is of interest that the number of cases is lowest in the eighth decade, being about 4 (3.4%) followed by second decade, 7 (5.9%) which is one-half of that for the first decade. The age group 20- 50 years being the most active period of life, persons of this age group outnumbered others.

The number of children below 10 years of age involved is 15 (12.8%), which is significant because in children the mortality rate is rather high which is due to the risk of involvement in traffic accidents, as an average Indian child is less protected from such accidents. The common notion that deaf, blind and crippled children are more prone to vehicular accidents is theoretically convincing, but in our series we have not found any case where we could establish that the child was either deaf or blind.

The middle age groups and late middle age groups 20–40 and 40–50 years though more stable and sturdy sustain injuries as a result of their involvement in quarrels, assaults falls and vehicular accident. In the present study, the youngest victim is a five months old female child and the oldest is 90 years male.

• Sex Incidence:

Out of the total 117 cases, 97 (82.91%) are males and only 20 (17.09%) are females. The high percentage (82.91%) of mortality in males was not amazing, since their involvement in most of the outdoor activities and are obviously more subjected to accidents especially in adult age group. The high incidence is seen in the age group 30–40 being 26 (23.07%). The next group is 20-30 years being 17 (14.5%). The lowest in the male is 3 (2.56%) in age group 70 and above. (Table 2)

The incidence of mortality in females is very low as they are not involved generally in such activities as men, like assaults, climbing up, etc., and majority of women usually stay in and look after the household work. Among the females the highest incidence is in the group 0–10 years being 7 (5.98%). Age and sex incidences are interrelated to the etiology of blunt force in deciding fatality, so, sex and age incidences could be better understood if all the three i.e., age, sex and etiology of blunt force are discussed together.

Our study shows that the pedestrian is injured by the direct contact with the vehicle and is forcibly thrown on the ground. These injuries are mostly due to blunt trauma. In some cases

the injuries are caused by the wheel passing over the head resulting in crushing. There were 27 deaths to the occupants of motor vehicles. (Table 3) Taking the road deaths as a whole and considering the number of motor vehicles on the roads, the evidence indicates that when two or more vehicles involved in an accident as in head on collisions, collision with a bridge, overturning etc it is the occupants of the smaller vehicles who pay the penalty. The contributory factors for the fatal injuries to the vehicle occupants include the movements of occupants within their vehicle at something like the speed of a vehicle, the deformation of the vehicle itself and the occupants may be trapped or wedged under the heavy vehicle. [6-10]

Summary:

The present study is based on the observation made on 117 dead bodies that died of cranio-cerebral injuries by blunt force: 78 of which from the clinical series and 39 of those who died before being admitted to any hospital. Brief history as to the etiology of blunt force was recorded at the time of admission to the hospital, in all these 78 cases. These cases were studied in detail regarding their investigative procedures, operation treatment if any and progress of the patient by going through inpatient case records.

Detailed post-mortem examination was conducted on every dead body by routine method. Various results were arrived at from the critical analysis of these cases regarding the etiology of blunt force, age, sex, fracture of the skull, intra-cerebral lesions, lucid interval, period of survival, associated injuries. Cause of death is inferred in all these cases.

From the clinical series 10 cases have been selected for correlating the clinical features with the autopsy findings. These cases have been discussed and interpreted in detail. Generally the clinicians are mislead or may fail to diagnose where head injury is associated with alcoholic intoxication and especially while the patient is in deep coma. In these cases it is always advisable to take the X-ray of the skull and Lumber Puncture done, without which, investigation will not be completed and justice cannot be meted out to the patient.

Medico-legally, Lucid interval is very important because, sometimes the victim after receiving mortal injuries to the brain were able to speak, or wrote down the name or names of his assailants. In such cases, medical evidence is required to state whether a person is capable of such acts after receiving such fatal injuries.

A guarded opinion should always be given in such cases. Sometimes the question of

pre-existing intra cranial lesions due to natural causes like arterio-sclerosis, intra-cranial tumors, intracranial aneurysms and other pathological processes may arise and complicate the autopsy findings. In such cases it is only by careful P.M. examination can reveal the facts and the final opinion to the cause of death is given after perusal of the each and every finding at autopsy. Lastly, in cases of alleged infanticide to exclude birth injuries and accidental trauma to the head, the role of Forensic Pathologist is indispensable.

Conclusion:

The subject of "Cranio-Cerebral injuries" has assumed paramount importance in recent times owing to the enormous mechanization of various aspects of life, increasing instances of brutal assaults and innumerable and variegated accidents in the air, in water and so on. The consequences of injury to the brain are of very great diversity and complexity and they offer many vexing diagnostic problems to the clinicians and contribute often thought provoking necropsy material to the forensic pathologist.

They are also important because of many other important Medico-legal implications that arise in connections with these injuries like time of survival, acts of volition, compensation settlements etc. In spite of the tremendous advance made during the past fifty years we are still unable to evaluate the entire lesion, which are exposed on the autopsy table. As cranio-cerebral injuries form a considerable percentage of deaths and as even trivial injury looks apparently normal in blunt force injuries, only a careful autopsy will enable us to asses every important facts on the autopsy table, which helps the public, police and the court of law in administering justice.

The present study is based on the observation made on 117 bodies that died of cranio-cerebral injuries by blunt force, 78 of which from the clinical series and 39 of those who died before being admitted to any hospital. Various results were arrived after detailed post-mortem examination and have been discussed and conclusions have been drawn regarding the age, sex and their relation to blunt force injuries.

Various types of skull fractures, intra cranial lesions, associated injuries, lucid interval and incidence of period of survival have been critically analysed.

From the clinical series, 10 cases have been selected for correlating the clinical observation made with those findings at autopsy. These cases have been discussed and

interpreted. In some of these cases post mortem findings confirmed the clinical diagnosis.

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Table 2: Incidence of Sex in relation to Age

Age (Yrs)	Males	Females	Total	Percentage
0 – 10	8	7	15	12.8
10 – 20	7	0	7	5.9
20 – 30	17	2	19	16.3
30 – 40	26	1	27	23.2
40 – 50	15	4	19	16.3
50 – 60	15	3	18	15.3
60 – 70	6	2	8	6.8
> 70	3	1	4	3.4
Total	97	20	117	100.0

Table 3: Victims involved in Accidents

Category	Victims	Percentage
Pedestrian	32	35.2
Occupants of Vehicle	27	29.7
Driver of Open Vehicle	21	23.1
Cyclists	11	12.0
Total	91	100.0

Original Research Paper

Lipid Profiles with Increase Blood Lead Level: Risk of Cardiovascular Disease in Battery Workers of Lucknow City

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Abstract

In order to investigate the effects of lead exposure on risk of cardiovascular disease during Occupational battery workers i.e. lead exposure, plasma cholesterol and its fractions as high-density lipoprotein (HDL), low-density lipoprotein (LDL) and triglyceride (T.G.) were determined in various battery workers in Lucknow city U.P., India. Increased risk of cardiovascular disease was observed in the various battery workers. Total cholesterol in the battery workers and control group was 142.14 ± 31.92 (mg/dl) and 95.72 ± 11.57 (mg/dl) respectively, which is higher in the battery workers than that of present in control group, While LDL cholesterol in the battery workers and control group was 158.30 ± 22.70 (mg/dl) and 103.77 ± 4.62 (mg/dl) respectively. HDL cholesterol in the battery workers and control group was 38.80 ± 10.13 (mg/dl) and 65.53 ± 6.52 (mg/dl) respectively.

The triglyceride levels were 162.06 ± 90.85 (mg/dl) and 138.62 ± 5.65 (mg/dl) in the battery workers and control group respectively, which is not affected [$p > 0.05$]. The LDL/HDL and Total cholesterol/HDL cholesterol ratio, Blood pressure, and blood lead level, was also higher in the battery workers, Results suggest that lead exposure increases cholesterol synthesis and transport to peripheral tissues whereas reverse cholesterol transport to the liver is not affected.

Key Words: Lead; Lipid Profile; Cardiovascular disease; Battery Workers

Introduction:

Lead poisoning is presently becoming the most common disease of environmental origin and is increasing very rapidly in developing countries. [1-5] Environmental toxicants, including lead and other metals, are potentially preventable exposures that may explain population variation in cardiovascular disease rates. [6] The cardiovascular effects of lead, however, are not limited to increased blood pressure and hypertension, but also been associated with an increased incidence of coronary heart disease, stroke, and peripheral arterial disease. [7] In order to gain an insight into lead exposure and its effects on lipid profiles, we investigated the distribution of blood lipids in various battery workers in Lucknow city, India, who have been shown to be occupationally exposed to lead.

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Material and Methods:

The study conducted on 60 industrial employees (case group) exposed to lead through acid battery in the battery manufacturing and refilling & battery shops. The age and Body Mass Index (BMI) matched unexposed person from general population (control group). To prevent discrimination, subjects were recruited for our study fulfilling inclusion criteria (male sex, age 20 to 40 years, exposure more than five years, and five hours/day, BMI less than 25 and no history of chronic disease, at least one year tenure, no use of medication other than analgesics during the month preceding data collection). Every subject was offered the examination after obtaining ethical clearance from the Institutional Ethics Committee. The cases and control subjects were explained the procedure of study.

The subjects were given instruction to obtain from tea or coffee 24 hrs and stop medications 48 hrs prior to day of testing. They were asked to take light breakfast at least 2 hrs before testing. All the tests were conducted in the morning hours in a quiet room with temperature of 25°C - 28°C .

Anthropometric Measurements and Body Composition:

The weight of each subject was measured to the nearest 0.1 kg with a battery

operated scale. The height was measured to the nearest centimeter with the aid of a portable stadiometer. From these data, BMI was calculated. Blood pressure was measured two times on the left arm in each subject in a resting position. [8] Each measurement was spaced twenty minutes apart and was usually performed before collection of blood samples. The average of the two measurements was used for all analyses.

Blood Analyses:

Venous blood samples were obtained between 8.00 a.m. and 10.00 a.m. from the subjects after an overnight fast. Aliquots of blood samples were separated for lead analysis and the remaining blood samples were centrifuged to separate plasma and red blood cells. From Plasma concentrations the total cholesterol, LDL cholesterol and triglycerides were determined. HDL cholesterol was determined in plasma with the same commercial kits for total cholesterol after very low density lipoproteins (VLDL) and low density lipoproteins (LDL) were precipitated with heparin-MnCl₂ solution. [9]

Blood Lead Estimation:

Blood lead analysis was performed using atomic absorption spectrophotometer, which is automated Lead analyzer, named Lead Care II blood lead analyzer certified by waiver under the authority of public health service Act (PHSA) 42U.S.C.263 (a).

Statistical Analysis:

Results are expressed as mean \pm S.D. One-way analysis of variance (ANOVA) followed by the least significant difference (LSD) test were used to analyses the results with $p < 0.05$ considered significant. [10] The relationships between blood lead levels and plasma lipids and the anthropometric parameters were also analyzed using Pearson correlations. [10]

Results:

- **Age (Years) of Case and Control Group:**

Analyses of the anthropometric parameters (Table 1) showed that average age (years) of case group and control group was 31.62 ± 6.03 and 29.60 ± 6.01 respectively and P-value is $P > 0.0005$.

- **Time of Exposure (Years):**

The Time of exposure of occupationally lead exposed should be more than 5 years for case group. The analyzed data showed that average Time of Exposure (years) of case group and control group was 10.76 ± 2.43 and 0.00 respectively. There was significant difference in Time of Exposure (years) between cases group and control group.

- **Time of Exposure (Hours Spent /Day) in Workshop or Industries:**

The Time of Exposure of Occupationally lead exposed should be more than 5 hours spent /day in workshop or industries for case group. The analyzed data showed that average time of exposure hours spent /day in workshop or industries of case group and control group was 10.76 ± 2.43 and 0.00 respectively. There was significant difference in Time of Exposure between cases group and control group.

BMI between cases and control:

There was also no significant difference in BMI between cases and control. The average BMI (kg/m^2) in case group and control group is respectively 24.41 ± 4.74 and 25.99 ± 3.26 and P-value is $P > 0.05$. There was no significant difference between case and control group in reference with Age, Chest, Abdomen, Hips, Height, Weight, and BMI in size.

- **Blood Pressure:**

The systolic blood pressure (mm Hg) in battery workers was 127.63 ± 20.16 while in control group it was 123.18 ± 5.05 respectively and p-value is $P < 0.0001$, which is greater than control and borderline hypertensive. The observation shows that the diastolic pressure in cases was 79.23 ± 10.78 mm Hg.

- **Heart Rate:**

The heart rate in battery workers (case group) was 69.12 ± 11.15 while in control group it was 72.7 ± 3.46 respectively. The P-value is $P > 0.05$, which is not statically significant.

- **Hemoglobin:**

The hemoglobin (gm %) in battery workers (case group) was 9.036 ± 1.002 while in control group is 11.694 ± 1.018 respectively. The P-value is $P < 0.0001$, which is statically significant.

- **Plasma Lipid Profiles:**

In the battery Workers (case group) total cholesterol is higher i.e. 142.14 ± 31.92 mg/dl, than control group i.e. 95.72 ± 11.57 mg/dl respectively. Quantitatively, cholesterol levels of the battery workers were 1.5 or 2.0 times higher than that of the control group ($P < 0.001$). There were statistically significant differences in the LDL cholesterol between battery workers and control group. The values obtained for the battery workers (case group) were 158.30 ± 22.70 mg/dl and control group 103.77 ± 4.62 mg/dl respectively. It is significantly higher than controls group ($p < 0.001$). There was no significant difference in triglyceride (T.G.) between cases and control.

While in HDL cholesterol concentrations (mg/dl) the value in case group and control

group is respectively 38.80 ± 10.13 mg/dl and 65.53 ± 6.52 mg/dl and P-value is $P < 0.0001$. Therefore in HDL cholesterol concentrations (mg/dl) is being lower in battery workers (case group) than that of control group. While in VLDL cholesterol concentrations (mg/dl) the value in case group and control group is respectively 74.05 ± 68.65 mg/dl and 19.48 ± 4.15 mg/dl.

Blood Lead Concentrations:

Lead levels in the blood of the battery worker (case group) were significantly higher than that of control group ($p < 0.001$) in the Lucknow city. The Industrial battery worker (case group) has the higher blood lead level of 35.45 ± 13.36 μ g/dl than that of control group 6.04 ± 01.49 μ g/dl. (Table 2)

Correlations between Blood Lead and Anthropometric Parameters, and Investigated Lipids:

There was no significant correlation between blood lead levels and any of the anthropometric parameters ($p > 0.05$) (Data not shown). However, a positive significant correlation was observed between blood lead and total cholesterol and blood lead and LDL cholesterol.

Discussion:

Lipid and lipoprotein abnormalities play a major role in the pathogenesis and progression of atherosclerosis and cardiovascular diseases. [11-15] In Indian populations, dyslipidemia as a risk factor for cardiovascular disease and increasing incidents of death due to cardiovascular disease in both urbanized and underdeveloped rural countries have been reported. [16] In this present study, we evaluated the distribution of some blood lipids in battery workers who are occupationally exposed to lead; we found that majority had triglyceride levels not significantly different from controls. On the contrary, total cholesterol levels in the battery workers were between 1.5 and 2.0 times higher than controls.

In addition, HDL cholesterol in battery workers was considerably lower when compared with controls. To our knowledge, the distribution of blood lipids in battery workers in Indians has not been reported in the literature. Indications from this comparison are that while the HDL cholesterol and triglyceride concentrations of both the controls and cases were within the acceptable range prescribed by the American Heart Association (AHA), the battery workers with total cholesterol of 142.14 ± 31.92 mg/dl and LDL cholesterol of 158.30 ± 22.70 mg/dl seem to have unfavorable risk profiles for cardiovascular disease when compared with control.

Furthermore, the LDL/HDL ratio of the battery workers seems to have a greater risk of cardiovascular disease when compared with other controls.

The findings of the present investigation indicate that exposure to lead alters the metabolism of cholesterol and thus increases the risk of cardiovascular disease and atherosclerosis in lead-exposed subjects. HDL and LDL are two of the four main groups of plasma lipoproteins that are involved in lipid metabolism and the exchange of cholesterol, cholesterol ester and triglycerides between tissues. [17, 18] It is evident that HDL protect against atherosclerosis. Some of these factors appear to have anti-oxidant and anti-inflammatory effects which may obviate processes that initiate atherogenesis. [19, 20] Epidemiological studies have also shown that elevated concentrations of total or LDL cholesterol in the blood are powerful risk factors for coronary disease. [21] Numbers of studies have demonstrated that blood lead increases from 10 to 25 μ g/dl are associated with systolic and diastolic blood pressure increases of 1.4–8 mmHg and 1.2–4 mmHg, respectively. [22] Mean blood lead levels observed in the battery workers in this study were between 2.5 and 3.0 times higher than control subjects.

Even though job experience indicated that lead exposure has been going on in these workers for 4 to 26 years had a borderline high systolic blood pressure as prescribed by the AHA. It remains to be established in these workers the threshold value of blood lead that might be associated with increased blood pressure. In addition to blood lipids, other factors such as age, physical activity, genetics, body composition, alcohol intake, tobacco use and body fat distribution, contribute significantly to risk of cardiovascular disease. [14]

All the subjects who participated in this study were nonsmokers and by virtue of the demands of their occupations, most of the workers are physically active and this might account for the normal levels of HDL cholesterol observed in them. [23] The anthropometric parameters measured in the battery workers did not reveal any statistically significant difference, thus suggesting that these factors may not play any significant role in the dyslipidemia observed in these battery workers.

Conclusion:

Our data suggests that the lead exposed persons having altered lipid profile, increased total cholesterol and decreased HDL cholesterol.

It suggests that lead exposed persons are at the high risk of cardiovascular diseases.

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Table 1
Demographic and Anthropometric Characteristics of the Subjects (Values: Mean \pm S.D.)

Parameter	Case Group	Control Group	P-Value
Age(Years)	31.62 \pm 6.03	29.60 \pm 6.01	P>0.0005
Time of Exposure(Years)	10.76 \pm 2.43	00	
Hour of exposure per day in workshop	10.76 \pm 2.43	00	
Chest(cm)	81.36 \pm 3.46	81.83 \pm 3.52	P>0.0005
Abdomen(cm)	69.47 \pm 7.26	70.97 \pm 5.62	P>0.0005
Hips(cm)	82.71 \pm 2.91	83.60 \pm 2.77	P>0.0005
Height(m)	1.56 \pm 0.13	1.58 \pm 0.12	P>0.0005
Weight(m)	65.31 \pm 8.51	62.61 \pm 7.41	P>0.0005
BMI(Kg/m ²)	24.32 \pm 4.74	25.89 \pm 3.26	P>0.005
B.P. Systolic(mm Hg)	127.63 \pm 20.16	123.18 \pm 5.05	P<0.0001
B.P. Diastolic(mm Hg)	79.23 \pm 10.78	81.52 \pm 4.81	P<0.0001
Heart rate	69.12 \pm 11.15	72.70 \pm 3.46	P<0.005
Hemoglobin (gm %)	9.036 \pm 1.002	11.694 \pm 1.018	P<0.0001

Table 2
Blood Lead and Blood Lipid Profiles of the Subjects (Values Are Mean \pm S.D)

Parameter	Case Group	Control Group	P-Value
Blood lead value(in μ g/dl)	35.45 \pm 13.36	6.04 \pm 1.49	P<0.0001
Hemoglobin (gm %)	9.036 \pm 1.002	11.694 \pm 1.018	P<0.0001
Total cholesterol(mg/dl)	142.14 \pm 31.92	95.72 \pm 11.57	P<0.0001
T.G. (mg/dl)	162.06 \pm 90.85	138.62 \pm 5.65	P>0.005
HDL Cholesterol (mg/dl)	38.80 \pm 10.13	65.53 \pm 6.52	P<0.0001
LDL Cholesterol (mg/dl)	158.30 \pm 22.70	103.77 \pm 4.62	P<0.0001
VLDL(mg/dl)	74.05 \pm 68.65	19.48 \pm 4.15	P<0.0001
Total cholesterol /HDL Cholesterol	3.66 \pm 3.15	1.46 \pm 1.77	P<0.0001
LDL /HDL	4.07 \pm 2.20	1.58 \pm 0.70	P<0.0001

Original Research Paper

Sex Determination from Sternal End of 4th Rib In Western U.P. Population: An Autopsy Study

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Abstract

There have been several studies on the human skull, long bones, pelvis, sacrum and manubrium to establish the sex of skeletal remains. If small segment of the bone or small bone is found then it will be very difficult to identify the sex. The present study showed the sternal extremity of the fourth rib can be used in determining the sex by direct metrical analysis of an isolated 4th rib. The samples (55 males, 39 females) were obtained from individual of known age and sex and three measurements (SI, APW and PD) were taken from each rib. The sample was divided into five groups from less than 15 years to more than 60 years and was analysed by stepwise discriminant function analysis. It was found the specificity of sex determination varied from 50 % to 88.89 % and overall correct classification varied from 60% to 94%. SI was the most reliable followed by APW and APW measurement is most useful criteria for more than 60 year of age. It was therefore concluded that sexual dimorphism can be detected by direct measurement of fourth rib and this dimorphism increases with age

Key Words: Identification, Sex Determination, Sternal Rib, Discriminant function

Introduction:

Identification means absolute fixation of the individuality of a person. Identification of the individual whether living or dead is of paramount importance in day to day practice. After the identity of the individual is established it opens up the channel for successful crime investigation. Even in civil cases identification of a living person is important. Identification can be partial or complete. Partial identification means ascertaining only few facts about the individual's identity while the other facts still remain unknown. In Corpus Delicti, doctors have to establish two facts identity as well as cause of death. In case where the body is skeletonized age and sex determinations are always crucial and problematic especially when incomplete skeleton is received and when there is no other means available to identify the body.

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Determination of sex from skeletal remains has been studied and analyzed extensively by researchers from abroad. In India the pioneers in this field are Jit & Singh [1], Singh & Singh. [2-6] Krogman [11] is of the view that 100 % accuracy in sex determination can be achieved when the entire skeleton is available. However problem arises when fragmentary remains of skeleton are brought for examination.

Therefore we have used the sternal end of 4th ribs of both sides to establish the identity of sex of the victim. The sternal end of rib is chosen because it has been shown from earlier study by Iscan et al [7-9] to be a perfect bone to show advancement of age and the age can also be estimated by this method if the partial skeleton is found. It also appeared to fit Howell's criterion [10] of showing advancement of age rather than the effects of function & stress.

Aims and Objectives:

1. To determine the sex of the subjects by measurement of 4th rib parameters
2. To find out the best parameter to be used for measurement

Material and Method:

The present study was conducted by Department of Forensic Medicine, Teerthanker Mahaveer Medical College & Research Centre Moradabad on 100 pairs of 4th rib taken from dead body brought for postmortem examination in mortuary of district Moradabad, UP. Out of these 94 pair of 4th rib were taken for study and

6 pairs were excluded because they were partially destroyed and fractured during collection procedure and were not suitable for the study.

Study Material:

The material comprised of 188 (55 males, 39 females) 4th ribs collected at autopsy both from right and left side of dead body. Out of 188 fourth rib 55 ribs of right side and 55 ribs of left side are taken from males and 39 right rib and 39 left rib were taken from females, of known age who were brought in for post-mortem examination to the mortuary of district Moradabad. As soon as the body was brought for post-mortem examination its particulars were recorded and age was cross checked from relatives. The sternal end of fourth rib was collected after identifying and by cutting 2" long portion along with costochondral junction with the help of rib cutter. To avoid mixing of each rib it was suitably tagged and numbered.

The specimens were left in glass container filled with saturated solution of sodium chloride for 6 to 8 weeks. They were then boiled in water with a pinch of sodium bicarbonate for 30 minutes. All the adherent soft tissues including costal cartilages were carefully removed and dried for 2 to 3 days. Following the technique presented by Iscan et al (7-9], three osteometric measurements were taken at the sternal end of fourth rib with the help of vernier caliper to the nearest tenth of a millimeter:

- Maximum Superior Inferior Height (SI)
- Maximum Anterior Posterior Width (APW)
- Maximum Pit Depth (PD)

Age Groups

The ribs were grouped in five different age groups ranging from less than 15 year age group to more than 60 yrs. SPSS software version 19 was used for the discriminant function analysis. Standard canonical discriminant function co-efficient was obtained and D.F can be calculated by formula $DF = SI \times (X) + APW \times (Y) + PD \times (Z)$ where X, Y and Z are the coefficients of various parameters of different ribs utilized for the study. This equation can be used for all age groups and D.F can be accordingly calculated. Structure matrix value was obtained and the value having more positive value indicates the best parameter for the study in particular age group. Then all the data was compiled by SPSS to find out the correctness of the classification, sensitivity and specificity of the age group for the differentiation of gender.

Results:

In present study out of the 94 cases, male constituted 55 (58.51%) while female constituted 39 (41.49%) of cases. (Table 1) There is no significant association between the gender and location of the rib measurement and also there is no such significant association between gender and parameter of rib measurement as the p value is > 0.05 , hence the hypothesis of no difference is accepted (Table 2)

Descriptive statistics of all the participants with their individual parameter of the rib measurement showed that in the first age group of less than 15 years out of three osteometric dimensions two parameters (SI height and APW) were used to discriminate the sex while in rest of group all the parameters were used to separate the sex. (Table 3A & 3B)

According to the goodness of fit test data for all groups, less than 15 years age group is not good for fit as the significance value is greater than 0.05, the data is fit for the rest of the groups of participants as significance value is < 0.05 . (Table 5)

SI has shown positive coefficient for all age groups indicating best parameter except for 61–75 year group which showed APW having positive coefficient indicating APW is best parameter for this age group. From the structure matrix of group wise parameters it is evident that parameter SI is more appropriately and positively discriminating the gender. (Table 6)

In our study the group means of each predictor variable according to gender and age wise showed the negative values for age group (31–60) year in males and positive values for females. It indicates discriminant function analysis discriminates females more correctly than males in this age group. (Table 7) It is clear that sexual dimorphism is detectable by the discriminant function analysis in all the age groups. Average accuracy varied from 60 % to 94 %. Sensitivity in males was 88.89% and in females was 80%. (Table 8A & 8B)

Discussion:

With the skull and pelvis have been proved to be the most reliable indicator of sex but they can be missing or damaged in some cases. [11] Other parts of the skeleton have also been researched with varying degree of accuracy. Overall this study revealed that accurate sex determination from the sternal 4th rib could be as high as 94%. Also it is one of the few parts of the skeleton in which sexual dimorphism increases with age. This was comparable to highly dimorphic areas such as distal epiphyses of femur and proximal

epiphyses of tibia with correct classification rate of 89% & 87% respectively. [12, 13] Iscan et al [14] introduced the rib phase technique where it was indicated that sexual difference in adult rib can be assessed with great reliability using discriminant function statistics.

This study has demonstrated that 4th rib shows sexual dimorphism. It was found that superior inferior height was most potential measurement for sex determination and sexual dimorphism was highest in age group from 40 to 75 years and least in less than 15 year age group. The similar study was done on Turkish population [15] which also showed that SI height is most reliable dimension for sexual dimorphism and if both dimensions are taken together it gives an accuracy of 86 % to 90%.

Similar study done on West African population in Ghana [16] showed the accuracy of sex determination varied from 80% in the young and 74% in the old groups to 78% for the total group. Iscan et al [14] study in North American whites and black as well as in others showed the accuracy of sex determination varied from 82% in the young and 89% in the old group to 83 % for the combined group. The study is based on known age of males and females so the assessment of age is very much important before the analysis of the gender. If the approximate age is not known then there can be error in determination of gender. It should be noted that in all the studies mentioned above, 4th rib is used for the assessment.

The present work has used only 4th rib for sex determination; therefore more studies should be done on other ribs as well. In a study for analysis of intercostal age variation at the sternal end of the rib indicated that difference among 3rd, 4th and 5th ribs were within one phase for 98 % of the sample. [17] Another research for complete osteological analysis of variation in rib (3 to 7) of the rib cage was carried out and preliminary result indicated that SI and APW dimension of rib 3 to 7 are not statistically significant from the adjacent one. [18]

Therefore 4th rib should be identified first with very caution as the technique is specific to 4th rib e.g. if the skeleton is found in the grave or soil it will not be always easy to determine that which rib is the fourth one. Another problem is with the preservation of the sternal end of the rib. As many scientist know that soil condition is very much critical as less acidic soil will preserve much better than more acidic soil. To reduce any potential damage one must be very careful when the ribs are to be collected from the grave or from the ground as it is observed that police collects the skeleton and forms the bundle of

bones and sent it to medical officer for postmortem examination. Ideally forensic expert or anthropologist should be called by the police at the site where the body is exposed and destroyed by the natural condition or by animals to collect this fragile bone.

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Table 1: Frequency of Participants

Age grps (Yrs)	Male (%)	Female (%)	Total
<15	3 (60)	2 (40)	5 (100 %)
16-30	26 (68.4)	12 (31.6)	38 (100 %)
31-45	12 (48)	13 (52)	25 (100 %)
46-60	9 (50)	9 (50)	18 (100 %)
61-75	5 (62.5)	3 (37.5)	8 (100 %)
Total	55 (58.51)	39 (41.49)	94 (100 %)

Table 7: Function at Group Centroids

Age (yrs)	<15	16-30	31-45	46-60	61-75
	Function	Function	Function	Function	Function
SEX	1	1	1	1	1
Male	.382	.540	-1.354	-2.993	3.737
Female	-.573	-.281	1.250	2.993	-6.228

Table 2: Location and Parameter Wise Distribution

		SEX	
		Male	Female
		Count	Count
LOCATION (P>0.05, Non-significant)	L-4	84	78
	R-4	162	115
PARAMETER (P>0.05, Non-significant)	APW	84	66
	PD	78	61
	SI	84	66

Table 4B: Discriminant Function Analysis

Parameter		46-60 years		61-75 years	
		Mean	Std. Dev	Mean	Std. Dev
Male	SI	14.437	.6147	17.624	1.8569
	APW	7.012	.2150	8.954	.1916
	PD	3.637	.3637	5.874	.2373
Female	SI	17.746	.6370	17.082	2.3205
	APW	8.037	.7583	7.000	.2083
	PD	5.089	.6884	4.032	.1792

Table 3A: Descriptive Statistics of Parameters

	<15 years		16-30 years			31-45 years		
	SI	APW	SI	APW	PD	SI	APW	PD
N	10	10	76	76	76	50	50	50
Mean	13.42	4.662	15.482	6.499	2.959	16.140	7.318	4.203
Std. Error of Mean	.296	.1959	.1947	.0943	.0805	.2866	.1326	.1255
Std. Deviation	.937	.6195	1.6975	.8221	.7018	2.0264	.9374	.8873

Table 3B: Descriptive Statistics of Parameters

Parameter	46-60 years			61-75 years		
	SI	APW	PD	SI	APW	PD
N	36	36	36	16	16	16
Mean	16.091	7.524	4.363	17.421	8.221	5.183
Std. Error of Mean	.2980	.1260	.1525	.4961	.2489	.2363
Std. Deviation	1.7880	.7561	.9149	1.9843	.9955	.9450

Table 4A: Discriminant Function Analysis

Parameter		< 15 years		16-30 years		31-45 years	
		Mean	Std. Dev	Mean	Std. Dev	Mean	Std. Dev
Male	SI	13.587	.9758	16.312	1.0553	14.563	.6252
	APW	4.653	.6489	6.764	.8240	6.599	.5124
	PD			3.225	.7753	3.473	.3937
Female	SI	13.175	.9535	15.050	1.8130	17.597	1.7585
	APW	4.675	.6702	6.362	.7946	7.982	.7251
	PD			2.821	.6247	4.877	.6459

Table 5: Canonical Discriminant Functions

Age groups	Function	Eigen Value	Canonical Correlation	Wilk's Lambda	Chi-square	Sig.
<15 years	1	.273	.463	.785	1.691	.429
16-30 years	1	.156	.367	.865	10.507	.015
31-45 years	1	1.764	.799	.362	47.274	.000165
46-60 years	1	9.483	.951	.095	76.368	.00046
61-75 years	1	26.601	.982	.036	41.473	.000046

Table 6: Standardized Canonical Discriminant Function Coefficients and Structure Matrix

	<15 years		16-30 years		31-45 years		46-60 years		61-75 years	
	Function		Function		Function		Function		Function	
1			1		1		1		1	
	*SCDFC	**SM	*SCDFC	**SM	*SCDFC	**SM	*SCDFC	**SM	*SCDFC	**SM
SI	2.098	.446	1.434	.961	1.594	.998	1.501	.883	-.130	.992
APW	-1.879	-.035	-.249	.724	0.117	.069	-.245	.441	1.020	.847
PD			-.313	.609	0.006	.240	-.569	.307	-.010	.027

*Standardized Canonical Discriminant Function Coefficient

** Structure Matrix

Table 8A: Predicted Group Membership

	Sex	<15 years			16-30 years			31-45 years		
		Male	Female	Total	Male	Female	Total	Male	Female	Total
Count	Male	4	2	6	20	6	26	24	0	24
	Female	2	2	4	23	27	50	8	18	26
Sensitivity	Male	66.7	33.3	100	76.9	23.1	100	100	0	100
Specificity	Female	50.0	50.0	100	46.0	54.0	100	30.8	69.2	100
Overall correctly classified		60 %			61.8%			84.0%		

Table 8B: Predicted Group Membership

	Sex	46 - 60 years			61 - 75 years		
		Male	Female	Total	Male	Female	Total
Count	Male	16	2	18	8	2	10
	Female	2	16	18	1	5	6
Sensitivity	Male	88.89	11.11	100	80.0	20.0	100
Specificity	Female	11.11	88.89	100	16.67	83.33	100
Overall correctly classified		94%			92%		

Original Research Paper

Determination of Time Elapsed Since Death from the Status of Transparency of Cornea in Ranchi in Different Weathers

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Abstract

Determination of 'time elapsed since death' (TSD) is one of the important content of the post-mortem report. Although the status of transparency of cornea is variable, depending on different factors like other parameters used for the purpose of determination of time since death but it is less variable as compared to others. The study sample comprised of 238 medico-legal autopsies conducted in the department of Forensic Medicine & Toxicology, Rajendra Institute of Medical Sciences, Ranchi, Jharkhand during June 2006 to September 2007. In majority of cases cornea remains transparent & moist in 0—06 Hrs and becomes transparent & dry in 06—12 Hrs, transparent to hazy in 12—24 Hrs, hazy to opaque in 24—36 hrs and opaque in >36 Hrs. In sequence, changes occurs more in warm & moist weather then in warm & dry weather and cold & moist weather respectively and least in cold and dry weather.

Key Words: Cornea, Transparent, Hazy, Warm, Cold, Dry, Moist, Time Elapsed Since Death (TSD)

Introduction:

Determination of 'time elapsed since death' (TSD) helps in the investigation of complex and mysterious cases to unearth the truth for the administration of justice in many ways. In general, determining the time of death is extremely difficult, and accuracy is almost impossible. Although by careful study of different macroscopic, microscopic, chemical and biological parameters, the TSD can be determined in considerably narrow range. The status of transparency of cornea is also variable depending on different factors, like other parameters used for the purpose of determination of TSD but it is less variable as compared to others.

Materials and Methods:

The study sample comprised of 238 medico-legal cases for autopsies conducted in the department of Forensic Medicine & Toxicology, Rajendra Institute of Medical Sciences, Ranchi, Jharkhand, during June 2006 to September 2007.

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Only those cases whose TSD were known by relatives, police or doctors and verified by other post-mortem changes, were included in this study.

The study was based upon variation in: -

1. **Weather:** Condition of weather was categorized in terms of **warm & moist, warm & dry, cold & moist and cold & dry.**

Cold means the average of maximum and minimum temperature of the day when it is below 22°C and above 22°C is warm. [1] Moist means average of the relative humidity above 70% and below it was considered dry. [2]

2. **Cornea:** Transparency of cornea was noted in following manner:

- a. Transparent and moist
- b. Transparent and dry
- c. Transparent to hazy
- d. Hazy
- e. Hazy to Opaque
- f. Opaque

For the purpose of classifying the observation systematically, the dead bodies were grouped in the following manner based on the known time elapsed since death:

Group	Time elapsed since death
I	0—06Hrs
II	06—12 Hrs
III	12—18 Hrs
IV	18—24 Hrs
V	24—36 Hrs
VI	>36 Hrs

Inclusion Criteria:

- When TSD was known by the relatives, police or doctors
- When it is verified by other post-mortem changes

Exclusion Criteria:

- a. When eyes were open.
- b. Body was kept in cold room/ freezer.
- c. Body was grossly affected with septicemia.
- d. Death was due to diarrheal diseases and malnutrition.

Observation:

Status of Transparency of Cornea in Cold & Dry Weather:

During this weather a total of 54 cases were examined. In 0—6 Hrs of TSD, cornea remained transparent in 100% case in which it was transparent & moist in 91.67 % of cases. In 06—12 Hrs cornea remained transparent in 75% cases but it became dry, in 50% cases.

In 12 to 18 hrs cornea became transparent to hazy in 75% cases and in 25% cases remained transparent where as in 18 to 24 Hrs corneas became hazy in 50% cases and remained transparent to hazy equally in 50% cases. In 24—36 Hrs cornea became hazy to opaque in majority (54.55%) cases and remained hazy in 2nd largest number (27.27%) of cases. In >36 Hrs it became opaque in majority (62.5%) of cases and remained hazy to opaque in 28.57% cases.

Status of Transparency of Cornea in Cold & Moist Weather:

During this weather a total of 65 cases were examined. In 0—6 Hrs of TSD cornea remained transparent in 81.81% case in which it was transparent & moist in 63.63 % of cases. In 06—12 Hrs cornea remained transparent in 66.67% cases but it became dry, in 50% cases and in 25% cases it became transparent to hazy. In 12 to 18 hrs cornea became transparent to hazy in 50% cases and in 37.50% cases it became hazy where as in 12.50% cases it remained transparent and dry. In 18 to 24 Hrs cornea became hazy in 42.85% cases and remained transparent to hazy equally in 42.85% cases where as in 14.28 % cases it became hazy to opaque. In 24—36 Hrs cornea became hazy to opaque in (80%) cases and became opaque in 20% cases. In >36 Hrs it becomes opaque in majority (85.71%) of cases and remained hazy to opaque in 14.29%.

Above observation indicates relatively more changes occurring in moist weather may be attributed to relatively more decomposition in moist weather.

Status of Transparency of Cornea in Warm and Dry Weather:

During this weather a total of 44 cases examined. In 0—6 Hrs of TSD cornea remained transparent in 75% case in which it is transparent & moist in 50% of cases, where as in 25% cases it became transparent to hazy.

In 06—12 Hrs cornea remained transparent in 33.33% cases which all became dry and in 44.44 % cases it became transparent to hazy. 12 to 18 hrs cornea became transparent to hazy in 44.44% cases and in 33.33% cases it became hazy. In 18 to 24 Hrs cornea became hazy in 50% cases where as in 33.33 % cases it became hazy to opaque.

In 24—36 Hrs cornea became hazy to opaque in 85.71% cases and opaque in 14.29 % cases. In >36 Hrs it becomes opaque in 100% cases. Above observation shows that relatively more changes in warm environment.

Status of Transparency of Cornea in Warm and Moist Weather:

During this weather a total of 75 cases were examined. In 0—6 Hrs of TSD cornea remained transparent in 66.67 % case in which it is transparent & moist in 50 % of cases and in 33.33 % cases it became transparent and hazy. In 06—12 Hrs cornea remained transparent in 60% cases but it became dry, in 50% cases and in 40% cases it became transparent to hazy.

In 12 to 18 hrs cornea became transparent to hazy in 44.44% cases and in 22.22% cases it became hazy where as in 22.22% cases it remained transparent and dry. In 18 to 24 Hrs cornea became hazy in 23.08% cases but remained transparent to hazy equally in 61.54% cases where as in 15.38 % cases it became hazy to opaque. In 24—36 Hrs cornea became opaque in 100% cases. In >36 Hrs it becomes opaque in 100% cases.

From above observation it appears that initial changes in warm and moist weather (as compared to warm and dry weather) is less because the moisture prevents the drying of cornea; but later on changes hastens due to relatively more decomposition in moist weather.

Discussion:

A. Behera et al did ophthalmoscopic examination in cases in which time since death was within 2 to 4 Hrs as cornea was clear during this period. [3]

Lan Zhou et al established relationship between changes of corneal opacity and PMI by processing and analyzing corneal images [4]

Suzutani T et al says that when cornea is transparent, the time which has elapsed since

death is less than 36 Hrs with few exceptions, with eyelids either open or closed. [5]

Conclusion:

In majority of cases cornea remains transparent & moist in 0—06 Hrs and becomes transparent & dry in 06—12 Hrs, transparent to hazy in 12—24 Hrs, hazy to opaque in 24—36 hrs and opaque in >36 Hrs. In sequence changes occurs more in warm & moist weather then in warm & dry weather and cold & moist weather respectively and least in cold and dry weather. This is evident from the present study that corneal examination is an important tool for the estimation of Time Elapsed Since Death in different geographical and climatic situations with relatively greater degree of accuracy.

It may prove helpful for doctors working in periphery hospitals like sub-district and district hospitals, where one hardly find any amenities, facilities and environment to conduct autopsies.

Moreover, no such study has ever been carried out previously in this state of specific environmental settings, so the findings of the present study will be of great importance with respect to academic and Public Health issues.

Future Scope of the Study:

Some computer assisted device might be developed to quantify the opacity based prediction of TSD which can further help the same with even greater degree of precision.

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Table 1
Status of Transparency of Cornea in Different Time and Weathers

Time (Hrs)	Season	Transparent		Transparent to hazy	Hazy	Hazy to opaque	Opaque	Total
			Transparent & moist Transparent & dry					
0-6	C&D	12(100%)	11 (91.67%) 1 (8.33%)	0	0	0	0	12
	C&M	9 (81.81%)	7 (63.63%) 2 (18.18%)	2(18.18%)	0	0	0	11
	W&D	6 (75%)	4 (50%) 2(25%)	2(25%)	0	0	0	8
	W&M	8 (66.67%)	6 (50%) 2 (16.67%)	4 (33.33%)	0	0	0	12
6-12	C&D	6 (75%)	2 (25%) 4 (50%)	2(25%)	0	0	0	8
	C&M	8(66.67%)	2 (16.67%) 6 (50%)	3(25%)	1(8.33%)		0	12
	W&D	3 (33.33%)	0 3 (33.33%)	4(44.44%)	2(22.22%)	0	0	9
	W&M	12 (60%)	2 (10%) 10 (50%)	8(40%)	0	0	0	20
12-18	C&D	2 (25%)	0 2 (25%)	6(75%)	0	0	0	8
	C&M	2(12.50%)	0 2 (12.50%)	8 (50%)	6 (37.50%)	0	0	16
	W&D	1(11.11%)	0 1 (11.11%)	4(44.44%)	3(33.33%)	1(11.11%)	0	9
	W&M	4(22.22%)	0 4(22.22%)	8(44.44%)	4(22.22%)	2(11.11%)	0	18
18-24	C&D	0		4(50%)	4(50%)	0	0	8
	C&M	0		6(42.85%)	6(42.85%)	2(14.28%)	0	14
	W&D	0		1 (16.67%)	3 (50%)	2(33.33%)	0	6
	W&M	0		8(61.54%)	3(23.08%)	2(15.38%)	0	13
24-36	C&D	0		1(9.09%)	3 (27.27%)	6 (54.55%)	1 (9.09%)	11
	C&M	0		0	0	4(80%)	1(20%)	5
	W&D	0		0	0	1(14.29%)	6(85.71%)	7
	W&M	0		0	0	0	5(100%)	5
>36	C&D	0		0	0	2 (28.57%)	5 (62.5%)	7
	C&M	0		0	0	1 (14.29%)	6(85.71%)	7
	W&D	0		0	0	0	5(100%)	5
	W&M	0		0	0	0	7(100%)	7
Total								238

Original Research Paper

A Study of Pattern of Crush Injury in Medico-Legal Autopsy

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Abstract

Crush injury is a type of mechanical injury. A crush injury occurs when a body part is subjected to a high degree of force or pressure, usually after being squeezed between two heavy objects. Crush injuries are rarely encountered in everyday trauma care but become an important injury in disaster situations. These injuries are commonly found in victims of collapsed structures, which may result from earthquakes, hurricanes, tornados, bombings, and other large scale events. It is also seen in road traffic accidents, railway tract incidents, and in industrial accidents.

This present study is a retrospective study undertaken at the mortuary of Forensic Medicine, Gauhati Medical College and Hospital. The study includes all the crush injury cases coming to the mortuary for autopsy during the year 2011. The main objective is to study the pattern of the crush injury cases in respect of different epidemiological data, to find the causes of death in different crush injury cases, the sex ratio and the causes of such injury.

Key Words: Crush injury, Lacerated injury, Autopsy, Earthquakes, Hurricanes

Introduction:

Crush injury, a type of lacerated injury [11, 14] occurs because of pressure from a heavy object onto a body part. [13] When a heavy weight like a wheel of a truck passes over any extremity, by its shearing and grinding force, it tears the skin from the underlying tissues and crushes the muscles, soft tissues and bones beneath it, resulting in a crush injury. [8-10]

"A crush injury is a direct injury resulting from crush. Crush syndrome is the systemic manifestation of muscle cell damage resulting from pressure or crushing". [8]

Crush injuries are rarely encountered in everyday in trauma care but become an important injury in disaster situations. These injuries are commonly found in victims of collapsed structures, which may result from earthquakes, hurricanes, road traffic accidents, railway incidents, tornados, bombings, and other large-scale events. [6]

Crush Injury is also defined as injury sustained from a compressive force sufficient to interfere with the normal metabolic function of the involved tissue, May be open or closed. [5]

Crush Syndrome is the systemic manifestations of crush injuries.

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It consists of rhabdomyolysis, electrolyte and acid-base abnormalities, Hypovolemia, and acute renal failure. [5]

Materials and Methods:

This study is a retrospective study undertaken at the mortuary of Forensic Medicine, Gauhati Medical College and Hospital.

The study includes all the crush injury cases coming to the mortuary for autopsy during the study period starting from the 1st of January 2011 till 31st of December, 2011. Details of the cases were collected from the police, relatives accompanying the body, the inquest reports, hospital records and the autopsy reports. The main objective is to gather epidemiological information, to find the causes of death in different crush injury cases, the sex ratio and the causes of such injury.

Observation and Results:

A total of 2652 autopsies were carried out during the study period and crush injury comprised of 5.65% of the cases with 150 cases. Most of the victims were between 21-30 years of age, followed by 31-40 years. Only one case was found to be above 70 years. (Graph 1)

Most of the victims were male comprising of 89.3 cases out of the 150 cases studied during the study period. (Graph 2)

Most of the victims belong to the Hindu community, followed by Muslims. The religion of 10 cases could not be ascertained as they were reported as unknown cases. (Graph 3)

In this study most of the victims were married, and in 10 cases which were unidentified

cases, the marital status of the victims was not known. (Graph 4) Accidental injuries top the list with 96.6% of the cases, and rest are the suicidal cases. (Graph 5)

Head and neck were the most common body part involved in our study, followed by lower limbs. In one case, the whole body was crushed in a run over in highway by trucks. (Graph 6) In present study most of the injuries resulted from Road traffic incidents comprising of 52.6% of the cases and rest were the railway incident. (Graph 7) Most of the victims died on spot before getting any treatment. (Graph 8)

Most of the victims died instantaneously, followed by hemorrhagic shock. Crush injury associated with coma is found in five cases. (Graph 9)

Discussion:

Most of the victims were male and belongs to the Hindu community, which is similar to the findings of Dr. Gunajit Das, Dr. Y Malik and Dr. A.P. Baruah. [3, 4, 7] It depends on the relative ratio of various religions in a given area. In the area where Gauhati Medical College is located, most of the people belong to the Hindu religion, which results in their greater count in this study.

Most of the victims are between 21-30 years of age, which is similar to the findings of Dr. Y Malik [7] and Dr. A.P Baruah [13] but different from the findings of Dr. G. Das, [4] who found the most common age group to be 31-40 years.

Ahmad, M., Hussain, S.S., Rafiq, Z., Khan, M.I. in their study of phalangeal fractures and crush injuries found the mean age of the male patients was 35.6 years and that of female was 29.5 years.[1] The age group 21-30 years is the working age group in our area. Peoples from various districts come to Guwahati in search of job, which results in increased incidence of accidents and an increased incidence of crush injuries.

Most of the injuries are accidental in nature, which is similar to the findings of Dr. R. Basu, Dr. T.K. Bose, Dr. S. Batabyal and Dr P.B. Paul. [2] The public transport are carrying more passengers than their capacity, even the passengers were using the roof tops of the transport, resulting in increased number of accidents and an increased number of crush injury cases. Head, Neck and Face is the most common body part involved, which is different from the findings of Dr. G. Das, [4] who found the most common body part involved in crush injuries was the lower limbs.

Most injuries resulted from Road traffic accidents. Earlier it was thought that crush injuries were more common in railway incidents but in this study it is found that crush injuries were more common in road traffic incidents.

Most of the victims died on spot receiving no treatment, which is similar to the findings of Dr. A.P Baruah, Dr. G. Das and Dr. Y. Malik. [3, 4, 7] Most of the injuries occur in the head and neck region, resulting in crushing of the brain, resulting in immediate death of the victims.

Conclusion:

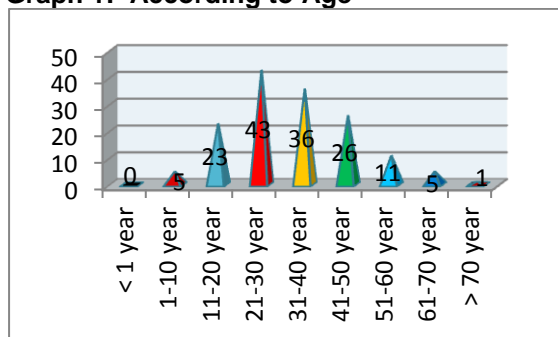
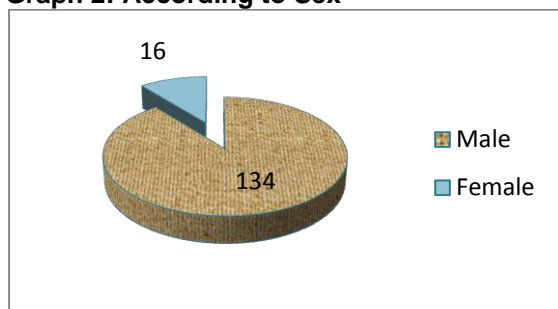
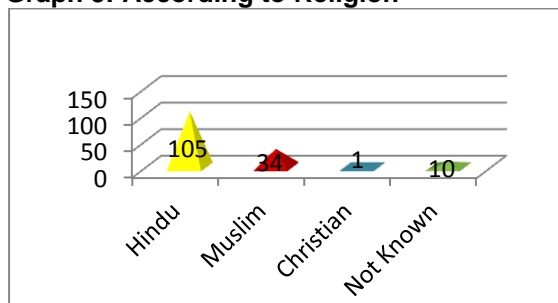
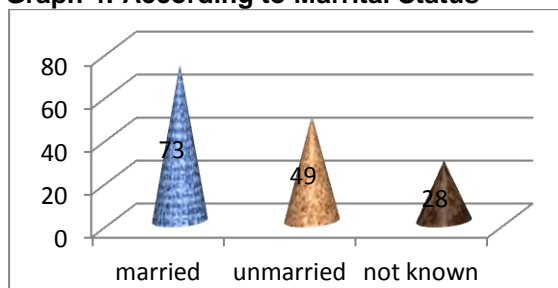
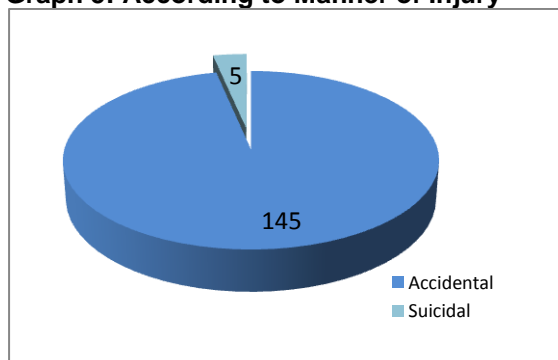
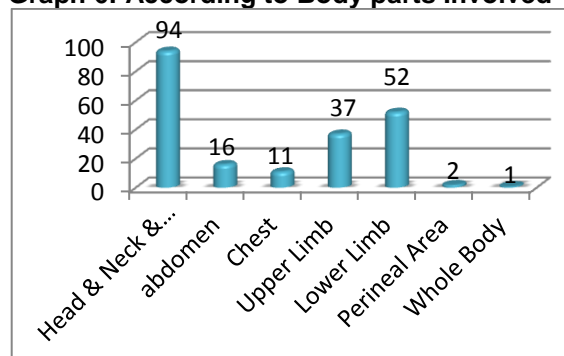
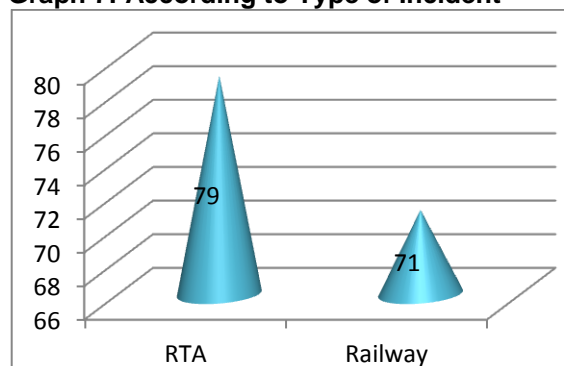
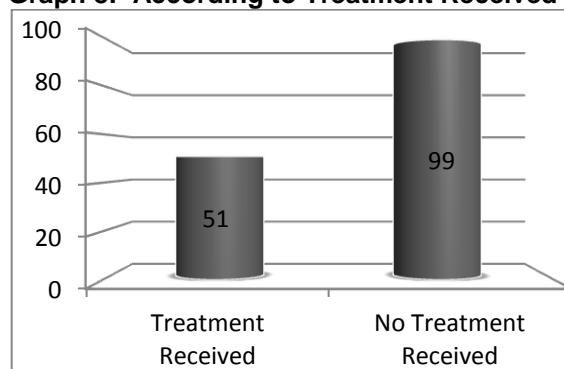
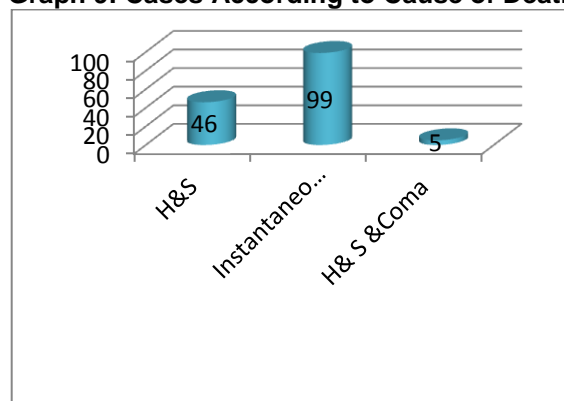
With increasing civilization the number of road traffic accidents as well as the crush injury cases is also increasing. In this busy world people do not have time to wait for their turn. Peoples are now travelling using the roof tops and even hanging outside the transport vehicle, resulting in casualties.

Mass education is the only option left by which we can reduce such injuries. The government needs to concentrate in this direction and the NGOs, social groups, and DOCTORS need to put in more sincere effort.

Steps should be taken not only to minimize the mortality but also to prevent and reduce their incidence at least in cases where human errors and human greed plays a role.

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Graph 1: According to Age**Graph 2: According to Sex****Graph 3: According to Religion****Graph 4: According to Marital Status****Graph 5: According to Manner of Injury****Graph 6: According to Body parts Involved****Graph 7: According to Type of Incident****Graph 8: According to Treatment Received****Graph 9: Cases According to Cause of Death**

Original Research Paper

Study of Hanging Cases in Ahmedabad Region

*Patel A P, * Bansal A, **Shah J V, ***Shah K A

Abstract

In spite of advancement in medical facilities, the natural end of life is inevitable. But for some persons, the death is destined earlier in an un-natural way. A few choose to make their own way by committing suicide. The major reasons are personnel problems, stress of life, family problems and financial problems. There are many methods for committing suicide like poisoning, hanging, self-immolation, drowning etc. Hanging provides painless death so it is one of the commonly adopted methods for suicide. However, in a few instances false allegations are made claiming that the ligature mark over neck is of strangulation rather than hanging. Vice versa cases are also likely. In such cases, the post-mortem findings are very helpful to differentiate between the two.

Present prospective study was carried out at the mortuary of Civil Hospital, Ahmedabad over 2 years period ranging from December 2008 to November 2010 with a view to study to incidence, ligature materials, and post-mortem findings in hanging cases. The place of hanging, manner of death and reason for death were also studied in the study.

Key Words: Suicide; Hanging; Autopsy, Demographic variables

Introduction:

Ahmedabad is the city with highest population in Gujarat with an approximate population of 5 to 6 million and it is also the economic capital of Gujarat. Due to population explosion, poverty and increasing stress and strain in our daily life, we frequently come across cases of suicides. Many people get stressed in this hard life. Some get overcome from that and some cannot. So they find easy way to come out of it and choose the way of suicide.

Suicide is a self directed having fatal outcome. There are many methods for committing suicide like poisoning, hanging, self-immolation, drowning etc. Hanging is a form of violent asphyxial death produced by suspending the body with a ligature around neck and the constricting force being the weight or part of the body weight. [1] It is the method of capital punishment adopted by Indian legislature.

All cases of hanging are considered to be suicidal until the contrary is proved. [2] Any substance available at hand may used as ligature. Articles commonly used as ligature are soft materials like 'dhotie', 'Saree', 'Bed sheet', 'Sacred thread', 'handkerchief', 'neck tie', or it may be the hard and pliable material like 'Electric cord', 'Belt', 'wire' or 'Leather strap'. In short, the material can be anything handy and available near the place of occurrence as the suicide is an impulse mediated act. [3]

Present study is an attempt to analyze the socio-demographic pattern, causes and precipitating events for hanging as well as the place of the incidence, ligature material etc all of that helps the investigating authorities into the circumstances of death. Post-mortem findings are of utmost important in differentiating the cases of hanging from ligature strangulation, so were also the part of the study.

Material and Methods:

The present prospective study of hanging cases was carried out at the mortuary of Civil Hospital, Ahmedabad. The duration of the study was 2 years from 1st December, 2008 to 30th November, 2010. A total of 6880 dead bodies were received for post-mortem examination during the study period. Out of them, in 332 cases, the corpses presented with ligature mark over neck. On the basis of post-mortem findings and correlating with the detailed history elicited from the police and the relatives of the deceased, it was concluded that the cause

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of death was hanging in 320 cases (4.65 %) and strangulation in 12 cases (0.18 %). All these hanging cases were selected for the present study.

The details regarding history of the incidence, personnel details of the deceased and post mortem findings were recorded on specially designed proforma. The scene of incidence was visited and the findings were also entered into the proforma. The data so collected were tabulated on a master-chart and analyzed.

Observation and Discussion:

A total of 6880 dead bodies were brought for post-mortem examination at the mortuary of Civil Hospital, Ahmedabad during the 2 year period ranging from 1st December, 2008 to 30th November, 2010. After post-mortem examination and correlated with the history received from the police and relatives of the deceased, it was confirmed that in 320 cases (4.65 %), the victims had died because of hanging. These 320 cases are the part of the study. Amandeep Singh [4] encountered the incidence of hanging as low as 1.28 %.

In our study highest incidence (128 cases forming 32.98 % of total) was noticed in the age group of 21-30 years. Amandeep et al [4] also found nearby results with highest incidence (59.24 %) amongst the population of 15-25 years. Whereas Azmak D et al [5] describes described highest victims (20.8 %) between 30 to 39 years. It is clear that in majority age groups males' outnumbered female with a male: female ratio of 1.5:1. (Table 1)

On eliciting the detailed history from the police and relatives of the deceased, we came to know the fact that majority of the victims (308 victims, 96.25 %) were recovered from closed areas that is mostly at home or work place. Only 12 victims (3.75 %) hanged themselves to the twig of a tree or a beam at open place under the sky (Table 2). In the study of Sharija et al [6] at Southern part of Kerala, 28.73 % victims were recovered from open places whereas remaining 71.27 % from enclosed area in the room.

Out of 320 cases, 316 victims (98.75 %) were recovered completely hanging from a higher point (complete hanging), whereas only 4 (1.25 %) were recovered in kneeling down position or with toes or feet touching the ground (partial hanging); most likely because of slipping of the knot at the higher point by weight of the body. (Table 3)

Seen from present study, in 8 cases (2.5 %), hanging was accidental as described in history and police paper and the sufferers were either children of 11-20 years age groups or

adults who were hanged accidentally while performing their duties as a part of the occupation. The remaining 312 cases (97.5 %) were considered to be of suicide, as hanging is always considered suicidal in nature until contrary is proved and all the cases under the study had not shown any other injury or defense wounds on post-mortem examination, thus excluding the possibility of homicidal hanging. (Table 4) However, O. Gambhir Singh et al [7] and Naik S et al [8] have described a few rare cases of homicidal hanging.

Our study shows that, in 132 cases, the victims committed suicide because of personal problems which may be failures in examinations, psychiatric problems or long time illnesses. In 88 cases (27.5 %), social/family/domestic problems played role. 48 cases (15 %), were classified to be of unknown reason as the deceased was unidentified or proper history was not available with the police or relatives of the deceased. (Table 5) Borrowings/financial problems were responsible for suicide in 32 cases (10 %) and extramarital affairs/sexual problems in 8 cases (2.5 %).

Some of the dead bodies under the study were received with ligature material in situ whereas for remaining cases police officer was asked to supply the ligature material for examination. For the purpose of present study the ligature material is divided into two broad groups. (Table 6)

1. Hard - e.g., electric /nylon wire, rope etc.
2. Soft - e.g., dupatta, bed-sheet, saree etc.

In present study, 'dupatta' was most commonly used ligature material (67.5 %) which is easily available in almost every house. The studies by Sharija et al, Naik S K et al and Sharma B R [6, 8, 9] have shown variation regarding material used for hanging. But all of them are of the opinion similar to present study that soft material being more commonly used than the hard one.

The difference in the studies could be because of fact that suicide is because of an impulse and for that the victim uses whatever material is available nearby on that particular period of time. To conclude it can be said that for a person to end his/her life by hanging, he/she may use any material available in the vicinity.

As the knot was fixed one in 248 (77.5 %) cases and of running type in 72 cases (22.5 %), (Table 7) The ligature material was cut away from the knot, the cut ends tied with strings and preserved for examination at FSL. The knot impression over neck was compared with the actual knot. On the basis of the position of the knot-mark over neck (correlated with the actual

knot of ligature material), the hanging was typical (knot impression over the sides of the neck) in only 8 cases (2.5 %) whereas it was atypical in 312 cases (97.5 %) (Table 3)

On external examination it was seen that in all the 320 cases (100 %) of hanging one or more signs of asphyxia were noticed and the ligature mark was obliquely placed. In 256 cases (80 %), the mark was situated at and above the level of thyroid cartilage. In all these cases soft and broad material was used as ligature. (Table 8) In remaining 64 cases (20 %) the ligature mark was because of hard material and situated above the thyroid cartilage. None of the case showed ligature mark below the thyroid cartilage as the ligature slips upward in hanging position. Congestion of face because of venous occlusion was noticed in 248 cases (77.5 %).

Dribbling of saliva from the angle of mouth opposite to the knot, the surest sign of ante-mortem hanging [10-12] was noticed in 228 cases (71.25 %). In 60 cases (18.75 %) the distribution of post-mortem lividity was typical of hanging means in legs, feet, hands and forearms suggestive that lividity was fixed as the body was suspended for more than 4 to 6 hours.

In 104 cases (32.5 %) the lividity was noticed on back side only when body was released from the point of suspension within a few minutes after death. In 156 cases (48.75 %) the mixed picture of lividity was seen because of shifting of the lividity when the dead body was released from the point of suspension within 4 to 6 hours after death. 88 victims (27.5 %) presented with ecchymosis along the edges of the ligature mark because of violent movements at the terminal event.

Discharge of semen was seen in 56 cases (17.5 %) whereas discharge of urine/faeces was noticed in 44 cases (13.75 %). La facie sympathetic and defence wounds were noticed in none of the cases under the study.

On internal examination all 320 cases (100 %) presented with white-glistening subcutaneous tissue and neck muscle contusion was detected in 20 cases (6.25 %). (Table 9) In no case under study rupture of the strap muscles, fracture of thyroid cartilage or hyoid bone or tear in the intima of the carotid artery was detected.

Conclusion:

The incidence rate of hanging is 4.65 % (320 out of 6880) in the present study with a male: female ratio of 1.5 and 21-30 years age group being most commonly (40 %) involved population. 312 cases (97.5 %) under the study were suicidal and remaining 8 (2.5 %) were

accidental. Personal reasons (136 cases, 42.5 %) and family problems (88 cases, 27.5 %) were encountered to be the common reasons for committing suicide. Soft material (80 %) was more commonly used as ligature than the hard one (20 %). However, on an impulse for suicide the victims used whatever material available on the particular time.

Correlation of the history with post-mortem findings are very helpful in cases of corpses presented with ligature mark around the neck as dribbling of saliva, the considered surest sign of ante-mortem hanging was noticed in only 228 cases (71.25 %). Examination of scene of incidence has an immense value in such cases.

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Table 1: Age and Sex Wise Distribution

Age grs (yrs)	Gender of the deceased		Total
	Male	Female	
0-10	00	00	00
11-20	36	40	76
21-30	68	60	128
31-40	44	20	64
41-50	24	04	28
51-60	20	04	24
Total	192 (60 %)	128 (40 %)	320 (100%)

Table 2: Place for Hanging

Place of Hanging	Cases
Open place	12 (3.75 %)
Closed place	308 (96.25 %)
Total	320 (100 %)

Table 3: Type of Hanging

	Type	Cases (%)
On basis of position of knot	Typical	08 (2.5)
	Atypical	312 (97.5)
	Total	320 (100)
On basis of degree of suspension	Complete	316 (98.75)
	Partial	04 (1.25)
	Total	320 (100)

Table 4: Manner of Death

Manner Of Death	Cases	Percentage (%)
Suicidal	312	97.5
Accidental	08	2.5
Homicidal	00	0
Total	320	100

Table 6: Ligature Material Used For Hanging

Ligature Material	Hanging (320 Cases)
Soft Material	
Bed Sheet	32 (10 %)
Dupatta	216 (67.5 %)
Sarree	04 (1.25 %)
Piece Of Cloth	04 (1.25 %)
Subtotal	256 (80 %)
Hard Material	
Electric Wire	04 (1.25 %)
Rope	60 (18.75 %)
Subtotal	64 (20 %)
Total	320 (100 %)

Table 9: Post-Mortem Findings on Internal Examination

Internal Findings	Hanging
Subcutaneous tissue	White glistening 320(100%)
	Contused 00
Fracture of thyroid	00
Fracture of hyoid	00
Neck muscle contusion	20(6.25%)
Strap muscle rupture	00
Intimal tear of carotid artery	00

Table 7: Type of Knot

Type Of Knot	Hanging
Fixed	148 (%)
Running	172 (%)
Total	320 (100 %)

Table 5: Reason for Death

Reason for Death	Cases
Personal	136 (42.5 %)
Social/family/domestic problems	88
Borrowings	32
Extramarital affairs/sexual	08
Not known	48
Accidental	08
Total	320 (100 %)

Table 8: Post-Mortem Findings on External Examination

External Findings	Hanging (320 Cases)
Placement of ligature mark	Oblique (100 %)
Place of ligature Mark at neck	above thyroid 20 (6.25 %)
	at & above thyroid 300 (93.75 %)
	Below thyroid 00
Congestion of face	248 (77.5 %)
Dribbling of saliva	228 (71.25 %)
La facie sympathique	00
Postmortem Lividity	Typical 56 (17.5 %)
	On back 164 (82.5 %)
Ecchymosis along edge of mark	88 (27.5 %)
Discharge of semen	56 (17.5 %)
Discharge of urine/faeces	44 (13.75 %)
Struggle marks	00

Original Research Paper

A Study of Pericardial Fluid Enzymes Activities after Death and their Correlation with Post-Mortem Interval

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Abstract

The estimation of time since death at the time of autopsy has been and remains to be one of the challenges to the Forensic Pathologist. A prospective study was undertaken in SMS Hospital, Jaipur on activity of Pericardial Fluid enzymes after death in deceased. A total of 50 study cases were randomly selected after screening. The pericardial fluid was examined biochemically for enzyme activity of Amylase, Creatine Kinase (CK), Gamma-glutamyl Transferase (GGT) and Lactate Dehydrogenase (LDH) enzymes by photoelectric colorimetry method. The enzyme activity levels so obtained were charted and statistically studied and graphical records obtained against known post-mortem interval. The data thus obtained was analysed with a view to ascertain whether such assays could be of any help to estimate time since death routinely. In this study we observed a positive correlation of all the four enzymes with the time elapsed after death of which rise in CK was found to be statistically significant.

Key Words: Post-mortem interval (Time since death), Pericardial fluid, Enzyme activity, Amylase, Creatine Kinase (CK), Gamma-glutamyl transferase (GGT), Lactate Dehydrogenase (LDH)

Introduction:

In today's scenario, medico-legal experts routinely rely solely on age-old subjective methods of observing the external as well as the visceral somatic changes in the dead body that take place after death like cooling of body, changes in the eye, rigor mortis, hypostasis, signs of decomposition, mummification, adipocere formation, maggot infestation etc. [1-3] and the circumstantial evidences for estimation of time since death.

No objective method is available which is accurate, reproducible and unequivocally accepted; hence, there is a need to re-explore objective methods which would be reproducible and accurate such as biochemical assays etc.

This study was an effort to find out whether it is practical and significant enough to estimate post-mortem interval by analyzing quantitatively the pericardial fluid enzyme activity changes. As a dead body is a biological material, there would be inherent biological variations in ante mortem and post-mortem enzyme activity in pericardial fluid.

Material and Methods:

A total of 50 cadavers brought to the Department of Forensic Medicine for medico-legal autopsy were studied. The cases with known time of trauma, known time of death and known mode of death were selected. As Pericardial fluid is known to be the ultra filtrate of blood [4-8] the cases in which pre-mortem disturbance of body fluids, blood electrolytes and enzymes were suspected were excluded i.e. cases of poisoning, burn, septicemia, sudden death, subjects brought dead to emergency with unknown history, history of alcohol intake prior to death, chronic alcoholic, vomiting, diarrhoea, blood transfusion, diuretic therapy, heart disease, liver disease, kidney disease, pancreatic disease, epilepsy, myopathy, chronic drug intake, chronic smoker. [9]

A valid informed consent from the legal heirs of the deceased was taken before collection of pericardial fluid sample. 5ml pericardial fluid was collected in a sterile syringe from the posterior sinus or the pericardial sac and transferred to a clean vial. Samples found contaminated with blood were discarded. The collected sample was immediately centrifuged at 3000 rpm for 10 minutes and supernatant fluid was analysed for enzyme activity by kit method using semiautomatic analyzer by standard protocols (Amylase by direct substrate method, CK by modified IFCC method, LDH by modified IFCC method and GGT by carboxy substrate method) using commercial kit (Crest

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Biosystems). The data thus collected was analysed specifically for relation between pericardial fluid enzymes activities and time since death.

Observations and Results:

Total 50 cases were studied (45 male, 5 female) of age range 8-70 years with maximum cases belonging to 20-30 year age group (36 cases). The manner of injury sustained was wide- ranging from Road traffic accident (39 cases), Fall from height (4 cases), train accident (3 cases), assault (2 cases), hanging (1 case) and fall of heavy weight (1 case).

We compared mean of enzyme activity of all four enzymes (Amylase, CK, GGT and LDH) with time passed since death (Table 1) and statistical significance of enzyme activity changes between three ranges of time since death (<6 hrs, 6-12 hrs and 12-24 hrs) (tables 2 to 5). The observations made were as follows:-

Amylase:

Mean of Amylase activity decreased between group of <6 hr and 6 to 12 hr and then increased in 12 to 24 hr group. On comparison between < 6 hr and 6 to 12 hr groups the decrease was not significant (p value > 0.05), however a rise in enzyme activity was noted on comparison between < 6 hr and 12 to 24 hr groups and between 6 to 12 hr and 12 to 24 hr groups though the rise was statistically not significant (p value > 0.05).

A positive correlation was noted between Amylase activity and time since death (r- value +0.277) but it was statistically insignificant (table-5).

Creatine Kinase (CK):

Mean value of Creatine Kinase (CK) activity increased between groups of <6 hr and 6 to 12hr and also between 6 to <12 hr and 12 to 24 hr groups. When we compared CK levels between < 6 hr and 6 to 12 hr groups the increase was not significant (p value > 0.05) but interestingly on comparing between < 6 hr and 12 to 24 hr groups a rise in enzyme activity was noted which was statistically highly significant (p value < 0.01). On comparison between 6 to 12 hr and 12 to 24 hr groups a rise was seen but was statistically not significant (p value > 0.05).

A positive correlation was noted between CK activity and time since death (r-value +0.325) which was statistically significant (p value < 0.05).

Gamma-Glutamyl Transferase (GGT):

Mean value of Gamma-glutamyl transferase (GGT) activity increased between group of <6 hr and 6 to 12 hr but then decreased between groups of 6 to 12 hr and 12 to 24 hr.

The rise was significant between < 6 hr and 6 to 12 hr groups (p value < 0.05) but the decrease between groups of 6 to 12 hr and 12 to 24 hr was not significant. On comparing between < 6 hr and 12 to 24 hr group a rise was seen but found to be statistically insignificant (p value > 0.05).

A positive correlation was noted between GGT activity and time since death (r-value +0.290) though statistically not significant.

Lactate Dehydrogenase (LDH):

Mean value of Lactate Dehydrogenase (LDH) activity increased between groups of <6 hr and 6 to 12 hr and also between groups of 6 to 12 hours and 12 to 24 hr. However, on comparing three groups, between themselves as above none of the rise was statistically significant (p value > 0.05).

A positive correlation was noted between LDH activity and time since death (r-value +0.226) although statistically insignificant.

Discussion:

Estimation of enzyme activity in different body fluids like blood [10-12], pericardial fluid [14, 15] and CSF [13] to estimate time since death has been done by various workers in the past. In addition, pericardial fluid has also been studied for changes in its constituents with time since death [14, 15], difference between natural and violent deaths [16], post-mortem diagnosis of myocardial infarction [17], cause of death [18] and relation of mechanism of death and nature of pericardial fluid sediment. [19] Some authors have supported the fact that level of pericardial fluid enzymes increases with time elapsed since death [14, 15] whereas some have outrightly refuted the fact. [2]

The advantage of pericardial fluid over other body fluids is the large amount available for analysis, the ease of collection and its fluid nature enabling equal distribution of its constituents. The disadvantages are that as it is centrally located in thorax [20-22], any pathology or injury to surrounding organs could have an effect on pericardial fluid constituents; furthermore as it contains heart with chambers containing blood hence located relatively close to blood and the microbes that invade blood after death.

In the present study the enzymes that were selected were Amylase, Creatine Kinase (CK), Gamma-glutamyl transferase (GGT) and Lactate Dehydrogenase (LDH)- two of cardiac origin (CK, LDH) and two of non-cardiac origin (Amylase and GGT). The hypothesis was- as the process of autolysis sets in after death, the intracellular enzymes of cardiac origin will be

released into pericardial fluid and their levels would rise with increasing post-mortem interval whereas levels of enzymes of non-cardiac origin will not be raised. Contrary to our hypothesis, in the present study the enzyme activity of all the four enzymes increased with the duration of death though up to different extents. (Fig. 1-4)

Though a rise in all the four enzymes was noted but no equation to predict post-mortem interval can be derived as the distribution of enzyme levels at same post-mortem interval was very wide. (Fig. 1-4) The possible reason being that there were many variables in the cases selected for this study i.e.-manner of injury, regions of body injured, mode of death, duration of survival after fatal injury, and periods for which dead body was kept in natural environment and deep freeze prior to autopsy and atmospheric temperature.

The regression equations of the present study could not be compared with other studies done in the past as none of the authors [14, 15] had established a regression equation for enzymes in pericardial fluid after death.

As a rise in all the four enzymes was noted, so the results of this study were contrary to our hypothesis. The possibility of pancreatic (Amylase) and hepatic (GGT) origin of enzymes cannot be ruled out, perhaps the mechanism being diffusion through diaphragm and pericardium into the pericardial fluid. In this study rise in CK was found to be statistically significant. The results of this study showed that of the four studied enzymes, CK and LDH would likely be of use for estimating post-mortem interval for the conditions under which this study was performed.

There is need for further studies keeping more of pre-postmortem variables standardized. This study is presented as a pilot study in this relatively less investigated subject and hopefully should pave the way for more elaborate work.

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Fig. 1: Pericardial Fluid Amylase Enzyme Activity with Post-Mortem Interval

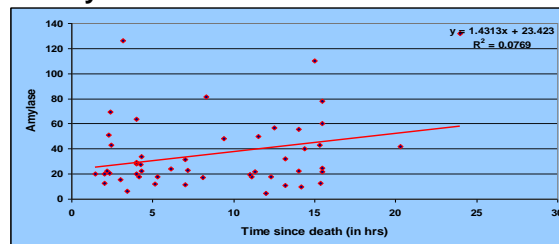


Fig. 2: Pericardial Fluid CK Enzyme Activity with Post-Mortem Interval

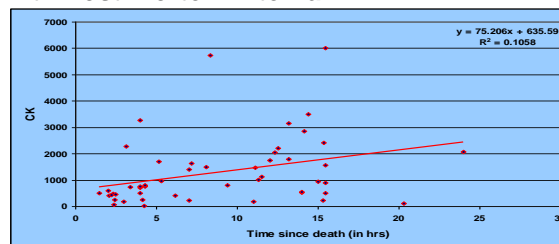


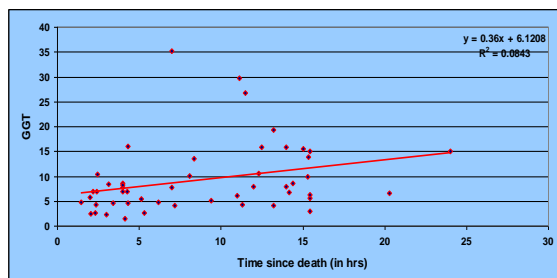
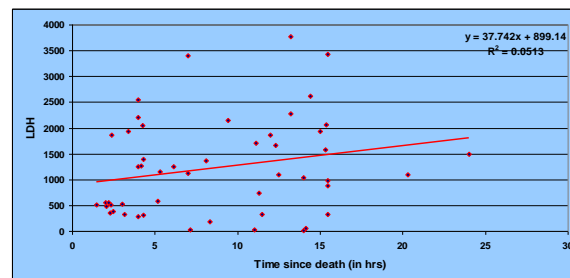
Fig. 3: Pericardial Fluid GGT Enzyme Activity with Post-Mortem Interval**Fig. 4: Pericardial Fluid LDH Enzyme Activity with Post-Mortem Interval**

Table 1
Comparison of Mean + SD of enzymes (Amylase, CK, GGT, LDH) with the Post-mortem Interval

Enzyme	Mean + SD U/L		
	Time passed since death (in hrs)		
	< 6 hr (n=21)	6 to <12 hrs (n=11)	12 to 24 hrs (n=18)
Amylase	32.43 + 26.43	31.40 + 19.63	43.00 + 34.00
CK	769.34 + 752.73	1412.43 + 1456.11	1842.05 + 1413.47
GGT	6.02 + 3.29	13.41 + 11.00	10.44 + 4.72
LDH	1002.45 + 711.83	1117.92 + 987.96	1566.94 + 1005.32

Table 2
Mean + SD of Enzymes (Amylase, CK, GGT, LDH) according to Post-Mortem Interval

Enzyme	Mean + SD U/L		p-value	Significance
	Time passed since death (hrs)			
	< 6 hr (n=21)	6-12hr(n=11)		
Amylase	32.43 + 26.43	31.40 + 19.63	> .05	NS
CK	769.34 + 752.73	1412.43 + 1456.11	> .05	NS
GGT	6.02 + 3.29	13.41 + 11.00	< .05	Significant
LDH	1002.45 + 711.83	1117.92 + 987.96	> .05	NS

Table 3
Mean + SD of Enzymes (Amylase, CK, GGT, LDH) according to Post-Mortem Interval

Enzyme	Mean + SD U/L		p-value	Significance
	Time passed since death (hrs)			
	< 6 hr (n=21)	>12hr (n=18)		
Amylase	32.43 + 26.43	43.00 + 34.00	> .05	NS
CK	769.34 + 752.73	1842.05 + 1413.47	<.01	Significant
GGT	6.02 + 3.29	10.44 + 4.72	> .05	NS
LDH	1002.45 + 711.83	1566.94 + 1005.32	> .05	NS

Table 4
Mean + SD of Amylase, CK, GGT, LDH according to Post-Mortem Interval

Enzyme	Mean + SD U/L		p-value	Significance
	Time passed since death (hrs)			
	6-12hrs (n=11)	>12hrs(n=18)		
Amylase	31.40 + 19.63	43.00 + 34.00	> .05	NS
CK	1412.43 + 1456.11	1842.05 + 1413.47	> .05	NS
GGT	13.41 + 11.00	10.44 + 4.72	> .05	NS
LDH	1117.92 + 987.96	1566.94 + 1005.32	> .05	NS

Table 5
Comparison between Enzyme Activities (Amylase, CK, GGT, LDH) with Post-Mortem Interval and their derived Regression Equations

Correlation	r- Value	p- Value	Significance	Regression Equation
Post-mortem interval v/s Amylase	+0.277	>0.05	NS	Y=1.4313 x + 23.423
Post-mortem interval v/s CK	+ 0.325	<0.05	significant	Y=75.206 x + 635.59
Post-mortem interval v/s GGT	+0.290	>0.05	NS	Y=0.36 x + 6.1208
Post-mortem interval v/s LDH	+0.226	>0.05	NS	Y=37.742 x + 899.14

Review Research Paper

Assisted Reproductive Techniques Ethical and Legal Issues

*B. L. Chaudhary

Abstract

The rapid advancements in sciences have revolutionized modern medicine in a number of ways; genetic engineering, Assisted Reproductive Technologies (ART), human cloning, stem cells etc. has opened up the unimagined and promise unquestionable and undreamed benefits to mankind. At the same time, they raise many questions of law and ethical issues relating to public interest, social and religious sentiments and family concern. Although ethical judgments may indeed express personal preferences and may be connected in complicated ways with cultural conventions, ethics itself is a form of rational inquiry that concerns how we should live and what we should do. Some ethical issues are matters of debate. The Delhi Government has promulgated legislation in this regard which is cited as "The Delhi artificial insemination (Human) Bill 1995. The Indian Council for Medical Research has laid down certain guidelines for clinics practicing of assisted reproductive techniques and handling of surrogates in India. There is a certain element of risk associated with all assisted reproductive procedures. It is, therefore, necessary to ascertain the therapeutic and research value of the AR procedure in each case.

Key Words: Artificial insemination, ART, Surrogate mother, Embryo, Guidelines

Introduction:

The special programmes by WHO on human reproduction has estimated that there are 60 to 80 million infertile couples worldwide; between 6-10% of the couple are infertile. [1] The advent of Assisted Reproductive Technologies (ART) from the late 70s has not only enhanced the possibility of pregnancy but has also made women conceive in situations which would not have been possible decades ago. However, many of these technologies require enormous technical expertise and infrastructure, are expensive and the couple's endurance physically, emotionally, socially and economically. [1]

In order to ensure quality of care, it is imperative that standardised protocols and guidelines should follow for the establishment and accreditation of ART Centres. National guidelines for Accreditation, Supervision and Regulation of ART Clinics have been formulated by ICMR in 2005 [1] to provide optimum benefit of these newer technologies by skilled team of experts, at affordable health and economic cost.

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Equally important are issues related to the conduct of research with material obtained i.e. follicular fluid, oocytes and spare embryos, semen samples, which can be used by researchers in basic or molecular science.

What are Assisted Reproductive Technologies?

Assisted reproductive technologies include any fertilization involving manipulation of gametes/ embryos outside the human body and transfer of gametes/embryos into the body. [1] The new reproductive technologies give great help and offer biomedical parenthood to various infertile couples who have exhausted all other avenues to have a child of their own.

Indication for ART: [2]

- When husband is impotent.
- When husband is infertile.
- When husband is unable to deposit semen in female genital i.e. hypospadias, epispadias etc.
- When Rh incompatibility between husband and wife.
- When husband is suffering from hereditary diseases.

New Reproductive Techniques: [2]

1. Artificial Insemination
2. In-vitro Fertilization
3. Surrogate Motherhood

Artificial Insemination (AI):

It involves manipulation of fertilization by injecting of a sperm artificially through a needle into the vagina/cervix/uterus/fallopian tubes of the wife directly without sexual intercourse. Success rate of AI is 70 – 75% within three to four months while it is done successively for four five days in each cycle. [2]

Types of Artificial insemination (AI) [2]:

- **Artificial Homologous/Husband (AIH):**

Where the husband's sperm count is low or because of a disease cannot ejaculate, the artificial insemination is done with the sperm of the husband [AIH].

- **Artificial insemination donor (AID):**

Where the husband is not able to produce sperms, then sperm can be taken from an anonymous donor [AID]. It is normally the first infertility treatment, a couple can try as it is simple to accomplish, involves no pain and less expensive in comparison to other reproductive techniques.

- **Artificial insemination husband donor (AIHD):**

"Pooled donor" the semen of husband is composed with donor's semen where is chance to get fertilization from husband's sperm.

Ethical and Legal Concerns in AIH and AID:

AID raises ethical questions that are not raised by AIH as it takes place between husband and wife. Even though, it is through advanced biomedical techniques and not by natural procedure, most of the people have no moral difficulty to accept it. It maintains the integrity of family and there is continuity between procreation and parenthood.

It is simply viewed as a medical technology providing assistance to what could not be accomplished by normal sexual intercourse. Whereas AID introduces a third party into the reproductive matrix, therefore, someone who donates sperm, is now contributing genetic material without the intent to parent. Most of the religions also don't accept the impregnation of one's wife by the sperm of third person; it doesn't make the child one's own and is looked down upon as illegitimate. The donation is, however, always made anonymously, so that the father could not be traced by the child, nor can the father elect to make contact with the child. [4]

Recommendations on AI:

The Government of Delhi has promulgated legislation in this regard which is cited as "The Delhi artificial insemination (Human) Bill 1995. [2] The purposes of this bill are as under:

1. To allow the issueless couples to have a child through AI and to give it a legal status.
2. To control spread of HIV through AI.
3. To regulate the donation, sale/storage of human semen//ovum for AI. To control illegal donation/sale/supply of the same.
4. To make obligatory on the part of the medical practitioner –
 - a. Not to indulge into segregation of the XX or XY chromosomes.
 - b. Not to disclose the identity of donor/recipient.
 - c. To prohibit to carry on semen bank without registration.

In-vitro Fertilization: [1, 4]

In-vitro fertilization (IVF) is artificially performed fertilization outside the woman's body i.e. 'in test tube'. This procedure involves extraction of a number of eggs from the woman's ovaries and to do this, she is given a drug that enables her to super-ovulate or to produce more eggs in one cycle than she normally does. The eggs are then surgically removed and fertilized outside the body in the laboratory normally with the sperm of the husband but it may be done with sperm from donor. There may be following conditions;

- Where the wife is able to produce eggs but her husband unable to deposit sperm in her, may be due to oligospermia or low motility of sperm.
- Where the wife is able to produce eggs but unable to carry a child to term. Then wife's egg fertilized in artificial environment in laboratory and the embryo is implanted in wife's uterus.
- Where the wife is not able to produce eggs, another woman is hired to be inseminated with the husband's sperm/fertilized embryo may be implanted her womb and she carries pregnancy for them to term and then delivered a baby and hand over to that couple. This is called as Surrogate Motherhood.
- Where the couple desiring to have children cannot produce any of the sperm or eggs necessary for conception. So, the wife's sister/other woman donates the eggs and husband's brother/donor, donates sperm. Fertilization occurs in vitro and embryo is implanted in the wife's womb, which carries the pregnancy.

Ethical & Legal Concerns in IVF: [4]

The reproductive revolution has had the ability to separate genetic parenting from gestational parenting and from social parenting and the agent who brings it all about, a biotechnical, will be still another person. Sperm and eggs are being brought and sold and wombs are being rented. The fact, that these techniques have been developed and have a certain success rate does not make them morally acceptable.

Donation of sperms and ova are both contrary to the unity of marriage and the dignity of procreation of human being. Furthermore, these procedures lend themselves to commercialization and exploitation, when people are being paid for sperm, ova and for surrogate motherhood. Some of the ethical issues involved in this technology are:

- Bypassing the natural method of conception,
- Creating life in laboratory,
- Fertilizing more embryos than will be needed,
- Discarding excess embryos,
- Expensive technology, not affordable for common man,
- Creating embryos, freezing them and keeping them in limbo,
- Destroying embryos in research,
- Selective termination of embryos etc.

The legal problems that arise from in-vitro fertilization are that number of persons can assert for parental rights extends to the sperm donor, the egg donor, the surrogate mother, parents who raise the child. Further, if during the time in which the embryos are in storage, the couple divorces, legal complications may arise as to the custody of the embryo. The spare embryos are frozen, discarded, donated or used for experimentation. Since some religions believe that life begins at conception, it may amount to abortion which is contrary to both law and ethics. Expert indentation is also not permissible as science cannot experiment with someone with basic human rights without prior permission.

Donation involves separation of the biological and social roles of parenthood that is significant part of family concept and is equivalent to adoption before birth thereby calling for amendments in adoption laws of most of the countries. When she is carrying more developed embryos, it can endanger her life. The only alternative available to avoid risk to her health and life is to carry out selective termination of one or more of the developing

embryos. This not only involves trading of one life or more but the doctor is faced with the decision of which ones to terminate and how to make this decision. [1, 4]

Surrogate Motherhood: [1-3]

Surrogate motherhood involves a woman bearing the child of another woman. Where the woman cannot produce eggs, they enter into a contract with another woman to be artificially inseminated with the husband's sperm and she bears the child for them. Also where the woman can produce eggs but she is unable to carry a child to a term, the embryo is externally formed by in-vitro fertilization of husband's sperm and wife's ova, the embryo is implanted in surrogate mother's womb and she bears the child for them.

This can be done in two ways-either the husband's semen is squirted in the vagina of the surrogate or the fertilization is done externally in the lab by IVF and the embryo is implanted in the uterus of the surrogate mother. The surrogate mother is paid by the married couple for renting her womb. In this case the child would inherit the genetic code of the contracting couple and the sanctity of marriage is maintained. Still the surrogate motherhood is the most controversial of the new reproductive techniques.

Legal and Ethical Concerns in Surrogate Motherhood: [1, 4]

Surrogation involves a contract of sale between the married couple and the surrogate. Certainly, the most serious ethical objection to commercial surrogacy is that it reduces children to objects of barter by putting a price tag in them. Morally, it is no less than selling or trafficking of human beings violating the basic fundamental rights of a human being. Some women could be pressurized into surrogacy by their husbands for money. In India, the surrogate does not enjoy the same rights as in the west.

The Indian medical guidelines allow doctors to implant five embryos into a surrogate, whereas in Britain, the maximum is two and many European countries are moving towards a single embryo implant. Under British laws a surrogate mother who has provided an egg can claim the baby back within two years of child's birth. However in India, she has no right over the child after delivery.

She can cancel the contract only when it is proved that it was not a valid contract according to Section 23 of Indian Contract Act. Ethically also subrogation raises many issues like tempering with the normal process of procreation, undermining the institution of

marriage and family life, treating children as objects of sale etc. Most of the religions also don't approve of the idea of subrogation. There is no law concerning this issue until now.

The Indian Council for Medical Research guidelines for ART clinics and Surrogacy in India: [1]

It is necessary to follow ICMR guidelines in ascertain the therapeutic and research values of the AR procedure.

Informed Consent: After duly counselling the couple/oocyte/semen donor, an informed and written consent should be taken from both the spouses as well as the donor.

They should be explained that:

- The various risks associated with ovarian hyper-stimulation, anaesthetic procedures and invasive procedures like laparoscopy, aspiration of ovum *etc.* in simple language that they can understand.
- The possibility of multiple pregnancies and their risk, ectopic gestation, increased rate of spontaneous abortion, premature births, higher perinatal and infant mortality, growth and developmental problems, possible side effects of the drug used.
- There is no guarantee on the success/failure of the procedure.
- About the cost to the patient of the treatment proposed and of an alternative treatment, if any.
- There may be possible disruption of the patient's domestic life which the treatment an expenses may cause;
- About the possible deterioration of gametes or embryos associated with storage, and possible pain and discomfort;
- About the advantages and disadvantages of continuing treatment after a certain number of attempts.
- Informed consent should include information regarding use of spare embryos. It should be made clear whether embryos that are not used for transfer could or could not be used for research purposes or implanted in another woman's womb, or preserved for use at a later date or destroyed.
- Consent may be withdrawn at any time before implantation.
- Specific consent must be obtained from couples who have their gametes or embryos frozen, with regard to what should be done with them in case of death, or if any of the parties becomes incapable of varying or revoking her or his consent.
- Abortions should never be encouraged for research purposes.

Selection of Donor: The semen bank assumes the responsibility in selection of the suitable donor on following terms:

- **Complete physical examination** of the donor should be done; the donor should be healthy with reasonable expectation of good quality eggs or sperms and preferably with proven fertility record.
- **The physical characteristic and mental make-up** of the donor should match as closely as possible to that of the spouse of the recipient, especially with reference to colour, eyes and hair, height and build, religious and ethnic background, and education and ABO blood type.
- **Blood group** of the proposed donor and donee should be tested with respect to Rh compatibility.
- **No donor suffering from any sexually transmitted disease** (e.g. syphilis, gonorrhea, chlamydia, herpes, HIV *etc.*), infectious disease (e.g. hepatitis B and C, HIV) or genetically transmissible disease. Sexually transmitted diseases should be ruled out within a week of obtaining the seminal fluid.
- **It is essential that donated semen is cryo-preserved and used only after 6 months** as this would enable the centre to retest the donor after 6 months for HIV and eliminate the potential risk of HIV transmission in the 'window' period of HIV infection.
- **Identity of the donor as well as the recipient** should be protected from each other. However, all the records of the donor must be preserved for at least 10 years and should be confidential.
- **Confidentiality of the entire procedure** and its outcome is advisable and therefore, no relative should be accepted as a donor in order to avoid identification and claims of parenthood and inheritance rights.
- **Any information about clients and donors must be kept confidential.** No information about the treatment of couples may be disclosed to anyone other than the accreditation authority or persons covered by the license, except with the consent of the person(s) to whom the information relates, or in a medical emergency concerning the patient, or a court order.
- **Written consent and an undertaking of the donor should be taken towards unrestricted use of sperms** or oocytes for AR and he/she will not attempt to seek the identity of the recipient. In case the donor is

married, the written consent of the spouse should also be taken, if possible.

- **It is also desirable to restrict the use of semen from the same donor to a maximum of 10 pregnancies** to avoid the possibility of an incestuous relationship occurring among the offspring's at a later date.
- In case of the oocyte donor, incurring any health problems related to the process of donation, the costs of the subsequent health care should be borne by the potential recipient couple irrespective of whether they receive oocyte donation as planned or not.
- **In case of unused surplus/ spare embryos**, consent of the concerned couple should be obtained to cryopreserve such embryos for donation to other needy couples. The ownership rights of such embryos rest with the couple concerned.
- **Respect for the embryo's moral status** can be shown by careful regulation of conditions of research, safeguards against commercial exploitation of embryo research, and limiting the time within which research can be done on embryo up to **14 days' growth** i.e. when the **primitive streak** appears.

With Regard to Use of Gametes or Embryo:

- No woman shall be treated with gametes or embryos derived from gametes of more than one man or woman;
- No art clinic shall mix semen from two individuals before use;
- No art clinic shall provide a couple with embryo of desired sex;

- No gametes shall be stored for more than 10 years;
- An embryo shall be stored for not more than five years;
- Sale, transfer or use outside india is prohibited;
- The donor shall relinquish all parental rights over the child which may be conceived from her or his gamete.

Women have a special position as care givers for children with disabilities. Since the bulk of care falls upon the women, she should make the final decision among reproductive options, without coercion from her partner, her doctor, or the law.

Legitimacy of the Child Born through ART: [1]

A child born through AR is presumed to be the legitimate child of the couple having been born within the wedlock and with consent of both the spouses with all the attendant rights of parentage, support and inheritance. Sperm/ oocyte donor should have no parental right or duties in relation to the child and their anonymity should be protected.

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Review Research Paper

Forensic Onychology: An Essential Entity against Crime

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Abstract

Forensic Onychology (Greek word, Onuks = nail, Logia = study of) is the subject which deals with study of fingernails and toenails for better administration of justice in the court of law. Identification means determination of individuality of a person. Nails are important tissues for human identification. One of the major advantages of utilizing nail is that, in comparison with other tissues, sample size and sampling process can be considered relatively non invasive and non destructive and yet each nail retains a discrete record of detailed information on genetic inheritance, drug use, pathology, diet and location history as well as exposure to explosives residues or other pollutants. In contrast to soft tissues, nails survive relatively well in the decomposition environment. Furthermore, in contrast to other long lasting tissues (such as bone and teeth) nails are easy to decontaminate from external sources of DNA. Thus examination of nail is very useful in many ways against crime. In this paper, we discussed about structure and method of analysis of nail, utility of examination, drug use and nails and detection of DNA from nails.

Key Words: Forensic Onychology, Drug use and nails, DNA from nails, Justice

Introduction:

Forensic Onychology (Greek word, Onuks = nail, Logia = study of) is the subject which deals with study of fingernails and toenails for better administration of justice in the court of law. Nails are important tissues for human identification, employing morphological traits as well as bio-molecular information for individualization or direct comparison.

The nature of nail growth also provides unique chronological information along the length of the nail that is of utility in identification, bio-monitoring and in reconstructing recent life history. One of the major advantages of utilizing nail is that, in comparison with other tissues, sample size and sampling process can be considered relatively non invasive and non destructive and yet each nail retains a discrete record of detailed information on genetic inheritance, drug use, pathology, diet, and location history, as well as exposure to explosives residues or other pollutants. [1, 2]

Structure of Nail:

The main biological functions of nails are as protection for the underlying tissue of the nail bed.

Basically, the nail plate grows from the matrix, hidden by the proximal nail fold, eponychium, and true cuticle. The white proximal region of the nail, known as the lunula, is most prominent on the thumb and results from keratin that has not been completely flattened in the nail bed. Bulk of nail is comprised of hard alpha keratin. The water content will affect the flexibility of nails and can vary from 10% to 30%. [2]

Method:

Technological advances in electron microscopy (in particular, the advent of variable pressure scanning electron microscopy which allows for examination of nail in its native, uncoated state) and atomic force microscopy, the use of image analysis tools, and the development of cross-section techniques now provide a more comprehensive suite of techniques available to the nail examiner. [2]

Forensic evidence requires rigorous controls during sampling, packaging, and storage to ensure best preservation and to avoid problems of contamination. Although there is a certain degree of parity between different analytical techniques, it is important to take account of possible variation, particularly when dealing with small sample concentrations as with nail evidence, and also when this evidence may already be degraded. It is important to remember that use of one type of packaging material suited to one type of analysis may not benefit another, e.g. plastic packaging may affect chromatography because of the presence

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of labile plasticizers, which can mask characteristic peaks on the spectra. [3]

In any scenario where low levels of DNA are present there is a risk that levels of external sources of DNA may be high enough to bias, mask or modify results of genetic analyses. As such it is important to ensure that potential sources of contamination, which may include foreign fluids such as blood, semen, or saliva, or even the cellular debris left on nail, post handling with bare hands, are removed prior to any genetic analysis. A number of studies have, therefore, been focused on the efficiency of potential cleaning methods in removing foreign DNA. These include more elaborate protocols such as cleaning the nail through ultrasonication and treatment with boiling water, acetone, bleach, ethanol and detergents. Another simple and apparently efficient method was direct soak for 1 hour in a detergent plus proteinase K solution. [4, 5, 6]

Utility:

Few physical traits have been discussed in relation to human nail for the purposes of identification, other than the condition of the margins (which may be used to determine wear) and the longitudinal striae of the lower concave surface of finger and toenails in post mortem remains. [7] During putrefaction, nails may be shed, particularly in aqueous environments. Identification may be aided by cultural practices and current fashion trends which influence the outward appearance of nail style, different types of nail polish, artwork and jewellery are also now used on nails. Nail abnormalities are also important in forensic identification. [2]

Common disorders in nail can involve alteration to the nail plate, nail bed, and periungual tissue. Fungal infections of nail (termed onychomycosis) are caused largely by dermatophytes, a specific group of fungi that can exploit keratin as a direct nutrient source. They result in clinical conditions such as tinea capitis caused predominantly by trichophyton or microsporum species. [8]

Nails may also be a useful source of residues trapped in the distal groove beneath the nail plate or around the cuticle. [2] Different formulations of nail polish and lacquer may be visually similar but have markedly different chemical compositions and formulations. [9] In cases of sexual assault, skin may be recovered from beneath the nail margin in instances where there has been contact with an assailant. [2]

The presence of explosives and gunshot residues beneath fingernails can be used to identify individuals, link them to a crime, and

provide source information of particular importance with increasing terror attacks. Both inorganic and organic powder additives may provide characteristic signatures for sourcing explosives and gunshot residues. [2]

Because nail do not remodel, detailed chemical information (i.e., both isotopic information on food and water ingestion and molecular information on alcohol and other drugs) is locked into the nail as they form. This type of information can be used to build up a detailed picture of individual diet, recent location history, and exposure to pollutants or drugs of particular relevance to

- (1) Identification of unidentified remains,
- (2) Tracking the recent movement of people and
- (3) Exposure history or drug use. [2]

Nail growth rates are generally assumed to be more or less constant. However, there are seasonal, racial, and sex and age related differences. Growth rate slightly increases during spring and summer, during pregnancy and in adolescents. [2] Fingernails grow at rate of 0.1 mm/day or 3 mm/ month & Toe nail grow at rate of 0.03 mm/ day or 1 mm/month. [10]

Drug Use and Nails:

Nails have been found to be a powerful alternative to hair for the detection of past drug use. Methamphetamine, amphetamine, cocaine, and opiates have been detected in forensic cases, although, so far, developing the potential of drug monitoring in nails has been held back by lack of harmonization and validation of analytical methodologies and better comprehension is needed of the possible correlation between drug concentrations in the matrix and period of exposure. [11]

The presence of therapeutic drugs in nail (such as antidepressant and antipsychotic drugs) may be useful in identifying post mortem remains. Sectional or "segmental" analysis provides a high resolution chronology for the last few months prior to death, which, together with post mortem examination, can distinguish deadly chronic abuse from single acute drug over dosage. Additionally, sectional analysis of nail may be used to indicate dosage history and the state of addiction or the compliance of patients under long term treatment. [2]

Nails also provide a substrate for sectional analysis; however, drugs are incorporated into nails by both deposition at the root end of the growing nail (via the blood flow in the nail matrix) and via the nail bed during growth from the lunula to the beginning of the free margin. [11] Interpretation of parent drug and/or metabolites in nail is not straightforward.

Certain drugs remain difficult to analyze in routine clinical and forensic toxicology because of their thermal instability and low therapeutic range (0.5–5 ng/ml). Similarly, cosmetic treatment and grooming practice are considered potential factors influencing drug uptake in the nail. [2] Two different techniques neutron activation analysis (NAA) and graphite furnace atomic absorption spectroscopy (AAS) have both been used for segmental analysis for the presence of arsenic, cadmium, cobalt, germanium, lead, lithium, manganese, mercury, nickel and thallium in the nails and the results were found to be comparable. Periodic ingestion of arsenic can manifest in tissues with correspondent formation of Aldrich Mees lines on the nails, characterized by white streaks. [1]

The nail has also been used to track heavy metal exposure as with uptake of high levels of tungsten traced in nails of a patient exposed during drinking. [12]

DNA from Nails:

DNA sequences can, in theory, be recovered from almost all biological tissues, including nail and as often survive relatively better than other tissues in the post mortem context, have obvious appeal for human identification. Both fresh and old or degraded nail has been used as a source of both nuclear DNA and mitochondrial DNA. [5, 6, 13, 14, 15] It seems that the DNA content of fresh nail does not appear to vary significantly between individuals or by individual finger. [15] Furthermore, DNA from nail is subject to the similar problems of degradation, contamination and probably allelic dropout.

Whether heteroplasmy is an issue as yet remains unstudied. Studies into the degradation of DNA in old nail suggest that age, environmental conditions and thermal energy are important in DNA survival, as is the structural integrity of the nail itself. [13, 16] Numbers of studies have reported the successful identification of assailants and rapists using DNA extracted from epithelial cells trapped below, and subsequently recovered, from fingernails of the victim. [4, 17]

Conclusion:

Nails are uniquely important trace evidence with a key use in human identification. Each nail may yield discrete information. Furthermore, the unique growth of these tissues (with rapid formation rates and no further biogenic change once formed) introduces the potential for gaining important time series data of high chronological resolution. This may be used to follow patterns of drug use or to track

recent location history. In contrast to soft tissues, nails survive relatively well in the decomposition environment. Furthermore, in contrast to other long lasting tissues (such as bone and teeth) nails are easy to decontaminate from external sources of DNA. Therefore, nails represent a useful source of genetic information. It is important that any genetic analyses on such samples be performed in suitably controlled environments for example; those provided by specialist Forensic DNA laboratories. In short, Forensic Onychology is very useful in many ways to solve the crime.

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Case Report

Rape, Sodomy and Murder of a Minor Girl

*Putul Mahanta

Abstract

In this short case of article on typical sexual assault, a 14 year old minor girl was killed and found in a ditch of a jungle nearby her house. The minor girl has died as a consequence of barbarous act of sexual assault, sustained bruises on labia, recent hymnal tears, and tears around anus with signs of ligature strangulation besides the generalized signs of asphyxia. The wearing garments were found torn at places with the presence of stains of mud and sand particles. The laboratory findings confirm presence of spermatozoa. The presence of marks of violence on the genitals of the child, when an early examination is made is the strong evidence that the sexual assault has been committed. The psychiatric analysis of all the accused of this kind of cases should be made mandatory for better assessment of the cases besides an active legislative and judicial actions, comprehensive quick approaches of investigative officers and healthcare providers.

Key Words: Minor girl; Sexual assault; Hymnal tear; Sodomy; Manual Strangulation

Introduction:

India is well on its way to being the rape capital of the world. With most offenders taking solace in the idea that they can get away with it, there seems no solution in sight to the problem at the moment. More than 20,000 rapes were reported in 2008, and it is estimated that only one in 69 cases even gets reported. One of the worst places for a woman to live in, in terms of personal safety and security, India records 57 rape cases per day, up by 800 per cent if one considers the seven per day recorded in 1971. [1]

Sodomy is a term used in the law to describe the act of "unnatural" [2] sex, which depending on jurisdiction can consist of oral sex or anal sex or any non-genital to genital congress, whether heterosexual, or homosexual, or with human or animal. [3]

In young children there are few or no signs of general violence, for the minor usually have any idea of what is happening, and also incapable of resisting. The hymen may be intact or have tear depending upon the age and size of the minor. Anus may also be targeted for getting sexual gratification. No age is safe from rape, as children of one year or less, and old women of eighty-five year have been raped.

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Children are more frequently raped than adults as they cannot offer much resistance, and also due to false belief that venereal diseases are cured by sexual intercourse with a virgin. [4]

Rape is not a medically recognized entity, but a sociological and legal concept.[5] This presentation describes a case of sexual assault on 12 year minor girl with emphasis of early examination for the purpose of collecting evidence.

Case Report:

A girl of age around 14 years was recovered dead by local people in a ditch of a jungle nearby her house in the district of Kamrup, Assam after 12 hours of missing. Police suspected this case to be a drowning and brought for autopsy to the department of Forensic Medicine of Gauhati medical College.

Post Mortem Findings:

External Examination:

The victim presented with torn wearing garments at places, stained with mud and sand particles. Blood stained froth was found around the mouth and nostrils (Fig. 1) besides fecal matter at anus.

Multiple ligature marks, continuous and horizontal, bruises with nail scratch abrasions were found over both sides of the neck, more towards the nape of the neck. (Fig. 2)

Internal Examination:

Multiple bruises of variable sizes over neck muscles, both the sides of neck at places more towards the nape of the neck were present. Petechial hemorrhages over pleura,

pericardium and renal capsule with congestion of all viscera.

Negative Findings:

Mud and sand particles were not found on trachea and stomach besides negative diatom test. Chemical analysis of stomach contents also found negative for any drug or chemical.

Genital Findings:

Bruises on labia minora, recent hymenal tears at 5 and 7 o'clock position with oozing of blood with a tear of the posterior fourchette. (Fig. 3)

Anal Findings:

Two small linear abrasions extending from anal margin into the anus with dilatation (3.5x2cm size) and a bruise at its right margin with laceration of size (1.5x0.5) cm and fissure was seen around the anus. (Fig. 4)

Laboratory Findings:

- Vaginal smear shows spermatozoa. (Fig. 5)
- Barberio's Test positive.
- DNA analysis of trace evidence has established crime with the suspected criminal.
- Iscra analysis report shows negative result for drug, chemical, etc.

Discussion:

The world of sexual brutality and degradation of humanity is quite evident in every part of this world. Approximately 15% to 25% of all women were sexually abused and they were children [6, 7] of this age group.

Timely examination of the victims is important to document injuries. The genital injuries and the signs of anal penetration of this case are an agreement with the findings of Joyce A. Adams MD, et al. [8] The **Supreme Court (of India) judgment in 2000** delivered in State of Karnataka V. Manjanna [9], has recognised that the rape victim's need for a medico-legal examination constituted a medico-legal emergency, hence early examination is important to well document the genital injuries as well as to collect the trace evidence like seminal stain. A localized pattern of genital trauma can frequently be seen in women reporting non consensual sexual intercourse [10], but in this case of forceful sexual assault injuries were seen other than genital tract where signs of manual strangulation present besides the signs of rape and sodomy.

This case of sexual assault with traumatic physical injuries being assaulted by a stranger is well tallied with the findings of Ann L. Coker et al. [11], which is a typical example of

sex related homicide as stated by Geberth VJ. [12] This case highlights the importance of addressing 'child sexual abuse' as a public health issue and focuses the needs of study on the demographic profile of the victims in an urban area.

Conclusion:

Though more needs to be done to provide justice to all victims of sexual assault, an active legislative and judicial actions, comprehensive quick approaches of investigative officers and healthcare providers, and rehabilitation is of very much need in a case of sexual assault. The psychiatric analysis of all the accused in such kinds of cases should be made mandatory for better assessment.

Consent:

Informed consent was taken from legal guardian for publication or use of this material for research purposes.

Acknowledgements:

I am indebted to Professor Dr. SI Barbhuyan who has assisted me during the autopsy and to my wife Manmi Das Mahanta and to my kids Jacinth and Adriana for their help in various aspects.

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Fig. 1: Blood Stained Froth with Dirt and Mud Particles over the Body



Fig. 2: Bruises. Marks of ligature with Nail-Scratch Abrasions around the Neck



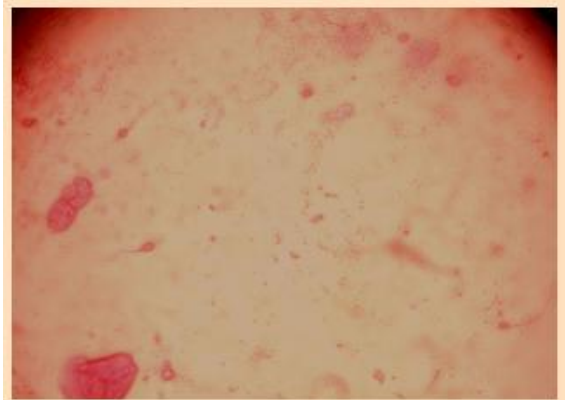
Fig. 3: Recent Hymeneal Tear



Fig. 4: Dilated Anal Canal with Bruised Right Margin with Laceration



Fig. 5: Microscopic Examination of Vaginal Smear showing Spermatozoa



Case Report

Exhumation and Identification: A Case Report

*Mukta Rani, **Pawan Kumar, ***Mukesh Kumar, ****Yashoda Rani

Abstract

The term exhumation is restricted to legally digging out the body from the grave after burial. The objectives of disinterment can vary in various cultures as well as countries and requirements vary from place to place. However, most cases of exhumation occur because there is a request from a magistrate to carry out an autopsy to gain essential forensic evidence. The paper discusses such a case of 10 year old girl who was buried after committing sexual assault and strangulation. After the passage of about two years the victim's body was retrieved from the place identified by the accused persons who confessed to the crime. The body of the victim was identified by her mother from a small piece of under slip and other articles she was wearing. The paper discusses various aspects of exhumation and also stresses the importance of careful examination and recording of personal articles, belongings etc of the victim recovered from/with the body during autopsy examination.

Key words: Exhumation, Identification, Autopsy, Sexual assault

Introduction:

Exhumation is a Latin word 'from the ground' which means in its simplest form, the removal of human remains, including cremated remains from any place of burial. The norm of many cultures is that the dead should not be disturbed. However, for a variety of reasons, they are disturbed through the process of exhumation. Many early traditional societies placed the corpse in the ground and exhumed it at a later date for religious rituals. On rare occasion in some countries prior to embalming, the body is removed from the ground. This could happen when professionals or the authorities suspect that the person might have been buried alive. Additionally, in historical context the French philosopher and death expert Philippe Aries' discussed necrophiliacs who disinterred dead bodies for sexual purposes.

Another important reason behind exhumation can be the need or desire to move the body to a different location. This may happen if a cemetery is closing or if the family buys a new burial plot or wishes to re-inter the deceased elsewhere with other family members.

For medico-legal purposes, corpses are disinterred when there is a need to establish its identity or cause of death. The paper discusses such a case of about 10 year old girl who was kidnapped and buried after committing sexual assault and strangulation at a secluded place to escape discovery at a later date. The body of the deceased was exhumed after passage of about two years on the instance of her mother. The paper discusses about various aspects of exhumation and that how it furnishes valuable information to forensic experts and is often the only means of freeing the innocent as well as convicting the guilty. [1]

Case Report:

A girl was missing for a period of about two years. The accused persons admitted of committing the crime of sexual assault, strangulating and then burying the victim to evade detection at a later date. The body was exhumed from the ground after the burial place was identified by the three accused persons independently. The body was dumped in a large jute bag (*bora*). After exhumation, the body was shifted to the mortuary of Lady Hardinge Medical College for autopsy. Along with the body there were personal belongings of the victim; silver necklace, black thread with marble stone *tabeez* and particularly an off white colour net cloth piece and an off white small cloth piece. (Fig. 2) These helped a great deal in identification of the body by the mother of the deceased.

The body was recovered in the form of skeletonized remains (Fig. 1) that comprised of partly broken skull with two halves of mandible,

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two scapulae, two clavicle, manubrium of sternum and twenty ribs. Amongst long bones there were two each of humerus, Ulna, radius, femur, tibia fibula with their upper and lower parts separated and one patella. There were two hip bones separated in two parts and three parts of sacrum. Additionally, two calcanei, one talus and some loose pieces of metacarpals and metatarsals were also recovered. There were twelve loose teeth; 6 maxillary and 6 in mandibular. The bones were not greasy or heavy and were dried and devoid of soft tissues and cartilage. Of them skull was brittle and broken. Other bones had separated ends.

In humerus, radius, ulna, tibia and fibula secondary centers of ossification at upper and lower ends have appeared but not fused. In the femur secondary center of ossification of lesser trochanter has not appeared. After thorough examination of skeletal remains opinion was expressed that bones examined belong to human female about 10-12 years old with approximate height of 138-140 cm. Soft tissues that were recovered with the bones were found negative for common poisoning. DNA profiling of skull, teeth and femur confirmed the identity of the girl.

Discussion:

The digging up of a buried body is called exhumation or disinterment, and is generally considered sacrilege or taboo by most cultures that bury their dead. Legally interred bodies are burials which have been approved by the authorities and which are buried in a cemetery. Unlawful burials on the other hand involve bodies not found buried in a cemetery and are the result of an individual or group trying to conceal or dispose of a body.[2]

Despite all cultures and religious barriers, exhumation is carried out throughout the world due to various reasons. The commonest reason for exhumation globally is medico-legal, i.e., if an individual dies in suspicious circumstances, the police may request exhumation in order to determine the cause of death. However there are so many other religious cultural and social reasons on basis of which exhumation is carried out in different part of the world.

Exhumation is done with some definite objectives under the order of appropriate authority [3] for the purpose of:

- i) Identification, to confirm the individuality for any criminal or civil purpose arising after the burial
- ii) To establish the cause of death: when any foul play is suspected, exhumation may be

ordered depending upon the public demand or request by the relatives

- iii) For second autopsy when the first autopsy report is being challenged or is ambiguous.

The objectives of disinterment are therefore to uncover previously undocumented evidence that, for some reason, had not been retrieved before burial. Karger et al. identified following main indications for exhumation:

- i) primary suspicion of intoxication,
- ii) primary suspicion of homicide,
- iii) possible medical malpractice,
- iv) accidents including road traffic accidents and
- v) To establish cause of death as well as identification. [4]

In an another report there is description of three and half years of war in Bosnia-Herzegovina in 1992-1995 when bodies of killed persons were buried in clandestine mass graves, dumped into rivers, wells, septic tanks, caves, or simply left unburied in fields, meadows and forests. To establish the identity more than 20,000 victims were exhumed to the end of 2008 and this process of exhumation and identification will be completed by the year 2015. [5]

In most of the countries exhumation is carried out mostly for the purpose of establishing cause of death when any foul play is suspected and the relatives' request for exhumation [6] as in a retrospective study by Karger et al of 155 exhumations over more than 30 years, the most common indication for exhumation was primary suspicion of homicide followed by possible malpractice and accidents including traffic accidents. [4]

There have been instances in the literature where exhumation for medico-legal purposes proved the cause of death beyond doubt when it had been ambiguous or unsatisfactory to the relatives. Exhumation proved the cause of death beyond doubt in a case of a 36-year-old woman who died with the diagnosis of acute right pyelonephritis. After the passage of five days after her burial, her husband lodged a complaint with the public prosecutor concerning the cause of her death. The corpse was exhumed and medico-legal autopsy was performed nine days after death.

There were findings suggestive of massive haemo-peritoneum with a macroscopically ruptured subcapsular hematoma. Pathological examination also confirmed acute right pyelonephritis. The cause of hemorrhage was rupture of the hilar part of hepatic artery subsequent to infectious arteritis that was probably secondary to the acute pyelonephritis. [7] Similarly, in another case

report the cause of death of a 73-year-old woman was initially certified as natural. The exhumation was ordered three weeks after the burial. At autopsy, there were findings suggestive of blunt force impact to occiput, thorax and upper extremities and compression of neck. The findings at autopsy proved foreign intervention and suggested death due to suffocation. Exhumation and further autopsy contradict natural death established the cause of death beyond further suspicion. An obvious lack of meticulous and thorough postmortem examination was probably the main reason for the misjudgment in this case. [8]

In a case of exhumation, performed to investigate the circumstances and cause of death one year after burial, post mortem computed tomography revealed a mass in the pharynx. The imaging study further directed the subsequent forensic autopsy to careful retrieval of a foreign body.

Apart from exhumation for medico-legal causes, the reasons of removal of body after burial can be varied. Sometimes exhumation is carried out on cultural basis. [6] In Southern Chinese culture, graves are opened after a period of years. The bones are removed, cleaned, dried, and placed in Taiwan in a ceramic pot for reburial or in a smaller coffin to be taken home by the rest of the family as in Vietnam. In Hong Kong the purpose of exhumation is different, where real estate is at a premium in government run cemeteries corpse are disinterred after six years under exhumation order [9] In some cultures exhumation is acceptable once the human remains reach a certain age. This may be followed by later reburial following traditional rites.

Sometimes the remains of the Venerable or the Blessed are exhumed to ensure their bodies lie in their correctly marked graves. Such gravesites become places for devotees to gather, and also to collect relics. In some cultures remains may be exhumed and reburied en masse when a cemetery is relocated, once local planning and religious requirements are met. [9] There have been instances in history when notable individuals are exhumed to answer historical questions. Many Ancient Egyptian mummies have been removed for study and public display. Exhumation also enables archaeologists to search the remains to better understand human culture. Contrarily, in some cultures exhumation is forbidden as in Jewish law. [10]

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Fig.1: All the bones are laid in anatomical position



Fig. 2: Personal Belongings of the Deceased that Helped in Identification



Case Report

Accidental Potassium Bromate Poisoning in Nine Adults

*Sushil Kumar, **Pranjal Pankaj

Abstract

Accidental Potassium bromate poisoning is uncommon in adults, can have varied manifestations in different patients and can sometimes be deceiving. Potassium bromate white powder and oxidizing agent is used predominantly in bakeries as a maturing agent for flour and as a dough conditioner. It is also occasionally used as a neutralizer in hair kits.

This paper deals with nine cases of accidental potassium bromate poisoning working in a bakery. Almost all the patients present with pain abdomen, vomiting and diarrhea. Severe gastritis leading to hematemesis is one of the dreaded complications. Acute renal failure can ensue after 24-48 hours of intake and thus patient must be investigated in this line. All of them ingested potassium bromate powder considering it to be milk powder. Potassium bromate poisoning must be considered as a possibility in every case presenting as acute gastroenteritis like symptoms after intake of bakery products. Strict legislation is required to decrease the risk of such incidents.

Key Words: Potassium Bromate, Poisoning, Serum Creatinine, Blood Urea, Bakery

Introduction:

Potassium bromate is an oxidizing agent used predominantly in bakeries as a maturing agent for flour and as a dough conditioner. It is a bromate of potassium which takes the form of white powder. It is also occasionally used as a neutralizer in hair kits. [1] Accidental ingestion of potassium bromate tablets in children have been reported in the past but this form of accidental poisoning in adults is uncommon. Potassium bromate has been banned in many countries but still being used in some including India in local bakeries. Whether they maintain the upper permissible concentration guidelines or not is a highly questionable issue and thus many cases of potassium bromate intoxication may go unnoticed. It is thus essential to have a high index of suspicion in patients presenting with gastroenteritis like symptoms after intake of bakery products.

History:

Nine adult workers of bakery presented to medical emergency with complain of colicky abdominal pain, loose motions watery in nature and vomiting.

They had a history of intake of some sweets last night in their dinner. Considering the possibility of infective gastroenteritis, patients were treated with fluids and antibiotics. After 45-50 minutes one patient developed one episode of hematemesis containing 40-50 ml of fresh blood with bits of altered blood. Now the index of suspicion was high and on taking the history in detail again it was found that all these workers had made this sweet themselves in the bakery using milk powder and sugar available in that bakery itself.

On enquiring about the ingredients repeatedly that powder was found to be actually potassium bromate rather than milk powder. Bakery officials later confirmed that the workers by mistake used potassium bromate powder rather than milk powder to prepare their sweet and then the diagnosis of potassium bromate poisoning was confirmed.

Physical Examination:

All the nine patients were conscious, alert and had stable vitals. All of them had significant dehydration. Two patients out of the lot had severe epigastric tenderness. There was no apparent abnormality detected in respiratory, cardiovascular and central nervous system. All the patients had normal urine output.

Laboratory Investigations:

Day 1

Complete blood counts, renal function tests, liver function tests, electrolytes, random blood sugar, routine urine examination, chest X-ray and ECG were performed in all the patients

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and all the investigations were found to be within normal limits.

Treatment:

1. Gastric lavage was not performed because by the time diagnosis of potassium bromate was ascertained, it was already more than 24 hours.
2. IV fluids were administered to combat dehydration.
3. IV proton pump inhibitors were given.
4. Input/output charting was done.
5. Dicyclomine intramuscular was kept SOS for pain abdomen.

Clinical Course of Patients over Next Few Days:

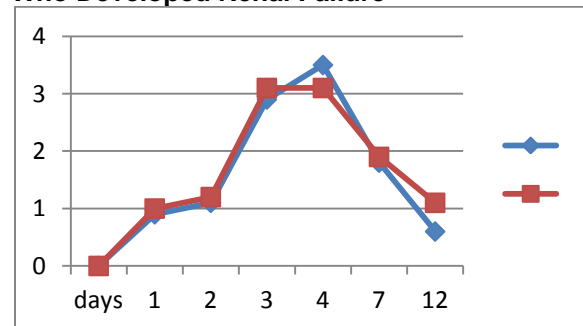
The same patient who developed hematemesis on the day of admission developed two more episodes of hematemesis containing fresh blood (about 40-50 ml) in an interval of 2 hrs. Patient was kept on continuous pantoprazole infusion and oral antacids. He was given fresh blood transfusion. Patient responded to treatment and no further episodes of hematemesis occurred. Loose motions and vomiting stopped by day 2 in all the patients. All the patients were apparently asymptomatic by the end of day 2.

Two patients developed oliguria and nausea despite adequate fluid administration on day 3. On investigations it was found that their blood urea and serum creatinine were raised and they had developed acute renal failure. Electrolytes were however within normal range. The course of serum creatinine and blood urea in those two patients is shown in Table 1.

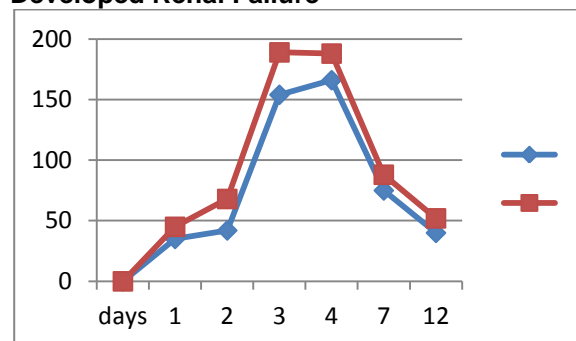
Table 1: Course of Serum Creatinine and Blood Urea

Day of Admission	Patient 1		Patient 2	
	Blood urea	Serum creatinine	Blood urea	Serum creatinine
Day 1	35	0.9	45	1.0
Day 2	42	1.1	68	1.2
Day 3	154	2.9	189	3.1
Day 4	166	3.5	188	3.1
Day 7	75	1.8	88	1.9
Day 12	40	0.6	52	1.1

Graph 1: Serum Creatinine in Two Patients Who Developed Renal Failure



Graph 2: Blood Urea Levels in Patients Who Developed Renal Failure



Patients were treated conservatively with diuretics and fluid. None of them required dialysis. Seven patients remained asymptomatic and had normal investigation reports throughout and were discharged by day 7.

Discussion:

Potassium bromate poisoning can be deceiving at times. Potassium bromate is an odorless, tasteless white powder which can be confused with milk powder. It is an oxidizing agent widely consumed in bread in which it is used as an additive in the baking process. [2] Various methods have been described for the determination of bromate residues with accuracy in variety of baked goods. [3, 4]

The nephrotoxicity results from interplay of increased formation of reactive oxygen species [5], Lipid peroxidation [6] induced DNA fragmentation [7] micronuclei formation and cellular proliferation. [8] Massive haemolysis and thrombocytopenia may be seen in children with bromate poisoning. [9]

The mechanism of bromated toxicity is not clearly understood [10] but proposed that renal failure could result from direct tubular toxicity due to active oxygen radicals¹⁰, reduced renal perfusion from dehydration and possibly decreased vasomotor tone [11, 12], hemolytic anaemia with haemoglobinaemia may also play a role. [13] A number of case reports of acute poisoning by potassium bromate solution have been reviewed. [14] In children 1.5-3 years of age, ingestion of 2-4oz (53-133gm) of a 2% solution of potassium bromated cause nausea and vomiting, usually with epigastric pain and/or abdominal pain; diarrhea and hematemesis occurred in some cases. [15, 16]

In both children and adults, oliguria and death from renal failure have been observed [17, 18], partial hearing loss and complete deafness have also been reported. [19] The toxic effects or lethal dose of potassium bromate in human has not been accurately established [9], but a

dose of 500mg caused serious symptoms in a 15 months old child. [19]

Usage in bakeries without quality control in high concentrations can lead to adverse outcomes. This type of intoxication can be easily misdiagnosed as infective gastroenteritis but can be far more dangerous and thus high index of suspicion is required for making the diagnosis.

Almost all the patients present with pain abdomen, vomiting and diarrhea. Severe gastritis leading to hematemesis is one of the dreaded complications. Acute renal failure can ensue after 24-48 hours of intake and thus patient must be investigated in this line. Renal failure usually ensues after 36-48 hrs of ingestion of potassium bromate. Continuous monitoring of renal function is thus warranted daily for at least one week after the suspected ingestion. (Graph 1 & 2)

Possible mechanisms causing renal failure include direct tubulotoxicity due to induction of active oxygen radicals, lipid peroxidation, induced DNA fragmentation and reduced renal perfusion from dehydration and possible decreased vasomotor tone. Management is predominantly supportive.

Conclusion:

Potassium bromate poisoning must be considered as a possibility in every case presenting as acute gastroenteritis like symptoms after intake of bakery products. Strict legislation is required to decrease the risk of such incidents. Hematemesis and renal failure as the possible adverse outcomes of potassium bromate poisoning have been reported in this case report.

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Case Report

Suicide Pact by Hanging: A Case Report

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Abstract

Suicides are more likely to occur during periods of socioeconomic, family and individual crisis. A suicide pact is an agreement between two people to end their lives. Most suicides are solitary and private; but few results from a pact between 2 people to die together. It is predominantly made by male-female partners and by less violent methods. Suicide pact between people of the same gender is an unusual event. We discussed a case of a suicide pact where a 19-year-old male and a 20-year-old male who were friends committed suicide by hanging because of drug addiction and poverty. Two young adult male made a pact to commit suicide by hanging themselves from a ceiling hook. It is unique case in this regard. Suicide pact is also very interesting from the perspective of medical examiners. They need to make comprehensive postmortem examination to finally conclude the proper cause and the manner of death.

Key words: Suicidal pact, Drug Addiction, Poverty, Hanging, Post-mortem

Introduction:

The word suicide derived from Latin word "suicidium" which means "to kill oneself" is the act of human being intentionally causing his/her own death. A number of factors are associated with the risk of suicide including as mental illness, drug addiction and socio-economic factors. While external circumstances, such as a traumatic event, may trigger suicide but it does not seem to be an independent cause. Thus suicides are more likely to occur during periods of socioeconomic, family and individual crisis. [1]

Nowadays, suicidal attempts are widely regarded as an important health problem. It has been found in recent years that majority of suicides occur among men and in younger age groups. It is estimated that over one lakh people die by suicide in India every year and one million people commit suicide in the world every year. India alone contributes to more than 10% of suicides in the world. The world health organization estimates that it is the thirteenth-leading cause of death worldwide.[2]it is a leading cause of death among teenagers and adults under thirty-five.[3]

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It is not uncommon to come across news headlines in the daily newspapers of suicides by unmarried sisters, issueless couples, disappointed lovers or a mother ending her own and her children's lives, frustrated individuals due to poverty or other family circumstances (Latha, 1996). Methods of suicide are usually poisoning, hanging, drowning and, more rarely, others such as jumping from a cliff, shooting or self-stabbing. [4]

A suicide pact describes the suicides of two or more individuals in an agreed-upon plan. The plan may be to die together, or separately and closely timed. Suicidal pact between two or more persons to end their lives at the same time generates interest in the popular media out of proportion to their frequency, yet they are rarely discussed in medical literature. [5] They represent 0.6-4% of all suicides, [6, 7] with the vast majority being double suicides. Typically, they involve married couples, aged 50-60 years, who are socially isolated and mentally ill. [6, 8] Double suicide between people of the same gender is an unusual event.

An extensive literature search revealed only few similar case studies reported by different authors. [5, 9, 10] However to date there appears to be no previous report about a suicide pact between two male friends and rarest thing of this case is the hanging of two male by a single ligature material and constriction force being the wt of another's body. We present a suicide pact involving two young adult male individual who were hanged themselves by means of a single rope.

Case Report:

A male aged 19 years and another male aged 20 years committed suicide by hanging using a single red plastic rope, tied in the form of a running noose around their necks. The dead bodies were found hanged to the ceiling hook of an isolated vacant government building. The bodies were hanged by means of a single rope. Both young adult were agreed to die that's why they use a single rope as noose. The one end of the rope was tied around the neck of one individual, then the rope was passed through the ceiling hook and another end was tied around the neck of second individual. Both young boys were standing over the row of bricks. They decide to die together and push the row of bricks simultaneously and hanged. (Fig.1)

Fig. 1:

Family history suggests that they belong to labour class and both were drug addict and gamblers. Their families were migrated from Gujarat to Haryana. They were living in slums in front of railway station and earn their livelihood by doing handicraft work. These young people were wandering in the villages and sold the handicraft items. They were cocaine addict and gamblers. Because of their bad habits there were intensive conflicts with elder family members. They were absconded from their family members fifteen days before their death. They wandered here and there in their depressive phase and decided to do the pact of suicide. The autopsies were conducted by the department of Forensic Medicine, Pt. B.D. Sharma University of Health Sciences, Rohtak.

Post Mortem Findings:**External examination:**

The dead bodies were of a moderately built and moderately nourished adult males, both having a brownish complexion. Dark discoloration of dead bodies present due to

decomposition. The skin and soft tissues of both the bodies were dried, shriveled and somewhat mummified. The mouths of the bodies were open and tongues were protruded out. Dried salivary dribble marks were present on the right cheek below the lips.

The post mortem reveals that the ligating material was tied around the neck of each deceased by means of sliding knot. The ligature mark on the neck of each deceased was present obliquely at the level just above the thyroid cartilage. The ligature mark receded upwards, backwards and medially and reaches up to the level of mastoid process of each side. The ligature mark was deficient posteriorly due to presence of scalp hair. Salivary stains were also present over the clothes of the dead bodies. On dissection marginal ecchymosis was appreciable. Here the force of constriction was not only ones own body weight but also the body weight of other. (Fig 2)

Fig. 2:**Internal Examination:**

In both the cases, the brain was grayish paste like. The lungs, liver and kidneys were softened and putrefied. The stomach contained mucoid material in each individual. The neck structures were dissected under a bloodless field, which showed dry, hard, and pale glistening subcutaneous tissue and neck muscles below the ligature mark. Other internal organs were intact and healthy. In both cases, the cause of death was hanging by ligature.

Discussion:

This case illustrates many of the key, defining features of suicide pacts that are carried out and also highlights the nature of the dependency relationship. The shared delusion was based on their life situation and experiences. As suicide attempts are important risk factors with regard to death from suicide, strategies aimed at decreasing the number of such deaths should involve reducing their frequency and prevalence in society. [11]

Atypical features of this case include number of participants, their young ages and their good health. Both were borderline personality, drug addicts and gambler.

Migration and solitude have been playing an important role in suicide attempts. [12] Adults who enter into suicide pacts tend to be socially isolated. The families of the deceased's had migrated from Gujarat to Haryana. They were living in slums in front of a railway station and earn their livelihood by doing handicraft work. These young people were wandering in the villages and sold the handicraft items. Because of their bad habits there were intense conflicts with senior family members. They were absconded from their family members fifteen days before their death. They wander here and there in their depressive phase and decide to do the pact suicide. This situation is in keeping with the idea stated in many studies that stressor events are experienced before suicide attempts. [5, 13, 14]

In the present case both the friends were obviously socially isolated and their relations with their respective fathers, sisters, mothers and brothers were estranged. Some shared risk factors could have made the friends susceptible to the suicidal pact. There were shared environmental stressors, such as problems in the family. Intensive familial conflicts, drug craving, gambling and scarcity of money led both the friend to suicide together.

To conclude with, double suicides are not that infrequent, certainly not in India, where they often involve lovers, or a mother and children, nor in the Western world in the case of older couples, one or both of whom are ill. Suicide attempts by two male friends are, however, a rare event. [15-17] the lack of any previous report on a suicide pact involving two male friends made a comparison of our study

impossible. In the present case, we may argue that the main motive for the suicide pact was relief from environmental stressors, such as immigrant and family problems.

This report stress the importance of history taking ,examination of crime scene photographs before conducting the post mortem examination. This report is important as a contribution to the prevention of suicide attempts, which represent an important public health problem, because there are few cases of double suicide in the literature.

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Case Report

Sudden Natural Death due to Takayasu's Arteritis

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Abstract

A young male aged 23 yrs with alleged history of chest pain was brought to the emergency medicine department of St John's Medical college hospital. On arrival was declared brought dead. There was no previous significant medical history. A Medico-legal autopsy was done which revealed left anterior descending coronary artery lumen to be occluded by grey white material. On Histo-pathological examination of the heart, it was diagnosed as Takayasu's arteritis. Takayasu arteritis, also known as Pulseless disease, occlusive thromboaropathy, and Martorella syndrome, It is a Granulomatous inflammation of unknown aetiology affecting medium and large arteries leading to vessel wall thickening and occlusion.

Females are more likely to be affected than males. Patients often notice the disease symptoms between 15- 30 years of age. Symptoms range from malaise, fever, night sweats, weight loss, arthralgia, fatigue and can present with absent pulses, limb claudication, blood pressure discrepancies, Hypertension, retinopathy Ischemia, postural dizziness, seizures, hemi paresis and many more. Sudden death due to Takayasu's arteritis affecting coronary artery is rarely reported during medico-legal autopsy, hence this case is reported.

Key Words: Takayasu's Arteritis, Sudden death, Vasculitis, Autopsy, Coronary artery

Introduction:

Disease of heart accounts for 45-50% of all sudden deaths due to natural disease, with the atherosclerotic coronary artery being the most common cause. [1] Takayasu arteritis is a chronic vasculitis of unknown aetiology which primarily affects aorta and its primary branches. [2] Its aetiology pathogenesis remains a subject of speculation even after a century it was first described by the Japanese ophthalmologist, Takayasu. [3] Though it is well known yet it is a rare cause of sudden death.

Case Report:

A young male aged 23 years was brought dead to emergency medicine department with history of sudden collapse while getting ready to go for work. In view of a sudden death with no previous medical illness it was registered as a medico-legal case and body was subjected to a post mortem examination.

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Autopsy Findings:

A 5 feet 9 inch male of moderate built and nourishment, rigor mortis present all over the body. Post mortem staining was seen over the back in patches and not fixed. No visible external injuries over the body.

On Internal Examination: Stomach contained 150 ml of brown coloured fluid and mucosa was congested. All organs were intact and congested.

Heart weighing 350 grams with the left ventricular thickness of 1.5 cm, proximal 2 cm of the left anterior descending branch of the coronary artery was blocked by a thrombus(Figure-1), the cut section of the inter ventricular septum showed whitish irregular areas along with petechial haemorrhages

On Histo Pathological Examination:

It showed Panarteritis(Fig. 2) with thrombus, with total luminal occlusion involving proximal left anterior descending artery with thrombotic emboli in small branches, Fibro-intimal hyperplasia of other small coronary artery branches, foci of Myocarditis., areas of septal Myocardial fibrosis consistent with healed infarcts.

All these features pointed to a diagnosis of Takayasu's Arteritis and thrombosis involving the left coronary artery with thrombo-embolism and healed septal myocardial infarcts.

Discussion:

Commonest cause of coronary artery vessel wall thickening and thrombosis is atherosclerosis, and non atheromatous causes are vasculitis of various origin. Vasculitis means inflammation of vessels that includes both arteries and veins. [4] The various conditions associated with coronary vasculitis are tuberculosis, infectious disease, Kawasaki's disease, metabolic disorders, metastatic disease, and substance abuse. [5] Most of these have specific features that enable diagnosis.

In living individuals the patient can be subjected to various blood tests including serological tests and angiographic studies to confirm the diagnosis of various forms of vasculitis. Angiography remains the gold standard for diagnosis [6] and histological diagnosis is usually impractical in living and is limited to those cases undergoing revascularization procedures and histological diagnosis is possible during autopsy.

Takayasu arteritis causes granulomatous inflammation of the medium and large size arteries leading to vessel wall thickening, fibrosis, stenosis, and thrombus formation, at times more acute inflammation can destroy the arterial media and lead to aneurysm formation. [2] The histo-pathological findings are panarteritis characterized by mononuclear cells and occasionally giant cells with marked intimal hyperplasia, medial and adventitial thickening and in chronic form, fibrotic occlusion [7], however similar finding is also seen in giant cell arteritis. However the discriminating factor is the age of onset of Takayasu arteritis is 20-30 years of age, and 40 years and above in case of giant cell arteritis. [8]

Conclusion:

In any case of sudden natural death in young, subjected to a post mortem examination and coronary artery showing thickening with or without a thrombus and has no significant atheromatous change in the aorta, it is wise to subject heart to histo-pathological examination to rule out any form of vasculitis. In conclusion, this case demonstrates the importance of forensic autopsies in sudden death cases and to determine the exact cause of death. To our knowledge, sudden death due to Takayasu arteritis as principal cause of death determined at post mortem examination is rare, hence this case is reported.

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Fig. 1: Photograph Showing Thickened Left Coronary Artery with Thrombus

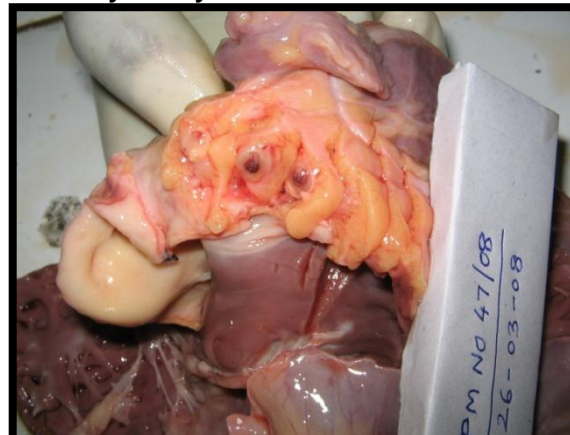


Fig.2: Coronary Artery Lymphocytic Infiltration and Giant Cells (Hematoxylin & Eosin X 40)



Case Report

Peripheral Arterial Embolism of Pellets after Shotgun Injury to the Abdomen: A Case Report

*Sadikhusen G. Momin, *Harish T. Khubchandani

Abstract

Dealing with shotgun injury to the abdomen it is important to be aware of the possibility of missile emboli and their potential clinical effects because it usually causes vascular trauma but intravascular missile embolism is relatively rare. Vascular trauma following shotgun injuries may involve laceration of the vessel wall, pseudoaneurysm, arteriovenous fistula or missile embolism. A pellet embolus should be suspected in all cases where gunshot entry wound is present with or without an exit wound. We recently encountered a case of a close-range shotgun injury to the abdomen with subsequent embolisation of pellets to bifurcation of popliteal artery both lower limbs. However, pellet embolus is asymptomatic, there is still debate over best management because conservative management avoids surgical risks and operative removal prevents the possibility of embolus related life threatening complications.

This case shows that it is necessary to do whole body imaging in all cases of shotgun injury whether exit wound present or not.

Key Words: Shotgun Wound, Vascular Injury, Pellet Embolisation

Introduction:

An embolus is defined as "a detached intravascular solid, liquid or gaseous mass that is carried by the blood to a site distant from its point of origin", or more simply, "an abnormal mass of undisclosed material which is transported from one part of the circulation to another".

The classification can be based on its composition i.e. - (a) thrombus and clot, (b) gas - air/nitrogen, (c) fat, (d) tumour, (e) bullets, (f) amniotic fluid, (g) bone marrow, (h) others (e.g. parasites).

Case History:

The identified dead body of a male aged about 29 years brought to mortuary of civil hospital, Ahmedabad with history of gunshot injury to the abdomen. On external examination, 2.5x 2 cm size of irregular tear present on front aspect of left side of shirt. All clothes were smudged with blood. After removing shirt, one oval shaped firearm entry wound of size 5x3.5 cmx cavity deep placed slightly obliquely present over lateral aspect of left abdominal wall.

Margins were irregular, abraded and contused, blackening of size 0.1 to 0.2 cm present over whole margin of wound except lower posterior quadrant of wound. No burning, tattooing and singeing of hairs were present.

The dead body was sent for whole body X-rays to Radiology Department. After examining X-ray plats, we found multiple radio-opacities in abdominal x-rays with left side Ilium bone were fractured in to multiple pieces. Another interesting finding was that we found single radio-opacity on X-ray of each knee joint.

Body was shifted in prone position and gastrocnemius muscle was reflected on each side. One pellet was recovered from both right and left popliteal artery. On internal examination, abdominal cavity contained about 1 litre of blood, blood clots and few pellets were recovered from it. Mesocolon of large intestine shows multiple perforations with extravasation of blood, few pellets were recovered from mesocolon. Left side ilium bone was fractured and converted into multiple pieces. On eviscerating the abdominal organs left and right common iliac vessels and their branches shows pelletal perforation with extravasation at places.

Discussion:

Arterial missile embolism is an infrequent complication of penetrating vascular trauma. In a review of 7,500 vascular injuries included in the Vietnam War registry, Rich reported 22 cases of missile emboli, 19 of which were arterial. [1] Michelassi and associates

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found 100 cases of arterial bullet embolism in an extensive review of the literature. [2]

The vast majority of these emboli entered the circulation through a penetrating wound of the heart or aorta. Shannon et al [3] described 30 cases of peripheral arterial missile emboli accumulated from a 22-year literature review. The site of entry was the heart or aorta in 28 (93%) of these patients. Bongard and associates reported four cases of peripheral arterial shotgun missile emboli. [4]

All four of these cases involved wounds to the extremities. Embolism occurs more frequently with shotgun pellet wounds than with single missile gunshot wounds because of the large number of pellets, their small size and the wide patterns of injury. First described in 1834, foreign body embolisation is a rare complication of penetrating wounds with bullets being the commonest artefact with a quoted incidence of 0.3%. [5]

A pellet embolus should be suspected in any patient who has a gunshot entry wound with or without an exit wound. So the whole body imaging required in all cases of shotgun injury whether exit wound present or not.

Pellet emboli access the vascular system by direct propulsion or erosion into the vessel lumen. 80% are arterial in nature with only 20% being venous.

There are 2 rare documented sub-groups of embolisation. First is retrograde embolisation seen in 15% of venous cases and defined as projectile movement against the normal direction of blood flow. Second is paradoxical embolisation, defined as the passage of a foreign body from the venous to the arterial system by communication through a right to left shunt. Causes include arterio-venous fistula, atrioventricular perforation, ventricular septal defect or patent foramen ovale.

Pellet emboli follow the same physical laws of distribution as do bullets. Pertinent variables include the force of blood flow, the direction of flow, the position of the body, the size and position of the arterial lumen, and the size and weight of the missile. [6] In injuries caused by bullets, this usually results in peripheral embolisation to the pelvis or lower extremities. The missiles tumble down the aortic arch and commonly lodge in the internal iliac or femoral arteries. Pellets, on the other hand, may just as commonly result in cerebral and upper extremity embolus formation as in lower extremity embolus formulation.

When pellet size is small (3 mm or less), embolus formation may occur almost exclusively in the head and neck. Cerebral pellets

preferentially lodge at the origin of the middle cerebral artery. When missile embolisation occurs to the extremities, the need for embolectomy is indicated by the size and shape of the missile, the site of lodgement, and the peripheral effects produced.

The larger the embolus is, the more frequently it will produce distal ischemia; the more irregular it is, the more frequently it will carry foreign material with it, which produces secondary trauma and infection. [7] While bullets often must be removed, pellets usually do not require removal from the extremities. Barnes and Helson [8] thoroughly investigated the ballistics of pellet missile guns. A velocity of 350 feet per second (fps) has been found necessary to break skin and cause deep soft tissue damage.

Vascular trauma following shotgun injuries may involve laceration of the vessel wall, pseudoaneurysm, arteriovenous fistula or missile embolism. Shotgun pellets are of sufficiently small diameter to embolise along even small arteries and veins. Their kinetic energy is sufficient to penetrate the soft tissues and vessel wall and lodge in the lumen without passing across it completely. The effects of arterial embolism are usually restricted to the injured extremity and apparent soon after the injury. Once circulation is restored it is unlikely to pose problems in future.

Venous embolism, on the other hand, is unlikely to have a significant effect on the injured limb unless the main venous outflow tract of the limb is completely occluded. It is more likely to produce systemic effects as the missile is carried forward through progressively larger venous channels towards the heart. Its manifestations would depend on the site of final lodgement of the missile and may not be apparent immediately after the injury. When dealing with gunshot-inflicted vascular trauma it is important to be aware of the possibility of missile emboli and their potential clinical effects. Conversely evidence of pellet embolism should be considered a sign of major vascular trauma after gunshot injury.

Thorough physical assessment and appropriate imaging remains the mainstay of assessment of these patients. Management of pellet emboli requires a selective approach based on site of lodgement of embolus, clinical picture, potential for further embolisation and adequacy of local circulation.

The possibility of missile embolus should be considered in any patient with unexplained clinical features and a prior history of firearm injury with possible missile embolism.

Conclusion:

Pellet embolism is a well documented but rare complication of penetrating injury. There is still debate over the best management, particularly when patients remain asymptomatic. Arguments for conservative management include avoidance of surgical risk and current evidence showing that the majority of patients have no complications. However operative removal excludes the possibility of subsequent embolus related life threatening complications. Our case has highlighted the need for whole body imaging in all cases of shotgun injury.

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Photo 1: Firearm Entry Wound over Left Side Abdomen



Fig 2: X-ray of Hip joint showing Multiple Radio-Opacity (Pellets) With Fracture of Left Ilium Bone



Fig 3: X-ray of Right Knee Joint Showing One Radio-Opacity (Pellet)



Fig 4: X-ray of Left Knee Joint Showing One Radio-Opacity (Pellet)



Case Report

Significance of History Taking before Autopsy: A Case Study

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Abstract

Many cases are being reported before the Forensic Experts, in which it becomes difficult to find out the precise cause of death. A 73 year male was brought for autopsy examination at Rajendra Institute of Medical Sciences, Ranchi, Jharkhand with suspicion of death due to brain tumor. The findings of autopsy examination was edema of brain matters and depressed area in right frontal lobe of brain with several stitches marks on right side of head. Detailed history from all the concerned persons were taken which reveals previously person was operated by neurosurgeon for space occupying lesion in cranial cavity. Histo-pathology examination of mass showed Koch's lesion as tuberculoma en plaque a very rare presentation of tuberculosis which is very common in our country even in the era of 21st century.

Case is being presented with brief discussion showing the need of early and prompt history taking including hospital records details before an autopsy examination. It may reveal important facts as well as helps the Forensic Experts to take the consideration of therapeutic artefacts during autopsy to find the exact cause of death.

Key Words: Tuberculoma En Plaque, Autopsy, Edema, Space occupying lesion

Introduction:

It is honourous duty to find out the exact cause of death as far as possible to reduce the numbers of negative autopsies [8], which becomes falsely high if reasonable exercise and proper history from all concern is not taken before autopsy examination. It becomes very important for an autopsy surgeon to know about the treatment details of hospitalized person which gives important clues.

This case report highlights the importance of history taking before the autopsy examination as police generally gives insufficient information in inquest report and challan report. This exercise not only reduces the number of negative autopsies whose incidence is about 2 to 5% in all cases [1, 2], but it also clarify the cause of death of victim to their near relatives.

Case Report:

A case was brought for post-mortem examination in the Department of Forensic Medicine and Toxicology, RIMS, Ranchi from Neurosurgery Department of RIMS, Ranchi with history in the inquest report and challan report that "death was due to treatment of brain tumor".

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An unnatural death Case was registered in the police station and autopsy of that person, aged about 73 years, Male, was conducted here in the Department of Forensic Medicine, RIMS, Ranchi dated 21.07.2012.

On external examination the dead body was of average built, Rigor mortis was present all over the body and P.M staining was present over posterior aspect of the body which was fixed. There was no apparent external injury except only an old healed scar mark (Fig. 1) having stitch marks over right fronto- parietal region of head. On removal of scalp there was bony gap of 10cm x 08cm in the right fronto- parietal bone with bone chip over the gap.

On removing the bone from the bony gap, there was depressed area of 06cm x 04cm in right frontal lobe of brain (probably due to old surgical resection of space occupying lesion in the right frontal lobe of brain. (Fig. 2) The brain matter was edematous and congested.

Discussion:

Discussion about the quality of autopsy started at the beginning of 19th century. [7] It becomes an established fact that these type of cases are not very frequently encountered before the Forensic experts for medico-legal purposes in our country as well as from outside the country. For this reason the case is reported to understand the importance of history taking in autopsy to solve the dispute in various criminal as well as civil cases. Autopsy findings of the victim in this case are cerebral edema with signs

of asphyxia. With these few findings it becomes very difficult to interpretate the cause of death of the victim.

On detail history of that victim including details of hospital records [3] which gave us important clue that victim was operated for about 2.5 months ago for space occupying lesion (SOL) in cranial cavity. After successful resection of SOL patient went back to home after discharge. Patient was in regular follow up with the neurosurgeon, again he developed convulsion and was re-admitted in the hospital in neurosurgery department. The death occurred after about 10 days of re-admission.

Before commencing the postmortem examination, the medical officer should obtain all available details of the case so that attention may be directed to salient points. The opinion of even the most eminent medical officer may be of little value if he is ill-informed of the clinical findings and facts. [4]

On review of the investigation details, available in neurosurgery, with evidence of suspected "tuberculoma en plaque", a very rare presentation of tuberculosis a space occupying lesion in cranial cavity. The histo-pathological examination of resected portion (frontal lobe of brain) of brain report shows Koch's lesion. (Fig. 3) Various studies showed that tuberculoma en plaque is a very rare presentation of tuberculosis caused by *Mycobacterium tuberculosis* [6] whose incidence is reasonably high in our country despite various steps taken by Government to prevent this disease.

Conclusion:

The present case highlights the importance of thorough history taking, which is regular practice in clinical cases in the era of 21st century as well as study of hospital records where there has been a period of treatment between an act of violence/disease or between the accident and the death and any other relevant paper are necessary before the autopsy examination so as to enable the doctor to concentrate on that organs and the part of body so that high degree of suspicion may reveal the facts. In the urgency of Forensic work, however, at times, during weekends, the autopsy may have to be proceeded without the hospital record, as there may be non to furnish the same and the attendants/relations of the deceased may not be subjected to harassment merely due to non availability of history in spite of the best efforts to procure the same. [5]

It also emphasize that in tuberculosis medical treatment should be prompt in early stage since medical therapy is generally

effective for intracranial tuberculomas, increased familiarly with this form of tuberculoma can heighten the index of suspicion and thus prevent aggressive surgical resections which lead to increased mortality and morbidity. It also signifies the high mortality rate of tuberculosis cases involving the brain. [6]

This case clearly reflects that during the autopsy examination of victim which is brought from hospital and died in hospital there must be BHT and details of investigation report should and must be supplied with the inquest report and challan report. This will help the Forensic experts to corroborate the findings, which is not a regular practice in most of the institution in our country.

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Fig. 1: Old Healed Scar Mark on Scalp



Fig. 2: Resected Depressed Area in Rt. Frontal Lobe



Fig. 3: Koch's lesion

