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EDITORIAL

Disinfection and biomedical waste management: Mortuary practices during COVID-19

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The World Health Organization (WHO) declared the COVID-19 outbreak as a "pandemic" on 11 March 2020. Till date, crores of cases have been registered across the world, and India stands second behind the USA with more than 90 lakhs cases till date. COVID-19 pandemic has warranted an overwhelming response from the administrators and health care workers. Significance of infection prevention and control practices have been emphasized from the beginning, and various protocols have been evolving for the management of COVID-19 infections. Strict infection prevention and control protocols have been advocated during the clinical management for the patients as well as for the dead body management. Mortuary premises are an integral part of the hospital set up in the management of COVID-19 pandemic. Critical tasks like dead body handover and autopsy in COVID-19 suspect/ confirmed cases are being carried out in the mortuaries. Considering that the mortuaries in India are resource depleted, strict adherence to infection prevention and control practices and proper biomedical waste management is crucial.[1] Forensic pathologists, as well as mortuary staff, must be well acquainted with all such protocols.

Novel coronavirus transmission occurs mainly through respiratory droplets, aerosol, contact with other secretions of the body and fomites. Mere dead body handling is considered a moderate risk procedure. Once the dead body is packed in the impermeable body bag, and the bag is disinfected externally, the chances of transmission of the infection are minimized. Autopsy on the COVID 19 positive body is considered a high risk procedure due to aerosol-generating procedures involved and exposure to various secretions. Asymptomatic transmission of COVID-19 is another grave issue where the infection can spread to others without any warning sign, thus, making the medical practitioners and other staff working in the mortuary vulnerable to infection. Novel coronavirus can survive in a dead body for some time after the infected person has died. It has durable survivability and resistance to cold environments, and the deceased may have a large amount of virus load.[2,3] Additionally, sharp instrument injury and body fluid spray contact can increase the risk of exposure to infection to healthcare workers. Hence, it is recommended to use full complement Personal Protective Equipment (PPE) for all autopsies in this COVID 19 pandemic.[1] During the autopsy procedure, there can often be the spillage of the fluids on the surrounding floor. Tissue handling for sample collection and preservation also pose the risk of transmission. Hence, along with personal protection, environmental cleaning is also equally critical.

Cleaning of the mortuary complex should be done by dedicated staff wearing PPE according to guidelines for waste disposal.[1] Before starting disinfection, the area should be sealed off after wearing appropriate PPE kit. All the buckets, jugs, or any other equipment used for cleaning should be rinsed with hot water. Sodium Hypochlorite (1%) is the preferred disinfectant for cleaning purposes. The solution has to be freshly prepared and should be allowed for at least 10 min of contact period with the surface. If 1% sodium hypochlorite is not available, 70% alcohol can be used as a disinfectant agent for mopping the surroundings, particularly over the metallic surfaces. The disinfectant should not be sprayed over the surface; instead, an application can be made using a damp cloth. The sweeping movement should be slow and steady without any splash to prevent aerosols generation.[4]

Cleaning should always be proceeded in a top-to-down sequence, i.e., ceiling, walls, then the floor based equipment, and lastly, the floor. Dip the mop only once in the cleaning solution, as dipping it multiple times may re-contaminate it. It is crucial to change solutions for every room, however frequent solution change can be done in heavily contaminated areas such as autopsy hall. Mopping and wiping of all accessible surfaces of floor, furniture, fittings, windows, and mattresses should be done with a 1% hypochlorite. All high touch surfaces such as door handles, knobs should also be wiped. All curtains or fabrics should be washed with hot water (at least 70°C) for at least 25 minutes with detergent or bleach. All the equipment used for cleaning purpose should also be disinfected by soaking in 1% hypochlorite solution. The cloth/absorbent used for mopping is to be discarded in biohazard bags after the disinfection procedures. Special attention must be given to body storage chambers, autopsy hall, and the movement area of a dead body inside the mortuary complex. The floor of such areas should be disinfected with 1% sodium hypochlorite and detergent. Three buckets, each of them containing detergent, 1% sodium hypochlorite, and plain water, are required. First, mop the floor with the detergent solution and warm water. Squeeze the mop with plain water and let the floor dry. After drying, mop the area with 1% sodium hypochlorite. Remember,

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all the mopping and cleaning should be done from the far corner of the room towards the door. Alternatively, cleaning can be done by using cleaning agents one after another in three different buckets, each containing 50 gm surf in 10L water, plain tap water, and 100 ml phenyl in 10L water, respectively. Final mopping should be done with the fourth bucket containing a 0.5% sodium hypochlorite solution. All spill areas in the autopsy hall or body storage chambers must be first disinfected with 1% sodium hypochlorite and leave it for 10 minutes. Larger spills can be decontaminated with 10% sodium hypochlorite solution with a contact period of 15 minutes.[4,5]

General cleaning of the floor can be done with hot water and detergent solution; however, if the supply of 1% sodium hypochlorite is adequate, it can be used at any time. Phenol is another agent that can be used for cleaning areas like office rooms/staff rooms and toilets. Scrub floors with hot water and detergent followed by cleaning with plain water. Cleaning of telephone, light switches, lockers, tables, cupboards, wardrobes, benches, shelves, chairs, and other furniture should be done by using detergent and warm water by damp dusting. Care must be given while cleaning light switches; cloth must be damp, not wet to avoid any mishappening. Mirrors and glasses should also be disinfected and cleaned with water and detergent solution by damp cloth. Clean the surrounding areas of mirrors also. Another forgotten area but the important one is the cleaning of toilets. Toilet pot and floor should be washed with 1% Sodium Hypochlorite. Scrub with the recommended agents and the long handle angular brush and allow to dry. Other areas of the toilet, such as Taps, sink, soap dispensers, etc. should be cleaned with hot water and detergent solution.

The frequency of cleaning depends on whether the area is high touch surface or low touch surface, as well as the flow of COVID-19 positive/suspected cases in the mortuary complex. Cold storage chambers and autopsy hall are high touch areas due to the handling of suspected dead bodies. These areas should be disinfected every 1-2 hours. High touch surface also includes door handles, knobs, telephones, call bells, light switches, and walls around the toilet. Such surfaces should be disinfected every 1-2 hours present in the cold storage rooms and autopsy halls and every 2-3 hourly in other areas of the mortuary complex. For low touch surfaces such as walls, mirrors, etc. in the areas where there is no flow of suspected cases, mopping should be done 3-4 hourly.[4]

Biomedical waste management in the mortuary is necessary to prevent further exposure to the infectious agent. The generation of biomedical waste during the autopsy should be avoided as far as possible. The safe handling and disposal of biomedical waste generated during the autopsy needs to be ensured. Separate color code bins should be kept as per Biomedical Waste Management Rules, 2016, for proper segregation of waste. As an additional precaution, double-layered bins/bags should be used for waste collection to provide strength as well as minimize leakage while dealing with COVID-19 suspected dead bodies. Such bins should be labelled as "COVID-19 waste" and should be stored separately. Maintain a separate record of biomedical waste generated from COVID-19 autopsies. The (inner and outer) surface of containers used for storage of COVID-19 waste should be disinfected with a 1% sodium hypochlorite solution daily. Donning and doffing should be done with utmost care in designated areas. All the PPEs should be discarded in the red bin after proper disinfection, packaging, and labelling. Goggles/Face shield should be first immersed in a 0.5% sodium hypochlorite solution (freshly prepared) for 10 minutes, followed by drying and wiping with 70% alcohol swabs. All used PPEs should be discarded in double-layered biohazard bags after proper sealing and labelling. Collect used masks (triple layer mask, N95 mask, etc.), head cover/cap, shoe-cover, disposable gown, non-plastic or semi-plastic coverall in Yellow bags. These bins should be hand over twice daily to the authorized staff from sanitation & housekeeping services of the hospital. As far as the liquid waste is concerned, the person looking after ETPs/STPs attached to discharge from the mortuary complex should adopt standard operational practices for safe disposal. It is essential to maintain hygiene and wear personal protective equipment (PPE). PPEs should include Goggles, face mask, liquid repellant coveralls, waterproof gloves, and Rubber boots. During the period of COVID-19 pandemic, the utilization of treated wastewater may be avoided.[1,5,6]

Mortuary staff should wash their hands with soap and water after removing PPEs and biomedical waste disposal. The staff of the mortuary directly involved in the autopsy procedure should sanitize themselves and take a shower with warm water after completion of the autopsy. The terminal disinfection of the autopsy hall and cold storage room is also crucial after the body is released from the mortuary. The staff should follow all the protocol as mentioned earlier for the disinfection. Fogging should be done with hydrogen peroxide based disinfectant while maintaining at least 30 minutes of the contact period. After completion of fogging, keep the room closed for at least 45 minutes for the mist to settle down and wipe all surfaces with a clean cloth.

Fight against COVID-19 pandemic requires an overwhelming response in terms of resources as well as manpower. Hence, it is of paramount importance to protect the health care personnel to continue fight against this herculean task. Lack of adequate resources and manpower can be a hurdle, however, strict implementation of infection prevention and control practices and biomedical waste management guidelines is strongly emphasized to overcome the threat of COVID-19 to healthcare workers.

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ORIGINAL ARTICLE

Estimation of stature from various sternal lengths: An autopsy based study in South Indian population

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Abstract

The stature of deceased along with various sternal measurements was taken to obtain a linear regression equation to estimate the height of an individual in Southern Indian population. The cross-sectional study was conducted on 210 sternums obtained from medico-legal autopsies conducted at JIPMER, Pondicherry, India. A significant and positive correlation was observed between the stature of deceased (STAD) and all measurements of sternal lengths ($P<0.05$ for LM, LB, LMB) for both sexes. The stature with LMB showed highest correlation ($R=0.490$) for males and LB showed the highest correlation ($R=0.472$) in females. This study will be of more helpful to forensic experts and anthropologists when only the trunk of the body was recovered with no available long bones.

Keywords

Stature; Sternal lengths; Linear regression; Autopsy; Identification

Introduction

The forensic anthropologists play a vital role in determining the identity of a person through evaluation bony fragments to establish age, sex and stature known as partial identity.[1,2] Stature is one of the characteristic features of a particular person's physiognomy. Karl Pearson's and Trotter & Glesser formulae for stature estimation used most frequently around the world will be more useful in a certain situation like only individual long bones are available.[3,4]

Telkka A suggested that necessity for deriving linear regression equation from each ethnic or racial group to find out the variation.[5] There is a need to derive the regression equation for estimating the stature from the axial skeleton like sternum in South Indians. There are various studies available to estimate the height of an individual using diverse bone lengths but works of literature concerning the estimation of stature via axial skeleton principally from Southern Indian population are very restricted. The challenge arises when the long bones are lost. This study aims to derive different regression equations to determine the height of an individual using different sternal length.

Materials and Methods

This study is cross-sectional study conducted on medicolegal autopsies at department of Forensic Medicine and Toxicology, Jawaharlal Institute of Postgraduate Medical Education & Research (JIPMER), Pondicherry, India during the period from December 2016 to December 2018, after obtaining permission from the institutional ethical committee. A total of 210 cases (160 males and 50 females) belonging to South India (Tamil Nadu, Pondicherry, Andhra Pradesh, Telangana, Kerala and Karnataka) of age from 21 years to 60 years. The procedure and aim of the study were explained to each case selected for the study and consent has been taken from the legal guardian of the deceased. Those having sternal fracture due to blunt trauma chest and resuscitation measures, congenital deformity of a sternum (pectus excavatum), transected body at level of abdomen following run-over by heavy vehicle, and displaced fracture of lower limbs following road traffic accidents were excluded from the study. Above mentioned exclusion criteria were noted from history, case sheet, inquest report and during an autopsy.

The stature of deceased (STAD) was measured in the supine position from vertex to heel with the steel measuring tape to the nearest 0.1 cm. The thorax was opened by routine standard autopsy technique and sternum was detached as a single piece by cutting sternoclavicular joint and the costochondral junction of first seven pairs of costal cartilages as per standard technique.[6] Then the separated sternum was cleaned by using a scalpel for removing the soft tissue till bony surface was exposed. The length of the sternum was measured on anterior surface midline with vernier caliper keeping it on a flat surface as follows:

The length of manubrium (LM): From the centre of a suprasternal notch to the centre of the manubrio-mesosternal junction in the midline (Figure 1A). The length of mesosternum (LB): manubrio-mesosternal junction to xiphisternal junction in the midline (Figure 1B). Total sternal length (LMB): a

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Figure 1: A: Measuring the length of manubrium, B: Measuring the length of mesosternum

combination of (LM) and (LB). The sternum was finally replaced in the dead body after required measurements were taken and not to be preserved after an autopsy.

The distribution of data on stature and lengths of the sternum were expressed as mean, standard deviation (S.D.) and median with range. The linear regression equation was carried out by using Pearson's correlation analysis to predict the stature via the lengths of the sternum as independent variables. The fitness of the predictive model was assessed by using Pearson's chi-squared test (X2) for the goodness of fit. p-value of < 0.05 was considered as statistically significant. The slope of the regression equations was compared. Statistical analysis was computed by using SPSS Software, v 19.0.

Results

The total number of subjects involved in the study was 210, of which 160 (76.19%) were males and 50 (23.81%) were females. The results of statistical descriptive for all cases sex-wise, STAD, LM, LB, and LMB are given in (Table 1). A significant and positive correlation noted between STAD and all measurements of sternal lengths (p<0.001) for both sexes. LMB had the highest correlation coefficients ('R' value) in males and LB in females. The 'R' value for LM and LMB were higher in males as compared to the 'R' value for LM and LMB in females. Combined analysis of both sexes showed a significant and positive correlation between STAD and LM, LB and LMB (P<0.001). Based upon these findings, there was a significant and highest positive correlation of STAD with LMB following LB, LM (P<0.001) are given in (Table 2).

The Linear regressions equations are derived for the estimation of stature from various sternal lengths are given in (Table 3). The reliability and accuracy for the estimation of stature were mainly based on the standard error of estimate (SEE); lower the SEE more reliable for the linear regression equation. The analysis

Table 1: Statistical descriptive results

Variables	Males N=160		Females N=50		Total samples N=210	
	Range	Mean±S.D	Range	Mean±S.D	Range	Mean±S.D
STAD	148.3-190.2	165.43 ±7.24	140.8-170.5	155.01 ±6.25	140.8-190.2	162.953±8.29
LM	3.730-6.234	4.773±0.496	3.454-4.948	4.287±0.315	3.454-6.234	4.657 ±0.504
LB	7.390-12.424	9.420±0.914	6.978-10.476	8.429±0.683	6.978-12.424	9.184 ±0.961
LMB	11.646-17.302	14.196±1.146	10.802-15.734	12.783±0.969	10.802-17.302	13.860±1.258

Table 2: Correlation of sternal lengths with STAD

Variables	Males		Females		Total samples	
	R value	p value	R value	p value	R value	p value
LM	0.417	<0.001	0.362	<.0001	0.534	<0.001
LB	0.388	<0.001	0.472	<0.001	0.540	<0.001
LMB	0.490	<0.001	0.425	<0.002	0.611	<0.001

Table 3: Linear regression equations for estimation of stature from sternal measurements

Sample and variable	Linear Regression Equation	SEE	R^2
Male X_1 : LM	S =136.387 + 6.085 (X_1)	6.6064	0.174
X_2 :LB	S = 136.453 + 3.076 (X_2)	6.6987	0.151
X_3 : LMB	S = 121.452 + 3.098 (X_3)	6.3350	0.240
Female X_4 : LM	S = 124.288 + 7.167(X_4)	5.8890	0.131
X_5 :LB	S = 118.644+ 4.315(X_5)	5.5706	0.222
X_6 : LMB	S = 119.99 + 2.740(X_6)	5.7195	0.180
Total samples X_7: LM	S = 122.026+8.787 (X_7)	7.0360	0.285
X_7 : LB	S = 120.123+4.663(X_8)	7.0013	0.292
X_8 : LMB	S = 107.097+4.030(X_9)	6.5846	0.374

Table 4: Multiple linear regression equations for estimation of stature from sternal measurements in females and total samples

Sample and variable	Multiple Linear Regression model	SEE	R^2
Females: LB	S=108.32+4.392 LB	5.567	0.256
Total samples: LM and LB	S=103.8 + 8.705 LM + 5.708 LB	6.404	0.413

showed that the equations derived from LMB had more accuracy and reliability in males and LB in females. The equation derived from LM and LMB has more accuracy and reliability in males as compared to the same equation derived in females. The study observed that the linear regression equation derived from the LMB can be a better tool for estimation of stature with high accuracy and reliability in total samples. The study recommended that the linear regression equation derived from LMB for estimation of stature is helpful in forensic casework when compared to LM and LB when sex is not identifiable.

All the variables were not statistically significant and the multiple linear regression equation can't be derived in males. For females, LB was statistically significant and multiple linear regression equations were derived from LB. Multiple regression for total samples, LM and LB showed statistical significance (Table 4).

Table 5: The comparison of correlation coefficient (R) of stature and sternum with present study to other similar studies (sex wise distribution) and total samples

Population	Authors	Sternal Lengths	Correlation coefficient (R)	
			Male	Female
South Indian	Menezes et al.[7,8]	Sternal Length	0.638	0.639
North West Indian	Singh et al.[9]	LM	0.191	0.237
		LB	0.255	0.229
		LMB	0.318	0.318
Turkey	Yonguc et al.[10]	LM	0.656	0.670
		LB	0.746	0.372
		LMB	0.850	0.740
Tamil Nadu	Manoharan et al.[13]	LM	0.38	
		LB	0.7	
		LMB	0.78	
Indian	Tumram et al.[11]	LM	0.44	
		LB	0.25	
		Sternal Length	0.55	
Delhi	Baraw et al.[15]	Sternal Length (Fresh)	0.809	0.755
		Sternal Length (Dry)	0.621	0.606
South Indian	Ranjith et al.[16]	Sternal length	0.941	
Jodhpur	Saraf et al.[12]	LM	0.367	0.680
		LB	0.853	0.747
		LMB	0.894	0.859
Present study		LM	0.417	0.362
		LB	0.388	0.472
		LMB	0.490	0.425

Discussion

In our study, all the measurement of sternal lengths was significant and positively correlated with stature similar to other earlier studies. [7-16] However, the extent of correlation coefficient ('R' value) between the STAD and various measurement of LM, LB, and LMB were varies in different studies. The mean STAD and various sternal lengths in males were higher than females, which were similar to past studies done by Menezes et al.[7,8], Maniho et al.[17], Singh et al.[9], and Tumram et al.[11] The main scientific reason behind these findings is due to the growth pattern observed between male and female, which is more in males which was consistent with study conducted by Lee.[18]

The present study was compared with other studies are given in table 6. The 'R' value for LM, LB, LMB of our study is higher as compared to Singh et al.[9] Our study showed the lower correlation coefficient between the stature and various measurements of the sternum as compared to other studies.[7,8,10-16]

In the present study, the 'R' value for LMB was higher in males and 'R' value for LB was higher in females. In other previous studies[9-12], 'R' value for LMB was more in both sexes. Based upon all findings it is suggested that estimation of stature from LMB in males and LB in females showed reliability and accuracy to the stature which was contradictory findings when compared to other similar studies. In the present study, the LMB in the total sample has the highest correlation with stature followed by LM, LB in total sample similar to other studies are given in (Table 5).

The linear regression equations were derived for estimating the stature from LM, LB, and LMB for males, females and total samples. The predictive models derived from LM, LB, and LMB for males, females and total samples show low standard error. The reliability and accuracy of predicting the stature were high in males, females and total samples. This study is also useful when sex is not known.

Conclusion

The forensic anthropologists have an important role in identifying the person; where only skeletonized remains are available. This study will be more helpful when long bones are not available, peripheral parts of body especially the upper and lower limbs were missing. The trunk of the body was recovered for the forensic investigation regarding the identification of the deceased when sex is not identifiable. Based upon all findings the present study revealed that axial skeleton like sternum will use as a better tool for estimating the stature in South Indian Population apart from long bones.

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ORIGINAL ARTICLE

Estimation of stature from Bi-mastoid breadth

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Abstract
Stature is defined as "natural height of a person in standing position". Bi-mastoid breadth is referred as distance between outermost prominent point on lateral surfaces of two mastoid process of temporal bone. The present study was conducted to estimate stature from bi-mastoid breadth. The cross sectional study was conducted involving 200 medical undergraduate students who are born and bought up in different parts of India and were the age group of 18 to 24years for a period of 2 months from April 2018 to May 2018. The height of an individual was measured using stadiometer and bi-mastoid breadth by spreading caliper. The present study showed moderate significant positive correlation between stature and bi-mastoid breadth for males with correlation coefficient (r) 0.528 and low significant positive correlation for females with correlation coefficient (r) 0.269 which are statistically significant at 0.01 levels. It is concluded that forensic expert can estimate stature from bi-mastoid breadth in males in situation where only skull/ head is available.

Keywords
Forensic Anthropology; Stature; Bi-mastoid breadth; Correlation

Introduction

Forensic anthropology is branch of science that involves application of skeletal analysis and techniques in archaeology using data obtained from body parts and skeletons from the living or dead people for forensic purposes. Estimation of stature is one of the important criteria in identifying an individual.[1]

Stature is defined as "natural height of a person in standing position". It varies at different times of the day by one and half to centimeters. It is less in evening and afternoon due to reduced elasticity of the inter-vertebral disc and longitudinal vertebral muscle.[2] It causes difficulty in identification, when incomplete skeletal remains or highly decomposed bodies are presented for medico-legal examination especially when skull is only available.[3-4] In similar conditions where primary identification methods cannot be used, practical and cost-efficient anthropometric methods with high accuracy rate are applied.[5]

Many studies have revealed the relationship between stature and some parts of the skeleton and the body parts in consideration.[1-12] For skull, there is no approved regression equation formulated to calculate stature from bi-mastoid breadth. Bi-mastoid breadth referred as distance between outermost prominent point on lateral surfaces of two mastoid process of temporal bone. Mastoid process of temporal bone is suitable of determination of age and sex as it is rather resistant to traumas with its compact structure and anatomical location.[5] Considering this fact, the present study was conducted to estimate stature from bi-mastoid breadth.

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Material and Methods

A cross sectional study was conducted for a period of 2 months from April 2018 to May 2018 in Department of Forensic Medicine and Toxicology, on 100 male and 100 female medical undergraduate students who are born and bought up in different parts of India and of the age group of 18 to 24 years. Medical student with history of accident, head injury, congenital deformity, hormonal imbalance, kyphosis, scoliosis were excluded from this study. Sample size was calculated by assuming correlation between stature and bi-mastoid breadth, r = 0.4, the minimum number of subjects to be included (n) calculated as 84 with 95% confidence and 95% power, thus, 100 males and 100 females were assessed in present study. After obtaining informed consent from students, the height of an individual was measured with help of stadiometer as a distance between vertex and standing platform.[9] Student was standing in anatomical position, with palm facing medially and head in Frankfurt plane. All measurements were taken between 9am to 11am by single observer to eliminate diurnal as well as inter-observer variations. All measurements were taken in centimeters up to two decimal points. The bi-mastoid breadth was measured with the help of spreading caliper from behind in an anatomical standing position, head being in Frankfurt plane.[9]

Data was collected in pre-structured proforma, and analyzed using descriptive statistics: correlation coefficient was calculated. Regression equation was formulated to estimate the stature by using software Statistical Package for the Social Science (SPSS) 20.

Results

The study consists of 200 healthy subjects consisting of 100 males and 100 females. The most common age was 20 years (males 39% and females 42%) followed by 21 years (males 31% and females 25%) as shown in Table 1. The mean age of males was found to be 20.20±1.054 years, ranging between 18 years and 24 years (Table 2). The mean bi-mastoid breadth of males was found to be 12.25 ± 0.87, ranging between 10.50 cm and 14 cm. The mean stature of males was found to be 174.40 ± 4.67 cm, ranging between 163.5 cm and 187.5 cm as shown in Table 2.

Table 1: Age-wise distribution of males and females

Age (years)	Male		Female	
	Frequency	Percent	Frequency	Percent
18.00	5	5	5	5
19.00	18	18	22	22
20.00	39	39	42	42
21.00	31	31	25	25
22.00	5	5	4	4
23.00	1	1	2	2
24.00	1	1	0	0
Total	100	100	100	100

Table 2: Descriptive statistics for age, bi-mastoid breadth and stature of males and females

Parameter	Male		Female	
	Range	Mean±SD	Range	Mean±SD
Age(years)	18.00–24.00	20.20±1.05	18.00–23.00	20.07±1.01
Bi-mastoid breadth (cm)	10.50–14.00	12.25± 0.87	8.50–13.00	11.72± 0.83
Stature (cm)	163.50–187.50	17440 ± 4.67	145.00–176.00	159.14± 6.49

SD: Standard Deviation

Table 3: Regression equations for estimation of stature from bi-mastoid breadth

	Correlation Coefficient (r)	p value (2-tailed)	Regression Equation	SEE
Male	0.528	0.000	Stature = 139.61+2.84 x Bi-mastoid breadth	3.985
Female	0.269	0.007	Stature = 134.60+2.09 x Bi-mastoid breadth	6.280

SEE: Standard Estimate of Error; Correlation is significant at the 0.01 level.

The mean age of females was found to be 20.07 ± 1.01 years, ranging between 18 years and 23 years (Table 2). The mean bi-mastoid breadth of females was found to be 11.72 ± 0.83, ranging between 8.50 cm and 13 cm. The mean stature of females was found to be 159.14 ± 6.49 cm, ranging between 145 cm and 176 cm as shown in Table 2.

The present study showed moderate significant positive correlation between stature and bi-mastoid breadth for males with correlation coefficient (r) 0.528 which is statistically significant at 0.01 level (p value 0.000) as shown in Table 4. Scatter diagrams showing correlation between stature and bi-mastoid breadth in males and females are seen in Figures 1 and 2 respectively. Regression equation for males is calculated as follows – Stature (in cm) = 139.614 + 2.840 x Bi-mastoid breadth (in cm).

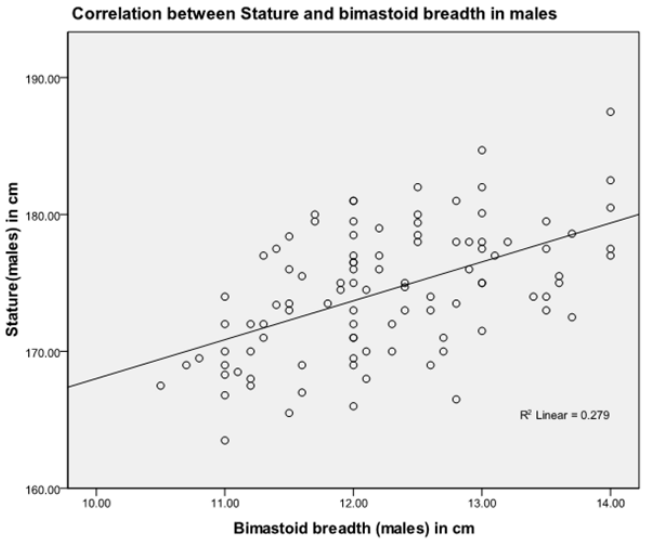

Figure 1: Scatter diagram showing correlation between stature and bi-mastoid breadth in males

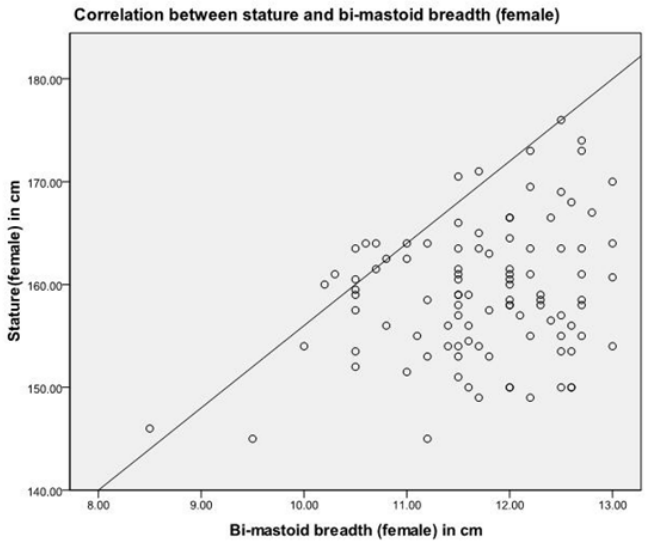

Figure 2: Scatter diagram showing correlation between stature and bi-mastoid breadth in females.

The present study showed low significant positive correlation between stature and bi-mastoid breadth for females with correlation coefficient (r) 0.269 which is statistically significant at 0.01 level (p value 0.007) as shown in Table 3. The regression equation for females is calculated as follow – Stature (in cm) = 134.598 + 2.094 x Bi-mastoid breadth (in cm).

Discussion

Identification of the deceased is one of the main aims in any medico-legal investigation. It becomes extremely difficult when incomplete skeletal remains or highly decomposed bodies are brought for examination. In such situations, the main aim of the investigation is to determine the stature, age, sex, and race. Estimation of stature from fragmented body remains is of great importance in forensic investigation especially when head/skull is only available. For such estimation, the regression analysis is considered as the most reliable and best method.[12]

In the present study it was observed that bi-mastoid breadth is more for males than females. Similar observation was found in a studies conducted by Buran et al.[5] with mean bimastoid breadth 108.5 ± 4.3 mm in males and 100.8 ± 4.1 mm in females and by Saini et al.[13] with mean bimastoid breadth 98.85 ± 4.56 mm in males and 93.76 ± 4.88 mm in females because mastoid process dimension is larger as the male cranium is bigger than the females and owing to activity of spleniuscapitis, longissimus capitis and sternocleidomastoid muscles is stronger.

It was found in the present study that mean stature for males is more compared to females because males are taller than females. This could be due to association of Y chromosome with stature and the age of puberty being two years later in males, giving extra time for growth.[14, 15] Similar observations were in found studies conducted by Wankhede et al.[8] and Agnihotri et al.[12]

It is evident from the present study that bi-mastoid breadth is better for estimation of stature of a person in males [correlation coefficient (r) 0.528] than females [correlation coefficient (r) 0.269] if the fragmentary remains of skull are brought for medico legal examination. It may be due to the fact that the growth of skull (bimastoid breadth) is mainly genetically determined through local epigenetic factors such as growth of brain.[12]

As there are no studies available related to regression analysis for estimation of stature from bi-mastoid breadth for comparison, an attempt is made to compare with nearest alternate skull dimensions i.e head breadth and bi-zygomatic breadth. A study conducted by Wankhede et al. showed significant relation between stature and head breadth of both sexes with correlation coefficient (r) 0.57 for males and 0.262 for females.[8] In contrast to this, the study conducted by Marko et al. showed weak correlation between stature and head breadth with correlation coefficient (r) 0.183 for males and 0.338 for females.[9] The study conducted by Agnihotri et al. showed weak correlation between stature and bi-zygomatic breadth with correlation coefficient (r) 0.177 for males and 0.276 for females.[12]

The estimation of stature from long bones is based upon the principle that the long bones correlate positively with the stature.[16] But in forensic examination especially when head/skull is only available, bimastoid breadth is good predictor for estimating stature. As mentioned in Table 4, correlation coefficient for males is 0.528. As the correlation coefficient (r) is considered to be significant only above 0.5, bimastoid breadth is good predictor for estimating stature in males. However it is not good predictor for estimating stature in females as correlation coefficient for females is 0.269 which is less than 0.5.

The regression equations and correlation coefficients vary from one geographical location to another as stature is dependent on multiple factors such as race, nutritional, regional and geographical factors.[8] Regression equations of one population cannot be applied to another population for stature estimation as they are population specific.[8]

Conclusion

The current study showed that forensic expert can estimate stature from bi-mastoid breadth in situation where only head/skull is available as moderate significant positive correlation between stature and bi-mastoid breadth for males was found in this study. However accurate stature estimation is not possible from bi-mastoid breadth in females because of low significant positive correlation.

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ORIGINAL ARTICLE

Estimation of stature in children and young adults using odontometric approach

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Abstract

There has been a marked increase in the number of crimes against children and young adults in the last decade, hence calling for an increase in the methods of identification of remains using forensic odontology. Dental morphometrics is a subject of great significance in forensic odontology in the identification of an individual. The use of teeth to represent a physical profile is valuable for the identification of and individual. The aim of the study was to check the reliability and accuracy of Carrea's index in deciduous and permanent dentition. The study was conducted on 51 participants in the age group 2-6 years and 51 participants in the age group of 12-20. The arch and chord values were measured intraorally using digital vernier calipers and the stature was measured using a standardized measuring tape. All this data was used to validate Carrea's formula and the results were analyzed statistically. We observed a positive correlation between measured stature and calculated stature using Carrea's index in young permanent dentition group and it was found to be statistically significant. (p-value 0.042). In females, it was more accurate as compared to males. Our results also showed that stature estimated using measurements from the dentition of the left side was more accurate as compared to the right side.

Keywords

Carrea's index; Forensic odontology; Stature; Odontometric approach

Introduction

Knowing the unknown has always driven human minds to unparallel knowledge in various fields. Anthropometry is the branch of physical anthropology that studies the quantitative variations of human features, such as stature.[1] In a forensic context, among the information potentially collected from human remains, estimated stature can be an important feature to be added to the criteria, helping to narrow the search from missing person's data. Stature is the height of a person in the upright posture. [2] it is said that Nature has an eye for proportion and it has been theorized that the stature of a person has a definite and proportional biologic relationship with human part like head, trunk, and extremities .[3] This relationship is of great use in forensics and criminal investigation as it helps the forensic experts to calculate stature from mutilated and dismembered body parts thereby aiding investigation and providing vital clues.

The dental arch has many variables which makes it almost impossible for two people to have identical tooth features. Teeth are special in cases of identification of deceased since they can resist the effect of time, are resistant to fire and trauma and can also provide information on species, race, gender, age, height, and individual characteristics. Teeth have also added advantage of standard anatomical landmarks which are easy to locate.[4] Thus enabling the reliable determination of stature of the person in life particularly when other predictors are destroyed or fragmented.[5] Literature review showed sparse work in stature estimation through odontometric measurements.[6] The seeds for stature estimation through tooth dimensions were sown by an Argentinean professor, Juan Ubaldo Carrea in 1920.[7] Carrea has proposed an index to estimate the stature of an individual based on the measurements made from mandibular anterior teeth.[8] The studies in Brazil and other countries have shown good validity of this index.[9]

Although the Carrea's index was published in 1920, it has not been validated in other population apart from the Brazilians and hence demands further investigation. Looking at the paucity of studies about the estimation of stature from odontometry in India and usefulness of these studies in forensic and legal medicine, the present study was designed to elucidate the anthropometric correlation of tooth dimensions with stature in children and young adults; for the first time, Carrea's index was used in deciduous dentition for estimation of stature.

Aims and Objectives

1. To check the reliability of Carrea's Index in children and young adults using the odontometric approach.
2. To compare the precision of the indices in the right and left sides of the arch.

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Materials and Methods

After approval from the institutional ethical committee, the total sample of 102 participants was divided into two groups as deciduous teeth (children below 6 years) and young permanent teeth (children aged 10 years to 20 years). Following the inclusion and exclusion criteria as mentioned below. Consent was obtained from the patient and their parents/ guardians after describing the procedure. The inclusion criteria for the participants selected in Group A (Deciduous Dentition) were the healthy state of teeth, gingiva and the periodontium; presence of fully erupted 71,72,73, 81, 82 and 83; the presence of a normal overjet and overbite along with a normal canine and molar relationship. The exclusion criteria for the participants selected in Group A (Deciduous Dentition) were mobile deciduous teeth; any missing deciduous teeth; any developmental anomaly or gingival deformity; loss of tooth structure due to fracture, attrition, caries or restoration. The inclusion criteria for the participants selected in Group B (Permanent Dentition) were the healthy state of teeth, gingival and the periodontium; presence of fully erupted 31, 32,33, 41, 42 and 43; a normal overjet and overbite with Class I molar and canine relationship. The exclusion criteria for participants selected in Group B (Permanent Dentition) were: partially erupted 31, 32, 33, 41, 42 or 43; any missing permanent tooth; a history of orthodontic treatment or orthognathic surgical procedure; any developmental anomaly or gingival deformity; loss of tooth structure as a result of caries, trauma or restoration.

Study Method

1. The purpose of the study was explained, subjects were instructed and written consent was taken.
2. Height was measured using a standard measuring tape, by making the subject stand erect on a horizontal plane, barefooted, aligning the posterior surface of heels, pelvic girdle, scapular girdle, and occipital region to the vertical plane.[5]
3. Arch and cord length were measured intraorally using a digital vernier caliper (Figure 1).
4. The measurements were correlated using the formula for Carrea's index.
5. Formulae:
    - ARCH = Mesiodistal width of central incisor + lateral incisor + canine measured on the labial surface
    - CHORD = Linear distance between ends of the arch, represented by the mesial edge of central incisor and the distal edge of canine on the same side measured on the lingual surface
    - MAXIMUM STATURE = Arch (in mm) x 6 x 3.1416 x 100 / 2
    - MINIMUM STATURE = Chord (in mm) x 6 x 3.1416 x 100 / 2

The data obtained is subjected to statistical analysis using SPSS 20 software.

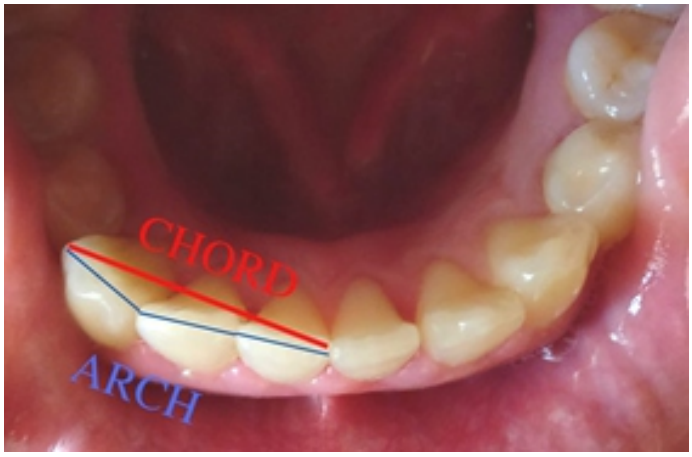

Figure 1: Pictorial representation of ARCH and CHORD

Results

A total of 102 participants were selected for this study which was divided into two groups. Group A consisted of 51 participants which contained 27 male and 24 female participants. Group B consisted of 51 participants which included 34 males and 17 females. Descriptive statistics of height, arch and chord values of the left and right side of both groups are represented in Table 1,2,3 and 4 respectively. In Group A it was found that in 25 participants (49.01%) measured stature correlated with the calculated stature. Out of these 25, 11(40.7%) were male and 14(58.33%) were female. The descriptive analysis, as well as the Pearson coefficient, were found to be statistically insignificant for Group A participants.

In Group B it was found that in 26 participants (50.09%) measured stature correlated with the calculated stature. Out of these 26, 12 (36.36%) were male and 14 (82.35%) were female. The descriptive analysis, as well as the Pearson coefficient, were found to be statistically significant for Group B participants.

Overall, it was seen that the measured stature and calculated stature was found more in females and males. And, when data collected from the right side and left side was analyzed, it was found that measurements collected from the left side (76.47%) was more reliable that right side (66.66%).

The Pearson chi-square test describing the overall distribution according to the side are described in Table 5 and 6.

Table 1: Descriptive statistics of the actual height, arch and chord values in Group A on the right side

	Gender	N	Mean	Std. Deviation	Std. Error Mean	p-value
Height in mm	Male	27	10126.2963	1015.02235	195.34114	0.679
	Female	24	10238.7500	901.31456	183.98006	
ARCH	Male	27	13.2463	.76399	.14703	0.210
	Female	24	12.9354	.97903	.19984	
CHORD	Male	27	11.1819	1.44233	.27758	0.747
	Female	24	11.0596	1.21943	.24892	

Table 2: Descriptive statistics of the actual height, arch and chord values in Group A on the left side

	Gender	N	Mean	Std. Deviation	Std. Error Mean	p-value
Height in mm	Male	27	10126.2963	1015.02235	195.34114	0.679
	Female	24	10238.7500	901.31456	183.98006	
ARCH	Male	27	13.1789	.71029	.13670	0.324
	Female	24	12.9825	.69458	.14178	
CHORD	Male	27	11.4030	1.16280	.22378	0.059
	Female	24	10.7608	1.20811	.24660	

Table 3: Descriptive statistics of the actual height, arch and chord values in Group B on the right side

	Gender	N	Mean	Std. Deviation	Std. Error Mean	
Height in mm	Male	34	16237.65	1243.346	213.232	0.012*
	Female	17	15357.06	894.048	216.839	
ARCH	Male	34	16.9626	1.09484	.18776	0.117
	Female	17	16.4365	1.14414	.27749	
CHORD	Male	34	15.5603	1.27270	.21827	0.045*
	Female	17	14.8041	1.16466	.28247	

Table 4: Descriptive statistics of the actual height, arch and chord values in Group B on the left side

	Gender	N	Mean	Std. Deviation	Std. Error Mean	
Height in mm	Male	34	16237.65	1243.346	213.232	0.012*
	Female	17	15357.06	894.048	216.839	
ARCH	Male	34	16.9621	1.08202	.18556	0.046*
	Female	17	16.3035	1.08964	.26428	
CHORD	Male	34	15.5979	1.37791	.23631	0.009*
	Female	17	14.4941	1.35247	.32802	

Table 5: Pearson chi Square depicting the overall distribution of hits and misses according to side (n=102) in Group A population

		Side		Total	p-value
		Right	Left		
Classification	Hits	20	19	39	0.839
	Misses	31	32	63	
Total		51	51	102	

Table 6: Pearson chi Square depicting the overall distribution of hits and misses according to side (n=102) in Group B population

		Side		Total	p-value
		Right	Left		
Classification	Yes	18	19	37	0.042*
	No	33	32	65	
Total		51	51	102	

Discussion

It has been universally accepted that there exists a proportional relationship between bones and body parts. Stature is an inherent characteristic determined genetically which can be modified by environmental factors. Similarly, teeth and bones are also genetically predetermined and their measurements are unique for each race and geographical region.[3] The most ancient study correlating this fact was first described by Carrea in 1920.[10] Unfortunately, there is no written description of the origin of this formula since Carrea's studies of 1920 and 1939 were done at a time when papers often lacked important information and methodological patterns were not observed by authors.[11] However, it is said he studied several human skulls to devise his formula. It has shown significant rates of success in both sexes with no statistical difference between them.

The likelihood of an embryological relationship between the tooth formations and long bones almost explains this phenomenon. Both, dentin that forms the bulk; depicts the tooth dimensions and long bones which determines the height or stature of an individual are derived from mesenchymal tissue (Dentin-Ectomesenchyme; Long bones-Mesoderm) and have similarities in structural composition.[12] Henceforth, it is presumable to accept the mere relationship between teeth and stature.[7]

In forensic odontology, age and gender are the important parameters of a deceased individual.[13] Sometimes height also plays an important role in personal identification described as the BIG FOUR of forensic anthropology, required for the identification.[14] Stature estimation is most commonly done with the help of long bones.[15] However, in case of decomposed or mutilated bodies. It becomes difficult to do so.[13] Some structures in the orofacial region are resistant to decomposition

and hence can be used for stature estimation; teeth are nondestructive, it is a simple process and can be applied to both living and deceased persons; other methods are relatively time-consuming, expensive, less reliable, and destructive, which may not be acceptable for ethical, religious, cultural or scientific reasons;[16] however, these odontometric characters are specific to population, and hence, a distinct formula must be developed for the specific population.[13]

Mesiodistal width of primary teeth is lesser as compared to the mesiodistal width of permanent teeth, indicating that the height of individual increases with age, and so does the jaw size and the mesiodistal width. However, if there is a definite proportionality and if there can be a regression formula derived to predict height, specific to the population is yet to be explored.[13] If there exists a definite proportionality, it can be harnessed to effectively predict the stature of an individual as he/she transits from child to adult. Considering that the complete mesiodistal width of the anterior teeth is achieved by the age of 13 years (+/-2) and complete growth of jaw occurs with the eruption of the second molar, but complete growth in terms of height takes place by 18-21 years of age.[17]

In Carrea's index, successful prediction of stature depends on the alignment of the mandibular anterior teeth as shown by Lima et al.[10] The Carrea's index was more successful in estimating the stature of subjects with crowded dentition followed by normally aligned and least successful in subjects with diastema. A closer look at the formula reveals that the maximum and minimum estimated stature is directly related to the arch and chord dimensions respectively. Presence of crowding in mandibular anterior dentition would reduce the chord dimensions without affecting the arch dimension, thus increasing the range between the maximum and minimum stature, hence, the probability that the actual stature lies within this wider range of maximum and minimum estimated stature also increases, thereby increasing the success rate of Carrea's index.[6]

Our study concluded that Carrea's index was not applicable in the deciduous dentition in its current form. Upon its application, in permanent dentition, the values were found to be of statistical significance. The study showed that the right hemiarch was more accurate in stature determination as compared to the left side. On the comparison between the sexes, stature estimation was accurate more in females as compared to males.

Lima et al. had proved that any side of the arch can be used for stature estimation as there was no statistically significant difference between them.[10] According to the "Principal of Bilateral Symmetry" given by Carrea, Any hemiarch can be used for stature estimation by accepting small variations as physiological asymmetries.[8]

Applicability of Carrea's index in the estimation of stature was attempted rarely in deciduous teeth. In the present study, we used Carrea's index for deciduous teeth. The previous study by Ramanna et al had shown the correlation of clinical crown length and estimated the height.[18] Very few studies in deciduous dentition are there in this regard. Our results showed no statistical significance in the ARCH and CHORD values and stature of the participants of the deciduous dentition group (Group A).

Similar studies have been one by Cavalcanti et al.,[9] which concluded that the stature determination was more accurate in males (100%) as compared to females (93.3%). The results of our study support this study.

In a study done by Rekhi et al. [3] there was a higher consistency between the stature estimation and the left hemi arch measurements and when considering the sexes, a higher consistency was observed for males as compared to females, though statistically not significant.

Difficulty can be encountered when going forward with Carrea's index. No substantial explanations were found about the mathematical calculation proposed by Carrea. Little is known about the measurements of the teeth and how they are related to stature itself. Moreover, no reliable data were discovered on the real value of the results obtained by the author's method.

Further studies are required among subjects belonging to extreme age groups as both dentition and stature changes these ages. Children tend to grow till the completion of their growth spurt and hence we need to know the cut off age above which Carrea's index can predict the height of subjects in a meaningful manner. In the geriatric population, the stature gets reduced due to varied reasons and also there is a loss of tooth material due to attrition (both proximal and occlusal) which might influence the arch and chord dimensions.[6]

Conclusion

Our study concluded that Carrea's index cannot be used in its present form in deciduous dentition whereas in young permanent dentition it can be used and was also found to be statistically significant. In cases of mass disasters or crimes which involve mutilation, dental specimens can bear the brunt of destruction and hence can be used in the estimation of stature to aid in the identification of the victim.

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ORIGINAL ARTICLE

Sex Determination Based on Morphological and Morpho-metric Study of Clavicular Rhomboid Fossa in Saurashtra Region, Gujarat

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Abstract
The correct determination of the sex of a person are critical requirement in physical anthropology and one of the essential steps in personal identification of an individual from the skeletal remains. The present study was conducted prospectively on 200 pairs of the clavicles which were obtained from the dead bodies brought for post mortem examination during the period of January 2014 to December 2014 in Forensic Medicine department, M. P. Shah Govt. Medical College, Jamnagar, Gujarat. The results indicate that Incidence of rhomboid fossa on right side of clavicle in males and females was statistically not significant ($p>0.05$). While the greater difference in fossa expression was noticed between male and female clavicles of left side, which had statistical significance ($p<0.01$). Elevated rhomboid fossa is more frequent in both the sexes, followed by flat nature and then depressed nature. The mean length of rhomboid fossa of right side clavicle was 20.56mm±5.99 in male and 15.28mm±4.89 in female, while on left side, the length was 19.24mm±5.57 and 15.97mm±5.88 respectively for males and females. The mean breadth of rhomboid fossa of right side clavicle was 10.71mm±3.51 in male and 8.35mm±2.73 in female, while on left side breadth was 9.58mm±2.83 and 8.13mm±2.89 respectively for male and female. It has been concluded that the length and breadth of rhomboid fossa of clavicle as a single parameter can't establish the sex of each clavicle in study population.

Keywords
Sex determination; Rhomboid fossa; Index of Rhomboid fossa (IRF)

Introduction

Any observation and measurement of skeleton which aid in establishing the sex, stature, age and race of an individual are not only of interest in Anthropology, Archeology and Anatomy but also of great value in Forensic Medicine, as Forensic Anthropology involves the building of an identification profile of a person from skeletal remains. When whole skeleton is available, there should be no difficulty in arriving at an accurate estimation of sex. But the nature and completeness of the skeleton varies widely from well preserved full skeleton to a scanty material with few bones only.

The determination of the sex is statistically the most important criterion, as it immediately excludes approximately half of the population, whereas the age, stature and race each provides the points within a wide range of variables. During examination of skeleton remain, chances to find broken or fractured bones are there, so it is important that how we can get as much as information regarding identification in that case. The clavicle is considered to be one of an important bone while dealing with sex difference in skeletal material.[1] There is paucity of material data available on clavicle, as the available literature clearly shows that the morphology of clavicles in this geographical region has not been widely studied. So this study was design to study role of Rhomboid fossa as a sex indicator when part or whole clavicle is available for examination.

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Materials and Methods

The present study was conducted prospectively on 200 pairs of the clavicles which were obtained from the dead body brought for post-mortem examination during the period of January 2014 to December 2014 in Forensic Medicine department, M. P. Shah Govt. Medical College, Jamnagar, Gujarat. This work was first approved by institutional ethical committee, M. P. Shah Govt. Medical College, Jamnagar.

Cases with skeleton anomaly especially of spine and long bones, cases of any hormonal or chromosomal anomalies where skeleton growth was abnormally affected, cases in which clavicles secondary ossification center was not fused with shaft, cases in which clavicle showed any pathological abnormality, fracture, or deformities are excluded from study. Cases of both sex in which clavicles showed complete ossification (post-fusion age group) are included in study data.

The subjects were selected by applying above inclusion and

exclusion criteria. Details regarding age, sex and religion were obtained from police papers. Prior written informed consent was taken from near relative of deceased person before starting dissection of body.

Clavicles were dissected out from the body by using scalpel with blade and forceps. After that soft tissue attached to clavicles were removed by putting the clavicles into hot solution of sodium bicarbonate for 5 to 10 minutes. The wet bones were then wiped with a piece of gauze and air dried. After measuring all below parameters bones were replaced into the body before handed over to concern police after post mortem examination.

Status and Nature of rhomboid fossa: (Figure 1)

The clavicle was examined at inferior surface at sternal end for the presence or absence of rhomboid fossa. If the rhomboid fossa was present then status of rhomboid fossa was noted as follow: the fossa was flat, the fossa was raised above the surface (elevated), the fossa was depressed below the surface (depressed).

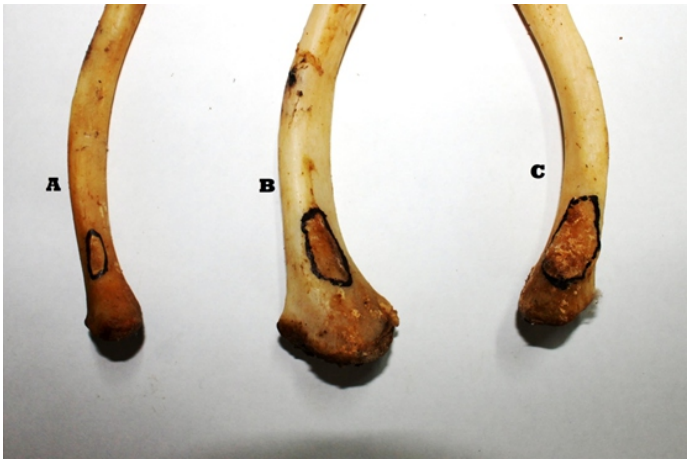

Figure 1: Type of rhomboid fossa; A- Flat, B-Depressed, C- Elevated

Length of the rhomboid fossa: (Figure 2)

The length of the rhomboid fossa was measured from medial to lateral ends of rhomboid fossa with help of external jaws of Vernier caliper in millimeters.

Breadth of the rhomboid fossa: (Figure 3)

The breadth of rhomboid fossa was measured as maximum distance between anterior and posterior end of rhomboid fossa with the help of external jaws of Vernier caliper in millimeters.

Index of Rhomboid fossa (IRF):

Index of the Rhomboid fossa was calculated by below mentioned formula: IRF=Breadth of rhomboid fossa × 100/length of rhomboid fossa

After all measurements and observations, master chart was prepared and data were statistically analyzed with the help of SPSS V.20. The demarking points were calculated using the formula mean ± 3SD. The findings thus generated were tabulated and compared with previous studies by different authors.

Figure 2: Measurement of length of rhomboid fossa

Figure 3: Measurement of breath of rhomboid fossa

Results

Out of the total 200 cases, numbers of male were 137 cases (68.5%) and that of female were 63 cases (31.5%). The maximum number of cases in the age group of 21-30 years, 70 cases (35%). The age group of 31-40 years followed it with 48 cases (24%). Hindu was predominately in both sex. The numbers of Hindu male and female were 126 cases (63%) and 53 cases (26.5%) respectively. Total numbers of Hindu were 179 cases (89.5%). Total numbers of Muslim were 19 cases (9.5%). The least affected religion was Sikhs and Christian, with 1 case of each (0.5%).

As mentioned in Table 1, Incidence of rhomboid fossa was

analysed in both males and females with considering side related differences. This difference in male and female was statistically not significant (p>0.05). On left side, the greater difference in fossa expression was noticed between male and female clavicles of left side, which had statistical significance (p<0.01). In the present study, (Table 1) the nature of rhomboid fossa was classified in to three type based on its appearance, viz., flat, depressed and elevated.

Table 1: Distribution of cases according to nature of rhomboid fossa of male and female clavicles

Status and nature of Rhomboid fossa		Right (n=200)		Left (n=200)	
		Male (n=137)	Female (n=63)	Male (n=137)	Female (n=63)
RF absent		12 (8.76%)	6 (9.52%)	6 (4.38%)	14 (22.22%)
RF present	Depressed	11 (8.03%)	6 (9.52%)	11 (8.03%)	6 (9.52%)
	Flat	19 (13.87%)	15 (23.81%)	22 (16.06%)	13 (20.63%)
	Elevated	95 (69.34%)	36 (57.14%)	98 (71.53%)	30 (47.62%)

Table 2: Discriminant analysis of length (mm) of rhomboid fossa of clavicles of male and female

Sr. No.	Details of parameters	Right		Left	
		Male	Female	Male	Female
1	No of Clavicles	137	63	137	63
2	Range	9.84 – 34.24	8.56 – 28.21	9.34 – 33.24	9.22 – 29.32
3	Mean	20.56	15.28	19.24	15.97
4	Median	20.42	13.45	19.26	13.4
5	Mode	20.72*	11.32*	14.32*	9.82
6	SD	5.99	4.89	5.57	5.88
7	p value	p < 0.001		p < 0.05	
8	Probability of predication	69.54%	34.43%	69.19%	32.47%
9	Identification point	> 28.21	< 9.84	> 29.32	< 9.34
10	% of identified bone	12.41%	4.76%	4.38%	3.17%
11	Calculated range (Mean ± 3SD)	2.59 – 38.53	0.61 – 29.95	2.53 – 35.95	-1.67 – 33.61
12	Demarking point (DP)	> 29.95	< 2.59	> 33.61	< 2.53
13	% of clavicles beyond DP	6.56%	0	0	0

Length (mm) of rhomboid fossa of clavicles (Table 2)

The mean length of the rhomboid fossa of right clavicle in male was 5.28mm more that of female. These differences were statistically highly significant in sex differentiation (p<0.001). The probability of prediction of sex of clavicle by length of rhomboid fossa alone was 69.54% in male and 34.43% in female right clavicles. The right clavicles with length of rhomboid fossa >28.21mm (12.41% of the sample) were identified as of males and that with <9.84mm (4.76% of female right clavicles) were identified as of females. On applying demarking point formula, 6.56% were definitely of male sex (DP < 29.95 mm) and no any female right clavicles was beyond the range of DP < 2.59 mm.

The mean length of the rhomboid fossa of left clavicle in male was 3.27mm more than that of female clavicle. These differences were statistically significant in sex determination (p<0.05). The probability of prediction of correct sex of the left clavicle by length of rhomboid fossa alone was 69.19% for male and 32.47% for female clavicles. A left clavicle with the length of rhomboid fossa >29.32mm was identified as male (4.38%) and that with <9.34mm was identified as female bone (3.17%). On applying demarking point formula, no any male and female left clavicle was beyond the range of DP.

Table 3: Discriminant analysis of breadth (mm) of rhomboid fossa of clavicles of male and female

Sr. No.	Details of parameters	Right		Left	
		Male	Female	Male	Female
1	No of Clavicles	137	63	137	63
2	Range	4.74 – 23.24	4.08 – 16.2	4.08 – 18.36	3.48 – 14.32
3	Mean	10.71	8.35	9.58	8.13
4	Median	9.98	8.24	9.48	7.24
5	Mode	8.32	4.08*	8.92*	6.24
6	SD	3.51	2.73	2.83	2.89
7	p value	p < 0.001		p < 0.05	
8	Probability of predication	69.9%	32.64%	69.19%	32.31%
9	Identification point	> 16.2	< 4.74	> 14.32	< 4.08
10	% of identified bone	5.11%	6.35%	6.57%	3.17%
11	Calculated range (Mean ± 3SD)	0.18 – 21.24	0.16 – 16.54	1.09 – 18.07	-0.54 – 16.8
12	Demarking point (DP)	> 16.54	< 0.18	> 16.8	< 1.09
13	% of clavicles beyond DP	5.11%	0	1.46%	0

Table 4: Discriminant analysis of Index of rhomboid fossa of clavicles of male and female

Sr. No.	Details of parameters	Right		Left	
		Male	Female	Male	Female
1	No of Clavicles	137	63	137	63
2	Range	30.29–95.87	27.14–86.23	20.76–89.99	25.50–82.36
3	Mean	52.72	55.42	50.68	52.98
4	Median	50.89	55.24	49.45	52.11
5	Mode	30.29*	27.14*	20.76*	25.50*
6	SD	10.59	10.87	10.02	14.65
7	p value	p > 0.05		p > 0.05	
8	Probability of predication	68.84%	31.82%	68.5%	31.82%
9	Identification point	> 86.23	< 30.29	> 82.36	< 20.76
10	% of identified bone	1.46%	1.59%	1.46%	0
11	Calculated range (Mean ± 3SD)	20.95–84.49	22.81–88.03	20.62–80.74	9.03 – 96.93
12	Demarking point (DP)	> 88.03	< 20.95	> 96.93	< 20.62
13	% of clavicles beyond DP	1.46%	0	0	0

Breadth (mm) of rhomboid fossa of clavicles (Table 3)

The mean breadth of rhomboid fossa of right clavicle in male was 2.36mm more than that of in female right clavicle. These difference were statistically highly significant in sex differentiation of right of clavicle ($p<0.001$). The probable prediction of correct sex of right clavicle by breadth of rhomboid fossa was 69.9% in male and 32.64% in female. The right clavicle having breadth of rhomboid fossa >16.2mm was identified as male bone and that with <4.74mm was identified as female bone. Thus, only 5.11% male and 6.35% female right clavicles were identified as male and female bones respectively. On applying demarking point formula, only 5.11% of male (DP >16.54mm) and 0% female left clavicles were beyond the range of DP.

The mean breadth of Rhomboid fossa of male left clavicle was 1.45mm more than that of female left clavicle. These differences were statistically significant for sex differentiation of clavicle ($p<0.05$). The probability of prediction of correct sex of the left clavicle by its breadth of RF alone was 69.19% for male and 32.31% female clavicles. A left clavicle having the breadth of its rhomboid fossa more than 16.8mm was identified as male and that with less than 4.08mm as female bone. Thus, 6.57% male and only 3.17% female left clavicles which did not show any overlapping can be identified as male and female bones respectively. On applying demarking point formula, only 1.46% of male (DP >16.8mm) and 0% female left clavicles were beyond the range of DP.

Index of rhomboid fossa of clavicles (Table 4)

In the present study, mean IRF of right female clavicle was bit more by 2.7mm than that of right male clavicle. This was statistically not significant for sex differentiation ($p>0.05$) and probability of prediction of correct sex of right clavicle by IRF alone was 68.84% in males and 31.82% in females. The right clavicle with its IRF >86.23 was identified correctly as of male and that having <30.29 was identified as female bones. Thus 1.46% male and 1.59% of female right clavicles which did not show any overlaps are identified correctly as male and female bones respectively.

Mean IRF of left male clavicle was less than that of left female clavicle by 2.3mm. This difference between male and female left clavicle was statistically not significant ($P>0.05$). The prediction of sex by IRF of left clavicle was 68.5% in male and 31.82% in female clavicles. The left clavicle with its IRF measuring >82.36mm was identified as male and that with IRF <20.76mm was identified as female. Thus 1.46% of male and 0% of female left clavicles which did not show overlapping are identified correctly as male and female clavicles.

Discussion

In the present study, the incidence of rhomboid fossa is more or less same in right side clavicle in both male and female while this difference is significant over left side of clavicle sex vice. These result was similar like study result of Shobha et al.[2], in which incidence of rhomboid fossa in male and female clavicles of right side is statistically not significant ($p>0.05$), but on left side, this difference has statistical significance. ($p <0.05$). But these results are opposite to the study results of Jit et al.[3], who found the incidence of fossa was greater on right side than on left side in both the sex and difference on right side was statistically significant in sex differentiation ($p<0.001$). Rogers et al.[4] found significant relationship between the presence of a rhomboid fossa and sex and concluded that the fossa expression is more common in males (36% left, 31% right) than in females (3% left, 8% right). In Shigh et al.[5] study, the difference in incidence of rhomboid fossa between two sex of was found to be highly significant for both the right as well as left clavicles. No significant difference was noted between two sides as regards to frequency of occurrence of this fossa. However, size differences were found significant only for rhomboid fossa of right clavicles. Prado et al.[6] showed that 97.1% of the clavicles of female individuals did not have a rhomboid fossa and only 2.9% had a rhomboid fossa bilaterally. However, 63.6% of males had a rhomboid fossa, 29% had bilateral fossae, 15.9% only on the left side and 18.7% only on the right side.

In the present study, when nature of rhomboid fossa (Table 1) is

analyzed, sex differentiation of the clavicle by finding different nature of rhomboid fossa is statistically not significant ($p>0.05$). In Shobha et al.[2] study, in both the sex, elevated nature of rhomboid fossa was more frequent, followed by depressed nature and then by flat nature. According to Cave et al.[6] findings, 60% of clavicles manifest a flat rhomboid area, 30% a depression and 10% an elevation of the bone site. In Shivarama et al.[8] observation depressed and elevated types (88.61% and 10.13%) of rhomboid fossa is more in males and smooth and flat types (31.8% and 52.27%) are seen mainly in female clavicles. The exact cause for different nature of rhomboid fossa expression is not clearly understood. However, many factors associated with sex like hormone levels, activity patterns, occupational stress, muscle build up, age and side related asymmetry are likely cause different morphological changes at rhomboid area.

In present study, sex differentiation of clavicles by length of rhomboid fossa has high statistical significance ($p<0.001$) on right side while statistical significance ($p<0.05$) on left side of clavicles. In Shobha et al.[2] study and Kaewma et al.[9] study these difference show high statistical significance ($p<0.001$) on both side but insignificant in Jit I et al[3] study ($p>0.05$). In the present study, on both side, the mean length of rhomboid fossa is comparatively less with study results of Jit I et al.[3], Kaewma et al.[9] and Shobha et al.[2] in both sex.

By length of rhomboid fossa alone as a parameter, probability of prediction of correct sex is 69.54% for male, 34.43% for female right clavicles and 69.19% for male and 32.47% for female left clavicles. While in case of Shobha et al.[2] study, this probability of prediction of correct sex is more higher in case of female as compared to male, 91.3% and 64% for right clavicles and 80% and 62% for left clavicles respectively. Thus length of rhomboid fossa of a clavicle as a single parameter can't establish the sex of each clavicle.

As length of rhomboid fossa of clavicles show considerable overlapping between the both sex, only 12.41% of right and 4.38% left male clavicles, 4.76% of right and 3.17% left female clavicles could be sexed correctly. While in study of Shobha et al.[2], this percentage of correct sexing is higher in male (31% of right and 16% left) but similarly in female clavicles and in Kaewma et al.[9] study this value is more higher 37.80% in male and 25.00% in female irrespective of side of clavicle.

Similar to the length of rhomboid fossa, sex differentiation of clavicles by breadth of rhomboid fossa has high statistical significance ($p<0.001$) on right side while statistical significance ($p<0.05$) on left side of clavicles. In Shobha et al.[2] study and Kaewma et al.[9] study these difference show high statistical significance ($p<0.001$) on both side but significant is not high in both side in Jit I et al.[3] study ($p<0.05$). In the present study, on right side, mean breadth of rhomboid fossa of male clavicle and female clavicle was more than that in Shobha et al.[2] study, While more in male and similarly in female in Jit I et al.[3] study. On left side, mean breadth of rhomboid fossa of male was comparable to that in Shobha et al.[2] study and Jit I et al.[3] study while that in females was more likely similarly with in Jit I et al.[3] study and more than that of Shobha et al.[2] study.

Similar to the length of rhomboid fossa, the breadth is not a single parameter which can help in identification of sex of each clavicle as probability of prediction of correct sex by breadth of rhomboid fossa of clavicle alone is 69.9% for male 32.64% for female right clavicles and 69.19% for male and 32.31% for female left clavicles. But on contrary Kaewma et al.[9] study shows that correct identification of sex by breadth of rhomboid fossa was 45.28% in male and 19.69% in female.

In the present study, the difference in the mean IRF is not statistically significant for sex differentiation ($p>0.05$). The correct prediction of sex based on IRF value alone is more for male than female in both sides. As IRF is ratio of breadth and length of Rhomboid fossa, these two parameters are equally more in males and less in females. Hence the resulting ratio is frequently similar in male and female. Thus most of the clavicles show overlapping in values of IRF between both the sex. The less number of clavicle that are not having overlapping in values of IRF could be sexed correctly i.e., only 1.46% of both side of male clavicle and 1.59% of right side in female clavicle while left female clavicle could be identified as male and female. Thus this parameter does not help in sex differentiation of the clavicles which consistence with study of Shobha et al.[2].

Conclusions

The incidence of rhomboid fossa is more or less same in right side clavicle in both male and female while this difference is significant over left side of clavicle sex vice. Sex differentiation of the clavicle by finding different nature of rhomboid fossa is statistically not significant. Sex differentiation of clavicles by length or breadth of rhomboid fossa has high statistical significance on right side while statistical significance on left side of clavicles. The IRF is not a single parameter which can help in differentiation of sex in study population.

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ORIGINAL ARTICLE

Bisexual differences with reference to finger-ball dermatoglyphics among Jaunsari tribe of Uttarakhand

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Abstract
The scientific study of finger ball ridges is called finger-ball dermatoglyphics, which is associated with human genetics, specifically with chromosomal abnormalities and forensic science. Features of finger-ball prints are used in anthropological applications, and it has a great significance in human variation. In the present study, the bilateral finger-ball prints were collected randomly from 170 individuals of Jaunsari Tribe (males = 70 and females = 100) from Jaunsar – Bawar of Dehradun District in Uttarakhand. The analyses were done by the method propounded by Cummins and Midlo (1943). The pattern types, Total Finger Ridge Count (TFRC) and Absolute Finger Ridge Count (AFRC) were calculated and analyzed. The test of Significance i.e. $\chi 2$ - test and t-test, was also done. The Furuhata's Index (Whorl/loop index) was greater among males (78.94) as compared to the females (70.78). The value of Dankmiejer's (Arch/Whorl) Index was higher among females (15.12) than males (6.66). This can be attributed to a higher frequency of whorl among females. Pattern Intensity Index is almost equal, and the value for males was 14 and for female was 13.31.

Keywords
Finger ball dermatoglyphics; Finger ball pattern; Ridge counting; Pattern type indices; Jaunsari tribe.

Introduction

In 1926, the word “Dermatoglyphics” was proposed (Cummins and Midlo) and accepted for skin patterning's of Fingers, Palms, Soles and Toes. Dermatoglyphics (derma means skin and glyphe means carve) is a common word for all the integumentary features, which was studied by Cummins and Midlo. The features of dermatoglyphics are formed during the 13th/14th week and completed by the 19th week in human foetus. Once formed, the epidermal ridges remain permanent, which never changes throughout the individual's life[1]. However; Dermatoglyphics is highly variable, not only between individuals but also between populations. Dermatoglyphics is also a valuable research tool in the field of physical anthropology, including human genetics, forensic science, and medicine. Research in dermatoglyphics has also taken a direct interest in anthropological applications and the significance of human variations[2]. So, the use of dermatoglyphics in anthropology has increased from time to time.

The significance of dermatoglyphics has been increased in clinical investigations, personal identification, inheritance studies, population variations and other biological aspects with rapid growth in human genetics and with the discovery of chromosomal aberrations in human beings. Hence, it plays many important roles in various fields. A previous study reported that the genetically twin's study has also played a central role in attempting to sort out genetics from environmental variation.[3] Dermatoglyphics was often claimed to be associated with several diseases like leukemia,[4] congenital heart disease,[5] Alzheimer's,[6] juvenile hypertension,[7] type 1 diabetes mellitus,[8] idiopathic epilepsy,[9] and cancer.[10] In India, most of the studies were done covering tribal as well as other populations from different parts of India to understand and know the population differentiation and human variation in respect to Dermatoglyphics traits. Literature review suggest a wide range of studies in dermatoglyphics and genetics and their findings may be reviewed from the work of Uchida & Soltan,[11], Alter,[5], Markow et al.,[12] Bhasin,[13] Dipierri. et al.,[14] and Sabina. et al[15].

The present study area, Jaunsar-Bawar, is a hilly tribal inhabited area in Chakrata and Kalsi tehsils of Dehradun district of Uttarakhand. The people of Jaunsar-Bawar are generally known as 'Jaunsaris' and 'Jaunsari tribe'. These people trace their origin to the Pandavas of Mahabharata. Traditionally, the Jaunsari practice polyandry (one woman marries to more than one husband). The main occupation of the Jaunsari people is agriculture. Agriculture is the primary source of income for the Jaunsari people. In rainy season landslides and other natural disasters are responsible for crop damage, and sometimes the area is cut off from the region because of that these people face many problems in their livelihood. However, such a study on Jaunsari Tribe is low. The present study aims to study the bilateral fingerprints of Jaunsaris to determine the variation and differences between the Male and Female Jaunsaris of Uttarakhand.

Materials and Methods

In the present study, five villages (Sahiya, Udpalta, Nevi,

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Khatasa, and Bohari) of thickly populated Jaunsaris in Dehradun District, Uttarakhand State were selected for the collection of bilateral finger-ballprints from Chakrata and Kalsi Tehsil. The finger ball prints of 170 individuals (70 males and 100 females) were collected and analyzed by the methods used by Cummins and Midlo (1943). The finger-ball prints were taken using ink-pad method, using Gesterner's ink, plain sheets, glass slab, cotton pad, duster, towel, soap, magnifying glass, and folding lens. Statistical analyses were performed through SPSS version 20.0. The data was represented in terms of percentage, mean, and standard deviation. Student's *t*-test was used for differences between the means in the two groups. Chi-square test was employed. The following pattern type indices were calculated.

Dankmiejer's Index=Arches x 100/Whorls

Furuhata's Index=Whorls x 100/loops

Pattern Intensity Index=2 x Whorls + Loops/number of fingers

Results

The data analysis revealed that in males, loop shows the highest frequency (54.3%), whorl shows the medium frequency (42.8%) and arch is 2.90% in both hands (Table 1). In females, loop shows the highest frequency (55.2%),whorl is 38.9% and arch is 5.9% in both hands. In both groups, loop showed the highest frequency in females (55.2%) than males (54.3%) and the frequency of whorl was greater in males (42.8%) than females (38.9%). Arches were higher in females (5.9%) than males (2.90%). Overall distribution showed that loops were of the highest frequency (54.8) than whorls (40.5) and arches (4.70).

Table 1: Distribution of finger-ball pattern types among the Jaunsari males and females

Pattern	Males (N=70)						Females (N=100)						Total (170)	
	Hand Right		Left Hand		Both hands		Right Hand		Left Hand		Both hands		Both hands	
	No	%	No	%	No	%	No	%	No	%	No	%	No	%
Whorl	161	46	139	39.7	300	42.8	198	39.6	191	38.2	389	38.9	689	40.5
Loop	179	51.1	201	57.4	380	54.3	272	54.4	280	56	552	55.2	932	54.8
Arch	10	2.90	10	2.90	20	2.90	30	6	29	5.8	59	5.9	79	4.70
Total	350	100	350	100	700	100	500	100	500	100	1000	100	1700	100

Table 2: Showing the difference between the hands of males and female (both left and right)

Variables	χ^2-value	*p*-value
Male right hand vs. Male left hand	2.887	0.23
Female right hand vs. Female left hand	0.2589	0.87
Male right hand vs. Female right hand	6.7297	0.03
Male left hand vs. Female left hand	4.0819	0.12

All parameters (W-L-A) were found to have non- significant differences among Jaunsari males and females (both hands) (Table 2) while the difference between male right hand and female right hand was found to be significant by diffrent (*p*-value = 0.03), which could probably be by chance because more data would have been given a legitimate result that is bimanual differences also.

The various pattern indices (Table 3) among the males and females of Jaunsari Tribe of Uttarakhand shows the value of Furuhata's index for Jaunsari males was 78.98 and females was 70.78, which is considered in whorl number. The value of Dankmiejer's index for males was 6.66 and females was 15.12. The value of the Pattern Intensity Index for Jaunsari males was 14, and females was 13.31. It differs very slightly among both the gender groups.

Table 3: Pattern type indices among Jaunsari males and females

Pattern type indices	Males	Females	Total
Dankmiejer's Index	6.66	15.12	11.45
Furuhata's Index	78.98	70.78	74.11
Pattern Intensity Index	14	13.31	13.59

Table 4: Showing t-test for variation among Jaunsari males (n=70) and females (n=100) based on TFRC

Population	Mean $\bar{X}$	Standard Deviation S.D.	Standard Error of Mean	Value of *t*-test	P-value
Males	170.77	39.066	±4.669	3.5293	P<0.0005
Females	145.94	48.938	±4.894		

Table 5: Showing t-test for variation among Jaunsari males (n=70) and females (n=100) based on AFRC

Population	Mean $\bar{X}$	Standard Deviation S.D.	Standard Error of Mean	Value of *t*-test	P-value
Males	239.24	91.304	±10.913	2.3913	P<0.0179
Females	203.65	98.323	±9.832		

The *t*-tests were calculated to know variation among the males and females (both hands) based on Total Finger Ridge Count (TFRC) and Absolute Finger Ridge Count (AFRC). On applying the *t*-test, it is observed that the variation between Jaunsari males and females was statistically significant.

Discussion

Previous studies in India suggests that finger-ball dermatoglyphics have been studied in other tribal populations of India as well. In 2011, Biswas studied the Dhimal's of north Bengal and found whorls (52.65%) was followed by loops (45.25) with little sexual differences.[16] Dorjee et. al., 2015 studied the Limboo of Sikkim and found that the most commonly occurring pattern was loop (males: 64.33%;

females: 75.00%), followed by whorl (males: 31.00%; females: 21.33%) and finally arch (males: 4.67%; females: 3.66%). There were no significant differences between sexes in pattern types.[17] In 2015, Singh and Mishra analyzed the finger-ball dermatoglyphics of Tarthar, Teivali and Christian Toda's of Nilgiri hills in Tamil Nadu. They found that the frequencies of finger-ball patterns in Tarthar Todas loop (males: 42.2%; females: 48.2%) was followed by whorl (males: 54.95%; females: 44.0%) and finally arch (males: 3.74%; females: 6.30%). While among Teivali Todas, loop (males: 51.4%; females: 46.6%) was followed by whorl (males: 41.4%; females: 72.2%) and finally arch (males: 7.1%; females: 3.3%); whereas among Christian Todas loop (males: 43.3%; females: 42.25%) was followed by whorl (males: 45.5%; females: 51.2%) and finally arch (males: 11.05%; females: 6.1%).[18] In another study, Sengupta (1990) studied the Finger-ball dermatoglyphics of Koch population of Goalpara District, Assam and found the overall frequencies of finger-ball patterns: whorl (40.18%), Loop (58.73%), Arch (1.09%).[19] In 1967, Tiwari and Chattopadhyay studied the Tibetan refugee of Mussoorie, Shimla and Delhi and found the frequencies of whorl (M: 60.24%; F:), Loop (38.99%) and Arch (0.76%) Males and in females whorl (48.67%), Loop (49.13%), Arch (2.20%).[20]

Although other tribes (Bhotia, Tharu, Raji) of Uttarakhand have been studied for the particular trait, no study on finger-ball dermatoglyphics was done on Jaunsar-Bawar tribe. Invoking an interest in conducting the present study among Jaunsar-Bawar tribe of Uttarakhand.

When compared to the different tribes of Uttarakhand, literature suggested that the highest frequency of whorls was found among Bhotias: 50.7% compared to Rajis (46.5%), Tharus (40.88%) and the present study population, Jaunsaris (40.5%). Also, the frequency of loops was found to be highest in Tharus (55.08%), which was similar to Jaunsaris (54.8%), then Rajis (52%) and Bhotias (47%).While, arches were found to be higher in the Jaunsaris (4.70%) as compared to other tribes (Tharus: 4.03%; Bhotias: 2.3%; and Rajis: 1.5%).[21,22] The frequencies of whorl-loop-arch was also compared and the difference between the Jaunsaris and Bhotias (χ^2= 15.038; p= 0.0005) as well as between Jaunsaris and Rajis (χ^2= 16.726; p= 0.0002) were found to be significant, whereas between Jaunsaris and Tharus (χ^2= 0.801) was non-significant (p= 0.6699).[21,22]

Conclusion

The present study to know variations in the finger ball patterns among the males and females of Jaunsari tribe of Uttarakhand concludes that the incidence of dermatoglyphic pattern type of Jaunsari population is similar to Tharu population. Pattern type indices also shows similarities between the Tharu and Jaunsari population, whereas the value of Furuhata's index was found to be higher in the Bhotias population.

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ORIGINAL ARTICLE

Histopathological study of changes in temporal bone in cases of drowning

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Abstract

Drowning is a global health problem which contributes to about 360000 deaths per annum worldwide viz., about 9% of global burden of deaths, according to WHO census of 2015. Establishment of drowning as a cause of death is a real challenge for the medical examiners on autopsy. Even though, there are so many corroborative evidences to establish the diagnosis of drowning in fresh dead bodies, it is still very difficult to establish the same in decomposed ones. In this study, various pathological changes in the temporal bones of about 11 cases of drowning were discussed. These changes can be very much helpful in clinching the postmortem diagnosis of "Death due to drowning". It has been established that, a spectrum of findings can occur ranging from mere oedema of soft tissues of mastoid air cells and middle ear, frank haemorrhage of mastoid air cells alone, with or without middle ear haemorrhage and inner ear oedema and haemorrhage in extreme cases as the pressure differential across the tympanic membrane increases. These findings were recorded by both gross and histopathological evidences. We also observed that, depending upon the degree of struggle (violent inhalation and exhalation of water) and the magnitude of pressure differential across the tympanic membrane, the degree of temporal bone pathology varies from mere oedema to frank haemorrhage within the ear cavities. However, alcoholism and incapacitation prior to get into the water, found to play a major role in presence or absence of such temporal bones changes in drowning.

Keywords

Drowning; Temporal bones; Mastoid air cells; Middle ear; Oedema; Haemorrhages

Introduction

Drowning is a form of asphyxia death that occurs due to suffocation or environmental asphyxia in which the atmosphere is replaced by a liquid medium, leading to oxygen deprivation.[1,2] Death by drowning has become the third leading cause of death among, total number of unintentional injury deaths throughout the world, accounting for approximately 7% of all deaths related to injury.[3] In 2015, it is estimated that the total number of people who died of drowning was 360000 amounting to 9% of global burden of deaths.[3] Thus drowning has become a major global public health problem.[3] However, the countries of middle and low income, account for about 96% of deaths of unintentional drowning. About 43% of the world's total death due to drowning and about 41% of the total global disability adjusted life years (DALYs) lost due to drowning are contributed by China and India together.[3] Men, children and those individuals who have good accessibility to water bodies are at increased risk of drowning.[1,2,3] Two thirds of the death due to drowning are accidental and one third of the cases are suicidal; however homicide by drowning is rare.[3] Drowning deaths due to hypothermia are a lot more common in both temperate and frigid (polar) zones than that of the tropics.[4]

Few characteristic pathological changes in a typical drowning case are presence of fine lathery froth in the airways, oedema aquosum, emphysema aquosum/ emphysema hydroaerique, Paltauf's haemorrhages, foreign bodies in airways and stomach, middle ear and mastoid air cell haemorrhages, Conjunctival haemorrhages, Venous congestion and fluid blood, foreign material in the hands, bruises of shoulder-girdle, cutis anserine, congestion and Petechiae.[1,2,5,6] Though, applications of specific gravity of blood and plasma, plasma chloride levels, plasma magnesium levels and serum Strontium levels are studied extensively, Diatom test is considered to have more corroborative importance than the rest, but its accuracy is limited by the very possibility of contamination.[7,8]

Other than drowning, dead bodies found in water may also belong to individuals who have died of effects of natural disease before falling in to water, effects of natural disease while in water, injuries sustained before thrown in to water, injuries sustained while leaping in to water, electrocution, hypothermia or poisoning. So, to confirm or exclude the diagnosis of drowning in such cases, this study of histopathological changes in temporal bones is greatly helpful[9-12].

In the present study, both macroscopic and microscopic changes within the temporal bones were studied in 10 cases of drowning and 1 suspected drowning case. These findings were expected to follow some specific pattern. The study aimed to analyse and establish those specific findings in cases of asphyxia due to "drowning" accordingly.

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Materials and Methods

The present study is a cross-sectional study with descriptive analytical approach, conducted on those autopsy cases with history of drowning. The whole study was conducted only after the approval of our institutional ethics committee. On autopsy, after reflection of scalp, incision was extended just below the tips of both the mastoids and freed from muscle attachments. Using the electric autopsy saw, the petro-mastoid portions of both the temporal bones were removed by wedge excision technique. Then soft tissues on the surface of temporal bones were removed thoroughly. Then they were sectioned to a thickness of not more than 5mm, fixed with 10% formalin and then decalcified by bathing in 20% formic acid.[13,14] The decalcified tissues were subjected to histopathological examination to observe and analyse various changes in mastoid air cells, middle ear, inner ear and labyrinth.

Results

Case 1

The dead body of a 19-year-old male, accidentally drowned in sea water and found dead in the shore two and half hours later was brought to the hospital for post-mortem examination. Autopsy was conducted on the same day of death. On autopsy, bluish discolouration of finger nails and gums, wrinkling and soddening of palms and soles, wet clothes with fine sand particles adherent to the clothes and body, fine leathery froth oozing from mouth and nostrils, dark red scalp deep bruising 6 x 4 cm on vertex, oedematous brain, thin dark red subarachnoid haemorrhage on the brain surface, multiple subepicardial petechial haemorrhages on surface of heart and subpleural petechial haemorrhages on the surface of both lungs; fine leathery froth oozing out of the congested cut surface; fine sand particles mixed with food particles in stomach were present. Diatoms test was positive. On gross sectioning of temporal bones, haemorrhages were seen. On histopathological examination, haemorrhages within the mastoid air cells, middle ear mucosa and cochlea were observed. Thin layer of subarachnoid haemorrhage between the vestibulo-cochlear nerve and its sheath were present bilaterally. Apart from asphyxial stigmata, features of typical drowning, presence of tympanomastoid and cochlear haemorrhages, supports the diagnosis of drowning.

Case 2

A 28-year-old male, alcoholic, was found dead in a drinking water sump in his household, after 3 days of disappearance. On autopsy, peeling off cuticles, loosening of scalp hair and nails, protruded tongue, bloated abdomen, scrotum and penis were present. Multiple petechial haemorrhages on surface of heart were found. Both the lungs were boggy with early signs of decomposition; multiple dark red subpleural petechial haemorrhages were observed on surface of interlobar fissure of both lungs. Cut section was congested and pinkish frothy fluid oozed out. All other internal organs were decomposing. Chemical analysis of viscera revealed presence of ethyl alcohol. Diatoms test was inconclusive. No gross petrous bone haemorrhages were seen. Even on rapid progression of decomposition changes, gross sectioning has shown bilateral mastoid air cell haemorrhages. HPE revealed bilateral mastoid air cell haemorrhages, congestion and oedema of middle ear linings, suggesting that the person had some struggle inside the water and intoxicated.

Case 3

A 17-year-old male was found missing one evening and was last seen by a known girl. He gave all his valuable personal belongings and asked her to hand it over to his relatives. The next day he was found dead on banks of a local river. On autopsy, on the next day of disappearance, decomposition changes were more pronounced. Clothes were wet and stained with dark greenish black foul-smelling fluid. Bluish discoloration of the finger nails, peeling cuticles, bloating of abdomen, penis and scrotum, protrusion of tongue was present. Hypostasis was noted on upper part of the chest, hands, forearms, legs and feet suggest floating in water with its dorsum facing upwards, for at least 6 hours after death. Faecal matter expressed at the anus. Scalp was oedematous and brain was pulpified. Larynx and trachea were oedematous. Both the lungs were greenish black and boggy; cut section showed oozing of dark brown foul-smelling fluid. All internal organs showed early decomposition changes. Diatoms test was positive. The stains of brackish water on the clothes conform to the crime scene. Oedematous larynx and trachea, greenish black and soggy lungs filled with dark brownish pink foul-smelling fluid were not typical, but still can be found in drowning.

Gross sections and histopathological examination of both the temporal bones revealed presence of haemorrhages of mastoid air cells, middle ear mucosa and inner layer of the tympanic membrane. These well-developed temporal bone haemorrhages strongly suggest that the individual was strong enough to exert violent breathing efforts inside the water.

Case 4

This 47-year-old male, who lived, separated from his family, because of his addiction to alcohol, got drowned in a pit with just 2 feet deep sewage water. Pale finger nails, in the absence of possibility of severe blood loss suggest chronic malnutrition. Pale grey lungs which are adherent to chest wall suggests pre-existing respiratory compromise. Detection of ethyl alcohol in

his visceral organs justifies intoxication followed by drowning in 2 feet deep water. Diatoms test was inconclusive. Apart from post-mortem findings, consistent with antemortem drowning, oedema and congestion of bilateral middle ear and mastoid air cells were present on histopathology. The absence of tympanomastoid haemorrhage in both gross and microscopic view suggests incapacitation.

Case 5

In this 50-year-old alcoholic male, full-blown decomposition changes had destroyed the appreciable signs of asphyxia except that of the petechial haemorrhages on the interlobar fissures of the lungs. The presence of blackish brown foul-smelling muddy fluid in the stomach and dark brownish pink foul-smelling fluid oozing out from the cut sections of both lungs, confirms the history of submersion in brackish water. Viscera revealed no alcohol. Diatoms test was positive.

On gross examination, blood-stained fluid in the right mastoid air cells and obvious haemorrhage in the left mastoid were present. On histopathology, oedema of right mastoid air cells and haemorrhages in the left mastoid and normal bilateral middle and inner ears were present. The existence of the considerable pressure differential across the left tympanic membrane caused haemorrhage on left side, whilst mere oedema in right mastoid may be due to relatively narrow eustachian tube.

Case 6

A 3-year-old male child, with history of accidental fall in water tank and near drowned, had been treated for 5 days. On autopsy, signs of head trauma (scalp bruise, thin subdural and sub-arachnoid haemorrhage over brain surface) suggest that death may be due to the effects of head injury rather than drowning. There were subpleural petechial haemorrhages with no obvious signs of pneumonia. Diatom test was inconclusive. Both gross sectioning and HPE revealed normal tympanomastoid cavities. Even if present, it would have got resolved by the duration of 5 days of treatment. Presence of bilateral perineural subarachnoid haemorrhages of vestibulo-cochlear nerves on histopathological examination conforms to the head injury and hence absence of respiratory struggle.

Case 7

Autopsy conducted on dead body of a 17-year-old male, revealed all signs of sea water drowning such as presence of fine sand particles over the body, within the lumina of larynx to tertiary bronchioles and also within the stomach along with asphyxial stigmata. Bilateral petrous bone haemorrhages were noted in both middle cranial fossae. Bilateral middle ear and mastoid air cell haemorrhages on both gross and microscopic examination were well in line with the built, conscious level at the time of submersion. There must be violent gushing of the seawater in and out of the lungs, during drowning. The presence of cochlear oedema suggests that the pressure differential was so high to get transmitted across the cochlear windows. Diatoms test was positive.

Case 8

In the autopsy of a 20-year-old male student, apart from asphyxial stigmata, signs of drowning in sea water such as presence of fine sand particles over the body, within the lumina of larynx to tertiary bronchioles, within the stomach, oedematous and boggy lungs with exudation of fine leathery froth from lumina of bronchioles were present. Dark red contusions roughly 8 x 4 x scalp deep on the right parietal region of scalp. Thin layer of dark red subarachnoid haemorrhage was present on bilateral parietal lobes of brain. Diatom test was positive. Bilateral petrous bone haemorrhages were noted through both middle cranial fossae. Presence of bilateral middle ear and mastoid air cell haemorrhages on both gross and microscopic examination explains the built and conscious level of the individual on submersion and bilateral perineural subarachnoid haemorrhage around bilateral eighth nerves correlate with subarachnoid haemorrhage.

Case 9

Temporal bone changes and positive diatom test were observed on autopsy of a 60-year-old male, twenty days after the alleged day of drowning. Except that of atheromatous plaques on aortic intima and critically narrowed coronaries, all internal organs were shrunken, soft, flabby and decomposed. No significant injuries were present on the body. Histopathological examination revealed mere oedema soft tissues of bilateral temporal bone cavities. It was an evidence of lack of violent breathing efforts, indicating the incapacitation of the individual by coronary arterial disease before falling into the water.

Case 10

An 80-year-old male, who accidentally fell in to a well was subjected to autopsy on the next day. In addition to the gross autopsy findings of atypical fresh water drowning and positive diatom test, his heart was enlarged, soft and flabby with narrowed right coronary artery suggestive of myocardial infarction and drowning. Even though, the petrous bone haemorrhages were not well marked, gross and microscopic sections of both mastoids and right middle ear showed frank

haemorrhages with oedema of left middle ear mucosa. Presence of less pronounced temporal bone findings indicates that the breathing efforts were not very strong and correlates with the age and incapacitation due to myocardial damage.

Case 11

On autopsy of dead body of a 17-year-old male, with alleged history of drowning in brackish water, multiple subpleural petechio-ecchymotic haemorrhages were found on oedematous lungs with pinkish fine leathery froth oozing out of their cut surface and also from lumina of larynx and trachea. Mud particles were also noted on mucosal surfaces of airways. Diatoms test was positive. Bilateral petrous bone haemorrhages were noted through both middle cranial fossae. Presence of bilateral middle ear and mastoid air cell haemorrhages on both gross and histopathological examination along with microscopic left cochlear oedema once again depicts that, it was a case of ante-mortem drowning and also correlates with the age and built of this young and robust male.

Figure 1: Section through a formalin fixed mastoid showing frank haemorrhages

Figure 2: Gross section of external, middle and inner ear

Figure 3: Gross section of a cochlea

Figure 4: Histopathological section of mastoid showing haemorrhages within the air cells

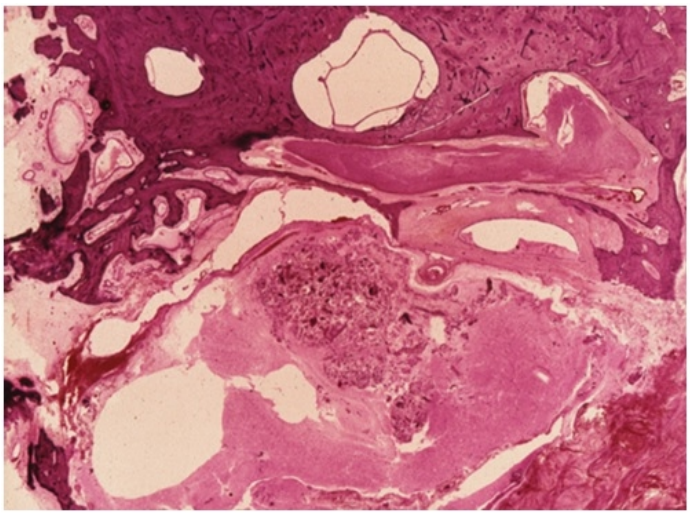

Figure 5: Histopathological section of tympanomastoid haemorrhages and cochlear oedema

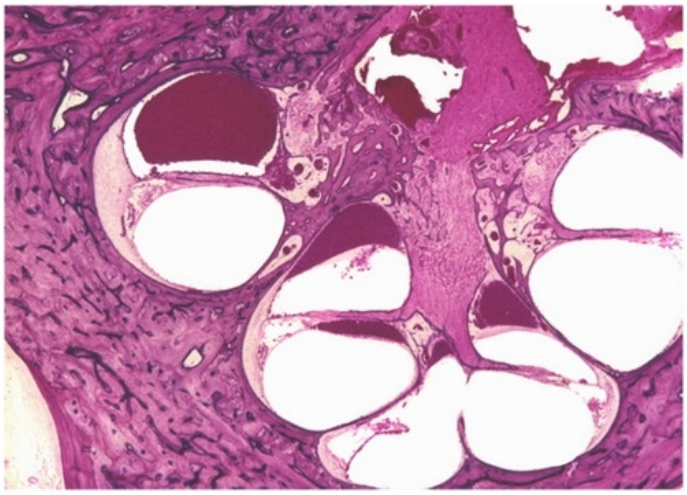

Figure 6: Histopathological section of cochlear oedema and haemorrhages

Discussion

In 1999, Kaga et al. studied temporal bones of six cases of accidental deaths due to drowning and found extensive congestion, petechiae and haemorrhage in blood vessels of mucosal layers of middle ear, mastoid air cells, carotid canal and around facial nerve.[9] Incidence of tympanomastoid haemorrhage in autopsy materials were studied in 258 temporal bones by Babin et al. in 1982. Among which, 11 were found to have tympanomastoid haemorrhages. Out of the 11, after excluding cerebrovascular accidents, skull fractures, and malignancies of blood, drowning victim was the one found to have such tympanomastoid haemorrhages.[10]

In 1990, Ito and Kimura, studied the histological findings of the temporal bone in 23 autopsy cases of various asphyxial fatalities with 32 controls. In drowning, bilateral oedema, congestion and haemorrhages of middle ear and mastoid air cells, depending up on the struggle.[11] In cases of ligature strangulation, bilateral oedema and haemorrhages from the mastoid air cells to the cochlear duct of the inner ear were demonstrated. In manual strangulation cases, oedema and congestion in the mastoid air cells and inner ear were found but no hemorrhage.[11]

These macroscopic and microscopic changes within the temporal bones in cases of asphyxial deaths due to drowning were expected to follow a specific pattern. In most cases, the consistent finding was haemorrhage within middle ear and mastoid air cells.[2,11] But, in intoxicated individuals the aforesaid temporal bone findings were found to be less pronounced or even absent.[2,11,12]

Among all the eleven cases of our study, it has been observed that even after decomposition of the body, soft tissues of the temporal bone cavities remain well preserved for a considerably longer time. The time duration required for decomposition of these intraossicular structures has not been described in any of the known literatures. This may be either due to encapsulation within one of the hardest bones of the body or their fibrous nature that provides relative dehydration. These ensure the least accessibility to the putrefactive organisms and relative dehydration, thereby delaying decomposition. Temporal bone is also much resistant to acidic and alkaline environment. The difficulty in decalcification either with acids or with chelating agents is a tell-tale evidence of the above statement.

From this study, it has been observed that, depending upon the degree of struggle(violent nature of inhalation and exhalation of water) and the built of the individual, the magnitude of that pressure differential varies.[15,16,17] The stronger the individual or the struggle, the higher the magnitude. The higher the magnitude, the greater is the chance of haemorrhage within the ear cavities.

During the process of drowning, a negative pressure is created by violent gushing of the liquid medium in and out of lungs across the nasopharynx. It causes a suction effect within the middle ear through patent Eustachian tube. In the presence of intact tympanic membrane, a pressure differential is created across the membrane (positive pressure outside and negative pressure inside).[15] It exerts a suction force on the walls of capillaries supplying the soft tissues of tympanic membrane, middle ear, mastoid air cells and inner ear, resulting in a spectrum of findings from mere congestion and oedema to frank haemorrhages due to rupture of the capillaries.[15,16]

The aforesaid negative pressure from the middle ear is very effectively transmitted to the mastoid than to the inner ear. Mastoid air cells are continuous with the middle ear cavity through Aditus antrum. Whereas, the middle and inner ears are separated by two membranous windows. Hence, the haemorrhages are more common in middle ear and mastoid than in inner ear. All cases described above, stand a proof for the aforementioned hypothesis.

Conclusion

The spectrum of pathologies that occur in drowning ranges from mere oedema of soft tissues of mastoid air cells and middle ear, frank haemorrhage of mastoid air cells alone, with or without middle ear haemorrhage to inner ear oedema, as the pressure differential across the tympanic membrane increases. In extreme cases inner ear haemorrhage can also occur but very rare.[15,17]

After all it is concluded that the presence of mastoid air cells and middle ear (tympanomastoid) haemorrhages along with other findings consistent with drowning, can be used as a positive correlation for arriving at opinion as to the cause of death as "Death due to drowning", Before that, other causes such as head trauma, cerebrovascular accidents, middle and

inner ear pathologies such as infection, aneurysms and malignancies should be excluded.[10,11,15,16,18] However, in the absence of the above mentioned findings in drowning cases, the possibility of incapacitation by injury, drugs or intoxication with alcohol or any other inebriants should be considered after ruling out tympanic membrane perforation, eustachian tube block or dysfunction.[15,17]

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ORIGINAL ARTICLE

Correlation of Diagonal Ear-lobe Crease with Coronary Artery Disease among Indians: An autopsy study

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Abstract
Atherosclerotic coronary artery disease (CAD) incidence, prevalence, morbidity and mortality are rapidly increasing across the world and particularly in India. Diagonal ear lobe crease (DELC) or Frank's sign had been known as a cutaneous marker of atherosclerotic coronary artery disease since many decades. However, only few Indian clinicians are aware of the relevance. The aim of the present study was to correlate diagonal earlobe crease with presence and extent of atherosclerotic coronary artery disease among Indian population. This was a prospective observational study for duration of 19 months, carried out in the Department of Forensic Medicine and Toxicology, Shri Vasantrao Naik Government Medical College, Yavatmal, Maharashtra state (India). The association between DELC and the extent of coronary artery atherosclerosis was analyzed on autopsied subjects. Amongst 767 cases, 79.1% were male, 93 with DELC and 674 without DELC. The prevalence of DELC was 83.3% in those with CAD and 4.1% without CAD. The numbers of coronary artery involved were more with DELC (2.10 ± 0.68) than without DELC (1.32 ± 0.55). Considering DELC as one of the diagnostic markers for CAD, validity of this diagnostic marker i.e. sensitivity and specificity were 0.83 & 0.96 respectively. Positive predictive value and negative predictive value for DELC was 0.70 & 0.98 respectively. From the above study we conclude that the diagonal ear lobe creases is a specific and sensitive marker for atherosclerotic coronary artery disease.

Keywords
Autopsy; Frank's sign; Diagonal Ear Lobe Crease; Coronary Artery Disease

Introduction

World Health Organization (WHO) report states that, cardiovascular diseases are the number one cause of deaths globally. An estimated 17.9 million people died from CVDs in 2016, representing 31% of all global deaths. Of these deaths, 85% are due to heart attack and stroke.[1] Heart attack or myocardial infarction is an acute event and an outcome of myocardial ischemia mainly caused by blockage of coronary artery/arteries due to atherosclerosis. The development of atherosclerotic coronary artery disease is complex and multi-factorial process. Epidemiological studies have documented that several factors including sex, age, smoking, hypertension, hyperlipidemia, diabetes mellitus (DM), obesity and family history are risk factors for CAD.[2]

The Diagonal Ear Lobe Crease (DELC) or Frank's sign refers to an oblique indentation in the skin overlying the ear diagonally backwards to the edge of the lobe at approximately 45°. In 1973 for first time Frank drew attention to the association between diagonal earlobe crease and coronary heart disease.[3] Since then many studies all over the world had been published addressing this issue. Of which several clinical studies[4-11] including autopsy-based[12, 13] and histopathological examination[14] confirmed the association of DELC with CAD. However, some studies have not found any significant association between DELC and CAD.[15]

The incidence of death due to coronary atherosclerosis has significantly increased in past few decades and it had become an epidemic in India. This is expected to escalate rapidly in the next decade.[16] It is highly important to explore the usefulness of various simple and reliable tests/ signs of coronary atherosclerosis for early detection and management. The DELC is one of the simple and easily observable 'signs' because it can be seen at a glance. Despite its identification over forty years ago, Indian literature is lacking regarding the usefulness of Frank's sign as a cutaneous indicator of coronary atherosclerosis. Also, no autopsy study till date had been published by Indian researchers in this regard. In the present study, the association between DELC and the extent of coronary artery atherosclerosis, controlled for age & sex was analyzed on autopsied subjects. We also examined other risk factors (history of Hypertension, diabetes mellitus, smoking and alcoholism and CAD) for atherosclerosis.

Materials and Methods

The present study design was a prospective observational study for duration of 19 months (1 Jan 2017 to 31 July 2018). It was carried out in the department of Forensic Medicine and Toxicology, Shri Vasantrao Naik Government Medical College located at Yavatmal city of Maharashtra state (India). No

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objection certificate for the study was taken from the Institutional Ethics Committee of Shri V. Ni Government Medical College, Yavatmal.

Based on the previous experience by authors, the youngest victim having significant coronary atherosclerosis autopsied was of 26 years, and had been brought dead to emergency care with history of symptoms of myocardial infarction. Hence, we included all corpses brought for autopsy having age ≥ 25 years for this study. Of all cases above 25 years of age, the corpse showing signs of decomposition and having absent ear or deformed ear/s as result of injury/ skin disease/ congenital anomaly were excluded. Thus, total 767 cases having intact earlobes without any disease/ unnatural deformity irrespective of cause of death were studied. The cases were screened for the bilateral typical DELC as per criteria of the ear lobule crease. The typical DELC was recorded as a deep diagonal crease extending obliquely from the tragus towards the outer border of the ear lobe, covering at least two-thirds of the ear lobe length.

The presence or absence of DELC on one or both sides was recorded along with age, sex and other epidemiological characteristics on prescribed proforma. Afterwards, the detailed disease profile of each case including information about hypertension, diabetes mellitus, smoking and alcohol drinking, history of CAD was noted from the relative & hospital record if any. The autopsy was conducted meticulously with special emphasis given to the dissection of coronaries. Degree of atherosclerosis with percentage of block was noted if present. Coronary Artery Disease was defined by diameter stenosis of >50% in one or more of the epicardial arteries (left main coronary artery, left anterior descending coronary artery, left circumflex coronary artery, and right coronary artery).

The collected data was reported as mean ± standard deviation. Comparison of the categorical or numeric variables between groups was carried out using a Chi-square test or Student's t-test separately. The multivariate regression model was used to rule out possible mutual association of traditional risk factors (including age, sex, and history of hypertension, diabetes mellitus, smoking and alcoholism) with DELC and Non-DELC group. The sensitivity, specificity, and predictive values of DELC in two genders and four age groups (25–44, 45–59, 60–75, and >75 years old) were computed. All statistical analysis was conducted using Statistical Package for Social Sciences [SPSS] Version 17.0. P value of <0.05 was considered statistically significant.

Results

In the current study, we studied 767 corpses autopsied by the Department of Forensic Medicine during the period spanning from 1st January 2017 to 31st July 2018. Out of 767 subjects studied who died due to varied causes, 93 were having DELC and remaining 647 were without DELC. The age group of the study sample was ranging from 26 years to 95 years. Majority of the study sample belongs to <45 years group (47.20%) followed by 45 to 59 years group (32.46%). The DELC was observed more commonly in <45 years group (44.09%) followed by 45 to 59 years group (34.41%). (Figure 1)

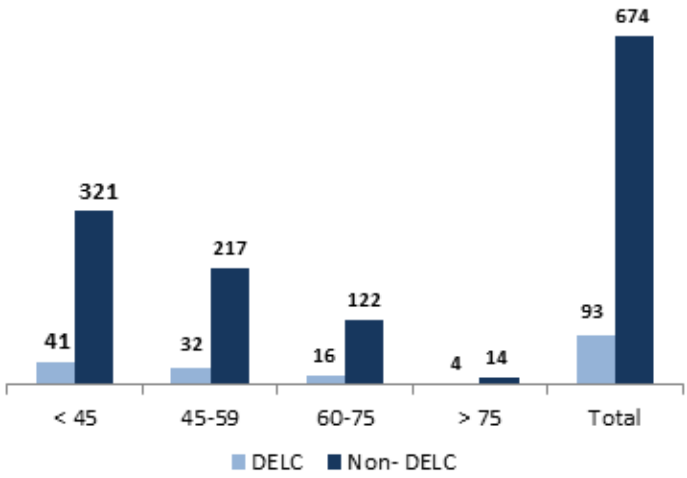

Figure 1: Age wise distribution of DELC and Non-DELC subjects. (n=767)

Table 1: Demographic and basic clinical characteristics of the subjects with and without DELC

Variables	All	With DELC	Without DELC	χ^2 or t test	*p* Value
Number	767	93(12.1%)	674 (87.9%)		
Male	607 (79.1%)	63 (67.7%)	544 (80.7%)	7.561	0.006
Female	160 (20.9%)	30 (32.3%)	130 (19.3%)		
Age (in years)	46.08 ± 13.72	47.61 ± 14.03	45.87 ± 13.68	1.145	0.252
Hypertension	125 (16.3%)	55 (59.1%)	70 (10.4%)	142.401	<0.001
Diabetes	83 (10.8%)	30 (32.3%)	53 (7.9%)	50.395	<0.001
Smoking	211 (27.5%)	27 (29.0%)	184 (27.3%)	0.123	0.726
Alcohol	202 (26.3%)	27 (29.0%)	175 (26.0%)	0.396	0.529
CAD	78 (10.16%)	65 (83.3%)	13 (1.69%)	413.2	<0.001
Coronaries involved	1.82 ± 0.73	1.88 ± 0.76	1.54 ± 0.52	5.544	<0.001

DELC- Diagonal earlobe crease, CAD- Coronary artery disease.
p< 0.05 is considered statistically significant.

Among DELC cases, 67.7 % were male & 32.2% cases were female. Average age in the study was 46.08 ± 13.72 while age with DELC cases was 47.61 ± 14.03 years and males outnumbered females among subjects having DELC. Among DELC subjects, the history of hypertension, diabetes and CAD was more associated than non-DELC subjects (student t test & P value significant). However, there is no significant difference between cases with DELC and without DELC in relation to the association of history of smoking and alcoholism. The numbers

Table 2: The multinomial logistic regression analysis of risk factors for CAD

Factors	β	95% CI	*p* Value
Male	-0.266	0.238 - 2.473	0.657
Smoking	0.233	0.415 - 3.845	0.681
Alcohol	1.429	1.359 - 12.811	0.013*
Diabetes	-0.008	0.309 - 3.178	0.989
Hypertension	3.929	16.633 - 155.521	0.000*
DELC	4.957	49.199 - 410.854	0.000*

DELC- Diagonal earlobe crease, CAD- Coronary artery disease.
CI- Confidence interval, p< 0.05 is considered statistically significant.

Table 3: The sensitivity, specificity and positive & negative predictive values (PPV & NPV) for DELC to predict CAD among gender and age groups

Group	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
All	83.33	95.93	69.89	98.07
Male	79.31	96.90	73.01	97.79
Female	95.00	92.14	63.33	99.23
25-44 years	84.61	94.34	53.65	98.75
45-59 years	87.09	97.71	84.37	98.16
60-75 years	72.22	97.50	81.25	95.90
>75 years	100.00	93.33	75.00	100.00

DELC- Diagonal earlobe crease, CAD- Coronary artery disease.
PPV- Positive predictive value, NPV- Negative predictive value

of coronary artery involved were more with DELC (1.88 ± 0.76) than without DELC (1.54 ± 0.52) **(**Table 1). Of the 93 individuals with DELC, 70% of the individuals (n=65) showed presence of coronary artery disease (CAD), while 30% (n=28) showed its absence. On the other hand, of the 674 individuals without DELC, 98% (n=661) showed absence of CAD, while only 2% (n=13) showed its presence.

The multinomial logistic regression model was used to rule out possible mutual association of traditional risk factors (including age, sex, cigarette smoking, alcohol drinking, hypertension, and diabetes mellitus) with CAD. Beta is co-efficient of regression and 'P' value is significant in alcohol, hypertension & DELC as a risk factor for CAD i.e. 0.013, 0.000 & 0.000 respectively. The multivariate regression analysis showed that DELC, Hypertension & Alcohol were all independent risk factors for CAD. (Table 2)

The sensitivity for the whole study subjects was 83.33%, the specificity 95.93 %, the positive predictive value 69.89 % and the negative predictive value 98.07%. For gender, higher sensitivity and negative predictive values were found in females, while higher specificity and positive predictive values were in male than that in females. The highest sensitivity (87.09 %) and specificity (97.71%) & positive predictive value (84.37 %) was seen in age group 45-59 yrs. And the highest sensitivity & negative predictive value 100% was seen in > 75 yrs. age group. **(**Table 3**)**

Diagonal Ear lobe crease has significant positive correlation with Diabetes mellitus (r = 0.256, p = <0.05), Coronary artery disease (r = 0.567, p < 0.005), Hypertension (r = 0.431, p < 0.05), family history of coronary artery disease (r = 0.264, p < 0.05)) & number of coronary artery involved (r = 0.736, p < 0.05) but there is no significant correlation with age, smoking & alcohol intake (p > 0.05).

Discussion

This is the first autopsy study from India relating usefulness of DELC as cutaneous marker of coronary atherosclerosis. The prevalence of DELC and its association with CAD may not be the same in different human races. We prospectively studied the association between presence of DELC and CAD in 767 autopsies conducted for medico-legal purpose and thus include wide spectrum of subjects. In our study, all the cases having DELC were bilateral (100%). Among 767 cases studied, male was 79.14% and remaining were females. Also, males outnumbered females in having DELC (63% & 32.3% respectively). In this regard different studies had documented different percentage among males and females. Kirkham et al.[12] found that, the proportion of creases in males and females were 72% and 67% respectively with 95% confidence interval for the difference in proportions was 5% to 160%. Study conducted in Iranian population had 69.6% of males and 52.3% of females with DELC and no statistically significant difference was observed between the two groups with regard to gender ($P = 0.058$).[4]

In our study, 93 subjects were having DELC and the majority of subjects with DELC were scattered in the ages ranging from 25 years to 75 years (95.70%) and only 4.30 % subjects were aged more than 75 years. Whereas, the prevalence of DELC was approximately double in age group above 75 years as compared to the other age groups. The creases are not usually present in childhood but develop during life and are not associated with diabetes.[5] In the study conducted by Montazeri et al.[4] 68% of DELC patients were ≥60 years old. Mehta et al.[6] & Christiansen et al.[7] in their study inferred that ear lobe crease become more common with advancing age, with the greatest increase in the fifth decade, and are associated with increased degrees of coronary artery sclerosis.

The pathophysiological link between DELC and CAD relates to the known fact that, both earlobes and heart are supplied by “end arteries” without possibility for collateral circulation. The histopathology studies of biopsies from earlobe in cases of DELC have reported loss of elastin fibers indicating a generalized microvascular disease and hinting at possibility of similar changes in coronary arteries in the affected individuals.[10] In current study, among 93 subjects having DELC, total 69.89% were identified on autopsy to be having significant coronary

artery disease. The international study by Sternlieb el al. has shown that up to 90% of patients with creases undergoing coronary angiography have significant disease.[8]

In 1973 Frank observed that, the patients with diagonal earlobe creases had association with an increased number of other risk factors for coronary heart disease and with premature onset of the disease.[3] Since then, various studies all over the world have found varying degrees of association between DELC and CAD as reviewed by Agouridis et al.[17] A study by Edston E[13] of autopsy cases, the existence of an ELC was noted in 55%. It was found that ELC was strongly correlated with CAD in both men and women. The results of Suen et al.[18] study showed that the presence of DELC was significantly associated with CAD. A study by Elliott WJ and Karrison T[19] found similar results. They suggest that a DELC is associated with increased all-cause and cardiac morbidity and mortality. Bahcelioglu et al.[20] found that there was a statistically significant positive association between ELC and coronary artery diseases in both sexes. In a Turkish study, 415 patients were examined for the presence or absence of bilateral ELC; angiographic evidence of CAD, and the data suggested that ELC was significantly and positively correlated with CAD. The ELC was an independent variable for CAD.[10] The study done on Chinese showed a significant association between DELC and CAD independent of established risk factors.[9]

In the present study diagonal ear lobe crease (DELC) was found to be associated with Coronary artery disease (CAD) among Indians. DELC is one of the diagnostic markers for CAD as validity of this diagnostic marker i.e. sensitivity among study subjects was 83.33%, the specificity 95.93 %, the positive predictive value 69.89 % and the negative predictive value 98.07%. Similar study carried out by Evrengul et al.[10], reported ELC sensitivity of 51.3%, specificity of 85.8%, and positive predictive value of 89.4% and negative predictive value of 41.2% for diagnosis of CAD among their study population. The Iranian study published in 2008 observed sensitivity, specificity, positive predictive value and negative predictive value of ELC for diagnosis of CAD were in the following order: 59.6%, 73.5%, 72.3% and 61%.[11]

Previously, CAD was supposed to be disease of the older age group from the fifth to the seventh decades of life. However there is rise in the cases of death due to coronary atherosclerosis in young people in recent years. In present study DELC sensitivity among young age group (25-44 years) was 84.61%, the specificity 94.34 %, the positive predictive value 53.65 % and the negative predictive value 98.75%. It is highly important to detect asymptomatic CAD in the younger age group to have early interventions to prevent first ischemic attack and subsequent mortality and morbidity.

Myocardial infarction as an outcome of myocardial ischemia is a dreaded complication of coronary atherosclerosis. Regarding myocardial infarction, Lichstein et al.[5] reported in 1974 that DELC (unilateral or bilateral) was significantly more common (47%) in patients with myocardial infarction than those without the disease (30%). Kaukola et al.[21] reported that 69%~72% of patients with an acute myocardial infarction or coronary artery atherosclerosis had a DELC, while in the like-aged control group 21%~24% of them had DELC. Studies from Denmark found that the prevalence rate (46.8%) of DELC in those with an acute myocardial infarction was significantly greater than in control group (31.6%).[22]

The present study shows positive correlation of DELC & Diabetes mellitus (DM) but studies conducted by Davis et al.[15], Kaukola et al.[22] & Jorde et al.[23] does not show similar findings. Considering the Hypertension (HTN), our study supports the positive correlation results obtained by Toyosaki et al., Kristensen BO and Moncada et al.[24-26] However study didn't support the result obtained by Wu et al. and Elliott WJ & Karrison T.[9,19] Our data depict negative correlation of alcohol intake and DELC, which was in concurrence with Petrakis L[27] giving reason that alcohol may maintain the patency of the end-arteries supplying the myocardium and the earlobe. The numbers of coronary arteries involved were found to be more in DELC as compared to non-DELC cases, similar findings were noted by Wu et al.[9] on Chinese population. Our study did not show significant correlation of DELC with smoking. However, the association between DELC and smoking was reported by Toyosaki et al.[24] and Doering et al.[28]

This study was conducted at a single center and in autopsied subjects; so, the results may not be generalized to whole population. Other important limitation of the study was regarding information. Being autopsy-based study, we had to rely on relatives regarding information data of the study subjects. Therefore, undiagnosed/ un-reported hypertension, DM and CAD event among study subjects might be missed leading to varied results that actual. The other limitation was non-grading of ELC; recent evidence has pointed out to the relationship between the increasing grades of ELC and the increasing severity of CAD.

Conclusion

To the best of our knowledge, this is the first autopsy report from India disclosing association of DELC with CAD. The frequency of CAD among subjects having bilateral DELC was significantly high among studied autopsy subjects. Agreeing with most of the previous studies from different countries, the DELC sign may be used for identification of person at risk of atherosclerotic CAD in Indians. Rural areas in India lack super specialty health care facilities, where this physical sign could be used as a useful marker for the prediction of coronary artery

disease. The DELC, if found effective can be used as a complementary approach that is simple, effective, and inexpensive for identifying patients with coronary risks.

Abbreviations

DELC - Diagonal Ear Lobe Crease

ELC - Ear Lobe Crease

CAD - Coronary Artery disease

DM - Diabetes Mellitus

HTN - Hypertension.

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ORIGINAL ARTICLE

Study of facial injuries sustained in cases of fatal accidents and intentional violence

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Abstract
Injuries or mutilation on the face can have disastrous effect on individuals. Unnoticed cranio-facial injuries especially those with fractures can lead to blindness, deafness, facial paralysis with many other medical problems and disabilities. Substantial progress has been made in treating craniofacial trauma with several specialties like maxillofacial, plastic, ENT and neurosurgery being involved. This study aimed to analyze the epidemiological data, injury pattern, role of patient and prevalence of cases in facial injuries. The study was a cross-sectional observational study conducted during the period of 18 months, on the cases of deaths associated with facial injuries, brought for medico legal autopsy to the mortuary of the Department of Forensic Medicine, V.M.M.C. &Safdarjung hospital, New Delhi. The study included 257 cases that were reported to the Mortuary with facial injuries. The peak incidence was, however, observed in the age group of 15 - 24 years with a male: female ratio of 2.43:1. Road Traffic Accident (RTA) that resulted in 55.64% of total followed by burns 30% and Assault 09.33 cases. Two-wheeler (motorcycle/ scooter) occupants dominated the list with 43.35% cases and Pedestrians seconded the list with 20.27% cases. Alcohol association was observed with the etiology of facial injuries. Most common type of injury was found to be soft tissue injuries (93.33%) cases. The authors gave recommendation to reduce the incidents/accidents leading to Facial injuries.

Keywords
Facial Injuries; Road Traffic Accidents; Mandibular Fracture; Assault; Sports Injuries.

Introduction

Human face is a very important part in defining an individual's identification. Injuries or mutilation on the face can have disastrous effect on individuals. The position and anatomy of face makes it more vulnerable to trauma. Sometimes, cases of unnoticed cranio-facial injuries especially those with fractures can lead to blindness, deafness, facial paralysis with many other medical problems and disabilities. Over the past few decades substantial progress has been made in treating craniofacial trauma with several specialties like maxillofacial, plastic, ENT and neurosurgery[1, 2] being involved. Such injuries sustained in accidents and intentional violence contribute significantly to morbidity and mortality of the population. Several workers have studied the causes, patterns and socio-demographic factors associated with facial injuries. This study aims to analyze the epidemiological data related to facial injuries and the role of patient in these accidents or intentional violence and to know the prevalence of cases with these facial injuries.

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Material and Methods

The study was a cross-sectional observational study that was conducted during the period of 18 months. The study was conducted on the cases of deaths associated with facial injuries, brought for medico legal autopsy to the mortuary of the Department of Forensic Medicine, V.M.M.C. &Safdarjung hospital, New Delhi. Decomposed bodies were excluded from the study. All the cases were subjected to standard autopsy procedure with special emphasis on examination of facial injuries along with injury characteristics and also epidemiological features of the cases which were entered on a predesigned proforma. Data are entered in Microsoft excel sheet for analysis.

Results

The total number of subjects incorporated in the study were 257 (N = 257). The accidental cases were studied and further sub categorized into Road Traffic Accident (RTA), Burns, Fall from Height (FFH) & Sports Injuries.

The age of the victims varied from 15 - 80 years. The peak incidence was observed in the age group of 15 - 24 years comprising 101 (39.20%) cases, followed by the age group 25 - 34 years amounting to 58(22.45%) cases. Thus, the maximum number of cases, i.e. 159 (61.65%), were reported between the ages 15 - 34 years. 17 (6.79%) cases fell under the age group of 55-64 yrs. The least affected were the subjects in the age group

of more than 65 yrs i.e. 2 (0.85%) cases. Out of 257cases 182 (70.81%) were males while 75 (29.18%) were females. Thus, a male: female ratio of 2.43:1 was observed. (Figure 1)

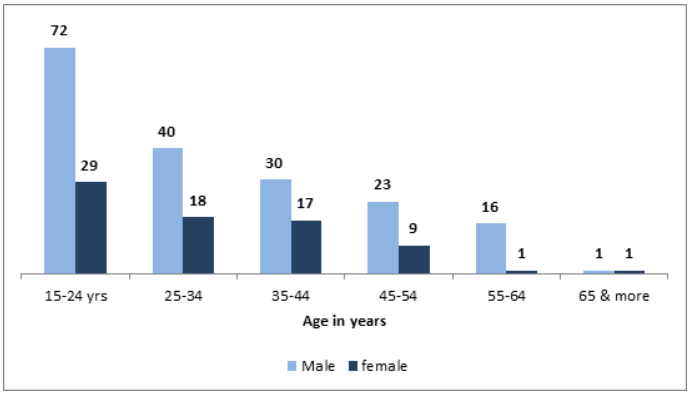

Figure 1: Age and sex distribution in facial trauma cases

Effect of seasonal variation in relation to number of victims is displayed in Table 1. Rainy season (July to Oct.) recorded maximum number of victims i.e. 115 (44.86%) followed by winter season (Nov. to Feb.) – 84 (32.57%). The least number of cases, 58 (22.57%) were reported in summer (March to June).

Table 1: Number of victims in different seasons

Season	No. of Victims	%
Summer (Mar. to Jun)	58	22.57
Rainy (July to Oct.)	115	44.86
Winter (Nov. to Feb.)	84	32.57
Total	257	100

Table 2: Sex-wise distribution of cases according to mechanism of injury

Mechanisms of injury	Number of victims				Total	
	Males		Females		N	%
	N	%	N	%		
Road Traffic Accident	137	75.27	6	8	143	55.64
Assault	8	4.39	16	21.33	24	09.33
Fall from Height	6	3.29	2	2.66	8	3.11
Sports injuries	2	1.09	0	00	2	01
Others	2	1.09	1	1.33	3	0.7
Burn	27	14.83	50	66.66	77	30
Total	I82	100	75	100	257	100

Table 2 illustrates the major mechanisms of facial trauma. Road traffic accident (RTA) resulted in 143 (55.64%) of total (N=257) cases, followed by burn 77 cases (30%), Assault with 24 (9.33%) cases. Fall from height contributed to only 8(3.11%) reports. The mechanism which caused the least incident of facial trauma was Sports injuries contributing to very minor amount i.e. 2 (0.77%) cases and 3(1.16%) cases from other mechanism

Table 3 shows the distribution of various types of road users and their respective involvement in Road Traffic Accident. The total RTA cases reported were 143. Two-wheeler (motorcycle/ scooter) occupants dominate the list with 62 (43.35%) cases. Pedestrians with 29(20.27%) cases second the list. Cyclists contribute to 23 (16.08 %), while four-wheeler occupants were the least common type of road users with 16(11.18 %) cases, of accidents.

Table 3: Types of road users sustaining facial injuries in RTA

Type of road users in RTA	N	%
Pedestrian	29	20.27
Cyclists	23	16.08
Two-wheeler (motorcycle/scooter) occupants	62	43.35
Four-wheeler occupants (car)	16	11.18
Others	13	9.09
Total	143	100

Figure 2 throws light on the type of vehicles that were either used by the RTA victims (i.e. 143) or were hit by these (in case of the pedestrians). Motorized two wheelers (consisting mainly of motorcycles and also scooters) comprised the major bulk of such vehicles, 42.65% (61) cases. Non-motorized two wheelers resulted in 12 (8.39 %) victims. Thus, both the categories of two wheelers result in maximum number of RTA. Four wheelers (light-mainly cars and jeeps) resulted in the victimization of 36 (25.17 %) i.e. 1/4th of total number of cases and thus, seconding the list. Heavy vehicles (mainly Tractors) resulted in 21 (14.68 %) cases and hence, the least common type of vehicles involved in RTA causing facial injuries.

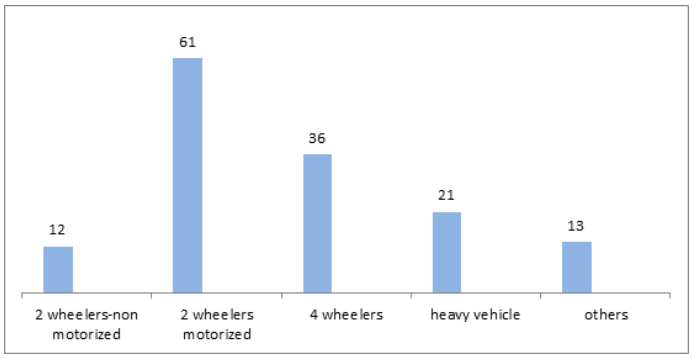

Figure 2: Type of vehicles involved in RTA

Figure 3 tries to establish the association that exists between Alcohol consumption and etiology of facial injuries. 12 (50%) out of 24 subjects were assaulted under the influence of alcohol consumption. These victims either had a direct association with alcohol consumption (i.e. victim was a consumer of alcohol) or indirect (i.e. the victimizer was under the influence of alcohol). 42(29.37%) cases were observed that had met with Road Traffic Accident under the influence of alcohol. The least common association was found to be among the fall from Height victims i.e. 1 (10.45%). In Sports related injury, however, no association was found. Alcohol was also associated with injuries due to burns in 7 cases.

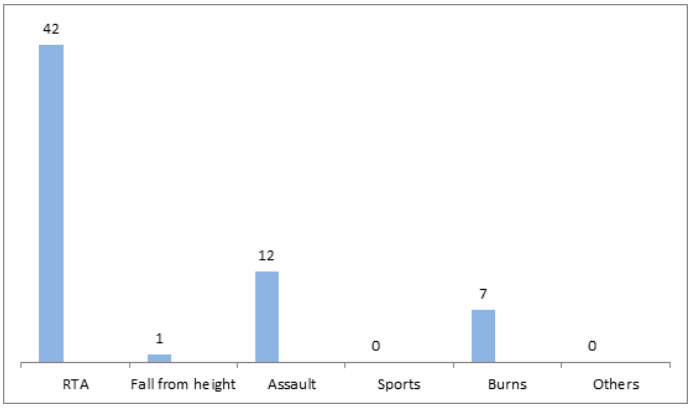

Figure 3: Association of alcohol with mechanism of injury

Table 4 shows the distribution of cases with various types of dominant facial injuries. Among the 257 cases studied the most common type of injury was found to be soft tissue injuries. Soft tissue injuries comprised of 168 (93.04 %) cases. Only 8 (4.23%) victims had bony fractures, while4(2.37%) cases had a mix of soft tissue injury and bony fracture. Out of the soft tissue injuries laceration is the most common with 79 (43.89%) cases.

Table 4: Distribution of cases according to type of dominant facial injuries

Type of Injury	Mechanism of Injury					Total	
	RTA	Fall from height	Assault	Sports	Other	N	%
A. Soft tissue injuries	36	2	6	1	1	46	24.89
1) Abrasion	63	3	10	1	2	79	43.89
2) Laceration							
3) Incised wounds	35	2	6	0	0	43	24.62
B. Bony Fractures	6	1	1	0	0	8	4.23
C. Combination of soft tissue injury and fracture	3	0	1	0	0	4	2.37
Total	143	8	24	2	3	N=180	

Figure 4 shows the different type of facial bone fractures in facial injury victims. The most common type of facial bone fractured was found to be the Mandible bone with 5 (39.45%) cases. Nasal bone fracture reported 4 (29.36%) cases followed by tooth fracture with 2 (17.43 %) cases. The least common type of fracture is Zygomatico-maxillary complex fracture, 1 (11 %) case.

Table 5 shows the location of injuries on face. The most common site of injury was Nose that was found among 58(32.22%) victims followed by Forehead with 55(30.55 %) cases. Cheek and Temporo-mandibular area accounted for 21.66 % (39) cases and the least common location was lip & oral cavity reporting 12(6.66 %) subjects.

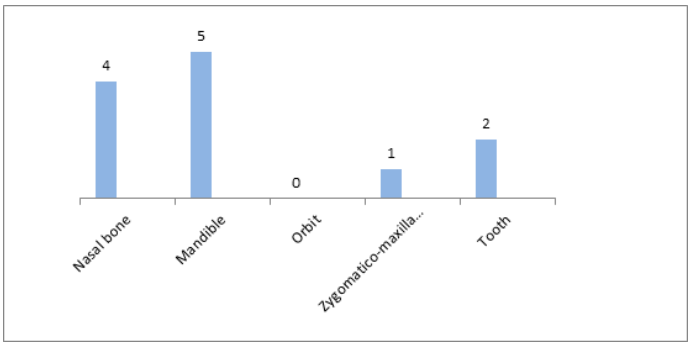

Figure 4: Type of fractures sustained in facial injury victims

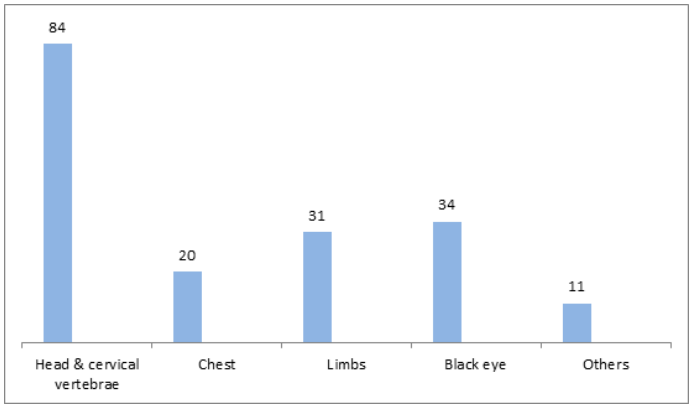

Figure 5: Distribution of the associated injuries, in relation with facial injuries

Table 5: Site of facial injuries among the victims

Site	N	%
Nose	58	32.22
Forehead	55	30.55
Lip & oral cavity	12	6.66
Eye lid and periocular area	15	8.33
Cheek and Temporo mandibular area	39	21.66
Total	180	100

Figure 5 shows the distribution of associated injuries common to facial injuries. The most common associated injury was Head injury and cervical spine injury with 84(46.66%) cases followed by Black eye with 34 (18.88%) cases and then Limb injury i.e. 31(17.22%) cases. The least common type of associated injury was Chest injury comprising 31(17.22 %) cases.

Discussion

The age of the victims varied from 15-80 years. The peak incidence was observed in the age group 15-24 years. Individuals in the age group of more than 65 years were the least affected. In this study 182 cases were males while 75 were females. Thus, a male: female ratio of 2.43:1 was observed. This is in accordance with previous studies.[2-9] The reason for high male incidence is probably due to men in most societies are more involved in driving and travelling. However, tendency towards an equal male to female ratio was observed[10] in many developed countries. This can be attributed to a changing work force and lifestyle.

In the study no individuals less than 15 years of age were found. This could be because the children have minimal use of vehicles or involvement in intentional violence or high energy sports. Similarly, lower proportion of accidents among individuals above 65 years is observed mostly because of the fact that they are less mobile and have limited outdoor activity.

The major mechanism of facial trauma is found to be attributed to Road Traffic Accident (RTA) which is in accordance with previous studies.[2,5,11-15] Delhi, in recent past, have witnessed a tremendous rise in RTA. This study justifies this with RTA as most common mechanism of injury in the list. Reasons are multifactorial like bad roads, use of mobile phones etc. Motorized two wheelers comprise the most commonly involved group in RTA due to two wheelers not being dynamically stable are prone to skid along with less use of safety helmets by the riders.

Interpersonal violence (*Assault)* was found to be 3rd most common cause of facial injuries with 09.33% (24) cases after RTA and burns, which is in accordance with previous studies.[1,7] Many researchers found that Assault & interpersonal violence is the major cause of facial trauma in developed countries as compared to RTA in developing countries, which could be due to the factors discussed above.[14,16-18]

Fall from Height (FFH) contributed to only 4.38 %(n=8) cases. It was found to be the 4th most common cause of facial trauma. The previous studies have shown fall from Height as an etiology of maxillofacial trauma.[1,4,6,7] Fall from Height could occur as a voluntary or involuntary act. In the former acts such as attempt to suicide is included. In the latter the fall is because of human negligence on the part of the victim or circumstances. The study found incidents of fall from Height in construction sites, during kite-flying. Very few cases were reported of fall from Height as a method of committing suicide (voluntary act). Sports injuries comprised of very trivial amount as compared with other mechanisms resulting in facial trauma, only 1% (2) cases.

In Males, the prevailing mechanism is RTA with 95.80 % (137), Consistent with previous stuidies.[2-7,9] Among Females, first cause of injury being Assault 16 (66.66%) cases out of total number of 24 assault cases. Previous studies [9-23] found that one third (33%) of female blunt assault facial trauma patients were subjects of domestic violence.

The soft tissue injuries are found to be more common than facial bone fractures; Laceration 79 (43.89%), followed by 43 incised wounds (24.62%) and abrasions 46 (24.89%). Fractures contributed to only 8 (4.23%) cases. This is in accordance with the previous studies done elsewhere.[1-2, 24-27] The differences in the above studies appear to be multifactorial and find their root in the differing social context of male and female trauma. Females are more prone to domestic violence and rape and less prone to involvement in criminal violence or gang violence. In assault victims the pattern is abrasion/bruises with 6(25%) cases followed by incised wounds with 6 (25%) cases and bony fractures 1 (4.16%). Lacerations 10 (41.66%) are the most common type of facial injury in assault victims. This in accordance with the earlier conducted studies.[28-31]

8 (4.23%) victims had bony fractures, while, 4(2.11%) cases had a mix of soft tissue injury and bony fracture. Mandible bone fracture reported 5 (41.66%) cases, followed, by Nasal bone fracture with 4 (33.33%) cases. Victims with tooth fracture were 2 (16.66 %) and the least number of cases were seen in Zygomatico-maxillary complex fracture i.e. 01 (8.33 %) cases. Mandibular fractures are one of the most common fractures of facial skeleton. The present study is in accordance with many studies done previously.[1,32-34]

Under influence of alcohol, assault as a mechanism of injury emerges out to be the major source behind victimization. 12(50%) out of 24 subjects. These victims either had a direct association with alcohol consumption or indirect (i.e. the victimizer was under the influence of alcohol). 42(29.37%) cases were observed that had met with Road Traffic Accident under the influence of alcohol. The least common association was found to be among the fall from height victims i.e. 1 (12.50%). These findings were based on the subjective assessment by Casualty Medical Officer (CMO) on duty. Similar assessment has been used by Nkombua[30] and other reserachers[2,26] in their analysis. Many researchers have also found similar pattern. There is, thus, a clear association between alcohol consumption and maxillofacial injuries. Impaired psychomotor function and increased risk-taking behaviour are

the two key inter-related factors involved in alcohol-related accidents. Exposure to alcohol also affects the function of various parts of the brain resulting in disruption of muscular co-ordination, reduced cognitive powers, reduced ability to judge distances and slower reaction time.

The most common associated injury was Head injury and Cervical Spine injury with 84 (46.66%) cases followed by Black eye (peri-orbital hemorrhage) with 34 (18.88%) cases and then Limb injury i.e. 31(17.22%) cases. The least common type of associated injury was Chest injury comprising 20(11.11 %) cases, and others 11 cases (06.11).This finding is in accordance with the previous studies.[2, 26-35] In this study we found that rainy season (July to Oct) recorded maximum number 115 cases (44.74%) followed by winter season (Nov. to Feb.) 84 cases (32.68%).The summer season recorded the least 58 (22.57%) cases. Poor visibility, flooded drains and pits near and on the roads makes driving more dangerous and control over the vehicle is difficult resulting in accidents. During the winters foggy weather is marked by poor visibility, resulting in road related accidents. In summers one can observe that lesser people ply on the roads due to the scorching heat, therefore, during this season lesser road related accidents are reported.

Conclusion

Although RTAs continue causing serious injuries and in many cases claiming the lives of the victims, so far little success has been achieved in curbing this menace. Control and check over the motorized as well as non-motorized traffic, Imparting knowledge about traffic rules with their strict implementation, Proper maintenance of roads, proper signs, Good lighting, Construction of subways and putting up of traffic lights, and zebra crossing are few steps which could reduce RTAs and their subsequent morbidity and mortality. Severe punishments, Incarceration and control of dangerous offenders, beefed up Security measures, Help-lines can help reduce instances of Assaults including domestic Violence.

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ORIGINAL ARTICLE

Demographic profile and outcome of near hanging cases presenting in tertiary care hospital in Northern part of India: An observational study

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Abstract
Suicide a serious public health issue every society is facing today and is highly preventable with timely and strategic intervention. Attempted suicide is often underreported in India. The present study aims to provide a complete demographic profile of near hanging cases which often go underreported from the medico-legal point of view. The present study is an observational study of patients presenting with near hanging and referred to the department of Forensic Medicine and Toxicology, for medico-legal opinion from Medicine Department of King George's Medical University, Lucknow. All the cases presenting with near hanging from November 2018 to November 2019 were studied. A total of 140 cases of near hanging were reported, out of 140 cases, 73 (52.14%) were male, and 67 (47.86%) were female. The most common age group involved was 21-30 years with male (62.96%), majority of the cases (57.14%) were married, and the common materials used for hanging were dupatta (39.29%). In the majority of cases, reason for hanging was a family dispute (40%) followed by marital disputes (21.43%). Majority of the patient (93.57%) had attempted hanging for the first time.84.29% of the patients got discharged, and in only 10% of cases, mortality was reported. Early hospitalization and rigorous medical intervention showed favorable outcome.

Keywords
Suicide; Near hanging; Ligature

Introduction

Suicide a serious public health issue every society is facing today; millions of people every year commit suicide and even much more attempt suicide. WHO says, “79% of suicides occur in low and middle-income countries and consumption of pesticides, hanging and firearm are amongst the most common methods of suicide globally”.[1] Suicide, despite being a global health issue, is still highly preventable with timely and strategic intervention. Attempted suicide reporting in Uttar Pradesh is only 3.6%, which seems to be quite underestimated.[2]

In India, the most common method adopted for suicide is pesticides, but in recent years suicide by hanging has increased by leaps and bounds. The grey area in reporting suicide is the attempted suicide cases which go underreported from the medicolegal point of view and demographic profile of such patients are not available or only partially available and it contributes significantly to the failure of National interventions for suicides.

Victims who survive an episode of asphyxial injury following attempted hanging, long enough to reach hospital is referred to as Near hanging. These are one of the most common causes of suicides among young adults; however, sufficient statistics are not available regarding its demographic profile in the Indian scenario.

The main aim of the present study is to study the demographic profile of patients with near hanging and their outcomes in hospital admitted patients, So, that medical health professionals involved in care of persons of attempted suicide need to update their knowledge to enhance their assessment and management skills to benefit people.

Material and Methods

This is an observational study of patients presenting with near hanging and referred to the department of Forensic Medicine & Toxicology for medico-legal opinion from Medicine Department, of King George's Medical University, Lucknow. All the cases presenting with near hanging from November 2018 to November 2019 were studied. The demographic profile, including age, sex, marital status, date of admission, type of material used, the motive behind the hanging, and hospital outcome were noted.

Results

A total of 140 cases of near hanging were reported, out of 140 cases, 73 (52.14%) were male, and 67(47.86%) were female.

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The most common age group involved was 21-30 years with males (62.96%) & female (37.04%) (Table 1). The majority of the cases (57.14%) were married (Table 2), and the common materials used for hanging were dupatta (39.29%), saree (16.43%), and cotton towel (15%) and in 5% of the cases, the material was unknown (Table 3).

Table 1: Age and sex wise distribution of the study population

Age group	Total	Male		Female	
		N	%	N	%
1-10	1	0	0%	1	100%
11-20	47	19	40.43%	28	59.57%
21-30	55	30	54.55%	25	45.45%
31-40	27	17	62.96%	10	37.04%
41-50	8	6	75%	2	25%
51-60	0	0	0	0	0
>60	2	1	50%	1	50%
	140	73	52.14%	67	47.86%

Table 2: Marital status of the study cases

Marital status	N	Percentage
Married	80	57.14%
Unmarried	58	41.43%
Widow	2	1.43%
Total	140	

Table 3: Classification of the study cases based on the type of ligature material used

Ligature material used	N	Percentage
Dupatta /Stole	55	39.29%
Saree	23	16.43%
Rope	18	12.86%
Wire(electric)	2	1.43%
Dhoti	7	5%
Cotton Towel/Muffler	21	15%
Curtain	1	0.71%
Bed sheet	4	2.86%
Unknown	7	5%
Plastic pipe	2	1.43%
Total	140	

The most common reason found for hanging was a family dispute (40%) followed by marital disputes (21.43%), a dispute with friends and police personnel were also reported (6.43%) (Table 4). The majority of the victims (93.57%) had no previous history of suicide attempts, and only in 6.43% (N=9) cases, a history of previous suicidal attempt was present. All the cases were admitted in Intensive care unit. However, 84.29% of the patients got discharged, and in only 10% of cases mortality was reported

Table 4: Motives for attempting suicide by hanging

Motive	N	Percentage
Marital dispute	30	21.43%
Family dispute	56	40%
Financial loss/Unemployment	12	8.57%
Other disputes (friend, love, etc	9	6.43%
Psychiatric issues	11	7.86%
Unknown reasons	22	15.71%
Total	140	

Discussion

A total of 140 cases were reported, which is much higher when compared to other published data in the literature. In this study, there was a male preponderance (52.14%), while a study published from Nepal shows equal preponderance among males and females[3] and a study by Mythri et al.[4] showed female preponderance, which is in contrast to our study. In our study, the majority of cases were reported between 11-40 years, which is nearly similar to the study of Ganesan, et al.[5] in which the most common age group involved was 21-59 years. Mostly young and middle-aged adults resorted to hanging as this age group is more exposed to stress related from family and work-related affairs.

The common material used for hanging were mainly daily dressing materials such as dupatta, saree, and cotton towel, as these materials are readily available at home. The reasons behind hanging were mostly family disputes, marital disputes followed by unemployment, disputes with friends, and even disputes with police officers were also noted in 2 cases. This is similar to other studies reported. [3,5] No History of previous suicidal attempts was seen in the majority of cases, which was similar to the study conducted by Ganesan et al.[5] The reason behind it seems to be that mostly suicide is an outcome of an impulsive behavior.

The mortality reported in the present study was 10% which is much higher than Ganesan et al., which reported 2.6%[5], but much less when compared to studies conducted in Texas which

reported 21% and the USA which reported 15%.[6,7] All the cases were admitted in Intensive care unit, but the majority of these (84.29%) were discharged, showing intensive care results in a good outcome. The majority of the cases only required supportive management. Renuka et al.[8] in their study concluded that a patient who reached alive at the hospital have a higher survival rate with aggressive management in ICU.

Conclusion

To conclude, near hanging cases have very good prognosis with prompt medical intervention and intensive care. To curb down further suicidal attempts, besides psychiatric counseling, awareness of family members and friends, to provide a supportive role to the patients also plays a very important role.

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ORIGINAL ARTICLE

Patterns of Suicides in Jaipur: An Autopsy Based Study

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Abstract
Suicide is an important cause of abrupt and preventable death. It is the consequence of mental, social, and psychological factors interplaying. Globally, suicide is one of the commonest causes of death especially in the most economically productive young age category. The forensic pathologist plays a crucial role in the determination of the manner of death as homicide, suicide, accident, or natural. Limited literature is available regarding the factors surrounding suicides and the rate of committing them in general population. This descriptive observational hospital-based study was undertaken to investigate suicide trends in the Jaipur region. In the present study, a total of 101 cases were studied, with male predominance, mostly belonged to 31-40-year age group, and rural population. Poisoning was observed as the most common method of suicide. The present research was conducted to know the magnitude and the socio-cultural factors of the problem of suicides so that a sound prevention program could be suggested, planned, and implemented for reducing the incidence of suicides.

Keywords
Autopsy; Cause of death; Death; Jaipur; Mortality; Suicide

Introduction

The term 'suicide' derived from SUI (of oneself) and CAEDES (murder),[1] which represent voluntary and intentional act of causing one's death.[2] The World Health Organization (WHO) describes the suicidal act as the injury with varying degrees of lethal intent and act with fatal outcome. Recently the term suicide has been replaced by "Intentional Self-Harm" (ISH) which has been included as intentional self-harm (ICD10).[3]

Suicide is an important cause of untimely and preventable death. Nevertheless, the interplay of behavioural, socioeconomic, and psychological factors is thought to occur.[4] Young people are ever more vulnerable to suicidal behaviour. Globally, suicide has involved the most economically productive age group (15-44 years).[5]

Suicide is aparamount health concern which is gaining increasing worldwide attention.[6] Reliable quantification of suicide deaths is timely as the Government of India's 12th five-year plan for 2012–17 includes chronic disease, injury, and mental health initiatives.[7] Here, we quantify suicide mortality within the ongoing Million Death Study (MDS) in India — one of the few nationally representative studies of the causes of death in any low or middle-income country.[8-10]

The methods adopted in suicide include consumption of poison, hanging, burns, drowning, and many others. The pattern of suicide in a region depends upon a variety of factors, such as availability and access of the method, socio-economic status of the individual and also the different avenue available in the community.[11] Knowing the pattern of suicide in an area not only helps in the early management of such cases but also suggests taking the earliest preventive measures.[12] The death investigators must be aware of the common scenarios, risk factors, methods, and victims as well as pitfalls that may be encountered.[13]

In Indian law, the act of suicide was legally punishable in consonance with the Right to life granted in the Indian Constitution and under sections 306 and 309 of the Indian Penal code.[14] However, a recent amendment has acknowledged the act of suicide as a domain of mental health issues, thus generating empathy for those who try to commit suicide. Suicides may be labelled as attempted ones if remain incomplete and the term committed suicide is more appropriate in cases where death occurs due to suicide.

The forensic pathologist plays a pivotal role in classifying the manner of death as homicide, suicide, accident, or natural. Both an extensive scene investigation and a thorough post mortem examination with complete toxicological study are warranted in the determination of a suicide. Although "classic" findings at the scene and at autopsy characterize a suicidal death, investigators should be astute to features that may have been intentionally altered to conceal the accurate manner of death.[14]

There is scarcity of literature on the effects of screening the general population on the ultimate rate of suicide.[15, 16] This study was thus initiated to study the pattern and the incidence of suicidal fatalities received for autopsy at the Department of Forensic Medicine, SMS Medical College, Jaipur. It is important to know the magnitude and the socio-cultural factors of the problem of suicides, so that a sound prevention

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programme could be suggested, planned and implemented for reducing the incidence of suicides and preventable mortalities.

Materials and Methods

The present study was a Hospital based descriptive, cross-sectional observational study that was carried out in the Department of Forensic Medicine, SMS Hospital and Medical College, Jaipur.

The time duration of the study was from June 2018 to July 2019. The aim of the present study was to establish the pattern of suicidal fatalities at SMS hospital, Jaipur, and, to find out the incidence of suicides among medico-legal autopsy cases brought to S.M.S. Hospital, Jaipur. Cases of suicidal deaths that were subjected to medico-legal autopsy at SMS Hospital, Jaipur were included in the study after obtaining informed written consent or participation in the study by relatives of the deceased. Cases which were hospitalized and survived after suicidal attempt or cases of suspected and undetermined suicide cases were excluded.

Results

The total incidences of alleged suicidal cases among the total medico legal autopsies conducted at SMS Hospital, Jaipur (India) was 12.6% which is less than a quarter of all medico-legal deaths reported (800). Out of total 101 suicidal cases, there were 61 males and 40 females in a ratio of about 3:2. In present study predominant cases were in 31-40-year age group (31.6%), followed by 21-30 years (28.7%) which is the active and productive age group. There were 64 cases from rural and 37 cases from urban regions. Thus, in spite of the location of the study centre at an urban area, more cases of suicidal deaths were received from the adjoining rural areas which show that suicidal deaths were more commonly observed in people from rural background as compared to those from urban areas. Predominant of the cases (93.6%) were of Hindu religion. Majority of the cases (44.5%) were educated up to primary level followed by illiterates (29.7%). Most of persons committing suicide were from lower (43.6%) and middle (47.5%) socio-economic status. Married persons were more (57.4%). In comparison to unmarried persons in committing suicide.80.2% suicidal deaths were seen in nuclear families as compared to 19.8% persons from joint families. Majority of suicidal deaths were seen in students (30.7%) followed by housewives (27.7%), daily wage workers (12.8%), unemployed persons (9.9%), farmers (8.9%) and businessmen class is least.

54.5% deaths from suicides occurred within 24 hours of the incidence. Suicide note was found in only 12 cases (11.9%). This reflects the need for investigation by police and Forensic personnel to determine the real manner of death in such cases.

In present study poisoning (46.5%) was recorded as the most common method of suicide followed by hanging (26.7%). Other causes of suicidal deaths include burns (12.9%) and railway injuries (8.9%). Most common poison used for suicide was organophosphates (34.8%), followed by Celphos and other pesticides and insecticides. In majority of cases of hanging, plastic wires (33.33%) were used as ligature material followed by different dress materials and ropes in equal proportions. Most common predisposing factor for committing suicide was family fight (40.6%) followed by mental illnesses (15.8%), chronic illness and debt (9.9% each) and failures in love (6.9%).

Discussion

A total of 12.6% cases of suicidal deaths were observed amongst all medico-legal autopsies on the basis of police record and alleged history narrated by the relatives and attendants of the deceased. The proportion of suicidal deaths among unnatural deaths is quite high in terms of value of human life. The most important aspect in this perspective is that these deaths are caused voluntarily by intentional self-harm. Suicidal deaths are preventable, if proper strategic measures of prevention of suicides are implemented on societal and administrative levels. The figures of proportion of suicidal deaths among other medico-legal deaths are quite high in the present study in comparison to 1.7% by Mohanty S et al. [6] and 2.4% by Rane A and Nadkarni A.[17] The higher rates observed in the present study are probably due to the modern lifestyle, increasing levels of stress in society especially the youths and active population of the society.

There was a male preponderance in this study with 60.4% males and 39.6% females. This is not very surprising as males are the active members of all societies and thus have to undergo more stress in daily life. Also, egoistic suicides are more common in males due to personality variation of both genders. Almost all earlier studies done in India as well as globally observed a male preponderance in cases of suicidal deaths. The results of the present study are similar to various studies conducted in the past.[6,17-24]

Considering the age wise distribution of suicidal cases, there were 60.4% deaths in 21-40 years of age followed by 26.7% deaths in 41-60 years of age group. Least numbers of suicidal deaths were observed among adolescents and adults still in their teens (5.9%). No suicide was observed at less than 10-year age. This reflects that majority of suicidal deaths were seen in young followed by middle aged adults which is obvious as this is most active age group in life. Most studies had reported a preponderance of suicides in this bread earning age group of life.[6,19,23,24]

Out of the 101 cases of suicidal fatalities received during the

study period there were 64 cases from rural and 37 cases from urban regions. This could be due to higher proportion of population residing in the rural areas. Similar results were reported by Mohanty S et al.[6] In present study, most of the person who committed suicide were educated up to primary level (44.5%) only. A large number of victims (29.7%) were illiterate also. This indicate that lower literacy level is associated with higher number of suicidal acts.[6,17,23]

Majority of persons committing suicide were from lower (43.6%) and middle (47.5%) socio-economic status; similar observations were reported by Mohanty S et al.[6] Majority of suicidal deaths were seen in students (30.7%) followed by housewives (27.7%). Similar results were reported by Kumar S et al. [23], Rane A and Nadkarni A [17] Married persons were predominant in comparison to unmarried persons committing suicide (57.4%). Similar results have been reported by Behera A et al. [19] and Mohanty S et al. [6] 54.5% deaths from suicides. In present study poisoning (46.5%) was found as the most common method of suicide followed by hanging (26.7%), and railway incidents (8.9%). The results of the present study are similar to those of Mohanty S et al.[6] and those in the study of Kumar S, et al.[23] Suicide due to poison is the most common method among males (31%), followed by hanging (26%), firearms (16%), burns (11%), drowning (10%), and, finally, falling from a height (6%); and Chettri et al [25] Hanging (94.8%) was found to be the significantly common method adopted for suicide by both males and females followed by jumping (2.1%), poisoning (1.4%), drowning (0.3%), overconsumption of alcohol (0.3%), stabbing (0.3%), and consumption of kerosene oil (0.1%). No suicidal death was reported by gunshot wound during the study period as the use of firearms in not very common in the region of the present study.

Deaths due to Organophosphosphates poisoning (34%) were most common, followed by Celphos and other pesticides and insecticides. Most probable reason for committing suicide in the present study was related to family fight (40.6%) followed by mental illnesses (15.8%), chronic illness and debt (9.9% each) and failures in love (6.9%). in 16.8% cases, the reason for committing suicide remained undetermined. Mental illness was a quite common cause for suicide in the present study and was observed in 15.8% cases. These figures (32%) are less than those observed by Yasamy MT et al.[18]

Conclusion

The present study reflected that the highest proportion of suicidal deaths was observed in the most productive age group of life of 21-60 years of age with a male preponderance and was more commonly observed in married persons of lower and middle socio-economic status with lower educational status. The most common victims of suicides in the present study were students and housewives, followed by labours and unemployed people. The most commonly employed method of suicide was poisoning followed by hanging. Railway injuries were other commonly employed methods in the present study. The act leading to the commission suicide is dependent on different social, cultural and psychological factors. Individuals having suicidal ideations often find themselves unable to seek assistance and help due to the stigma attached to mental disorders. The number of suicide attempts outweigh the number of actual suicides, and an individual who has already attempted to commit suicide will often try again. Thus, for effective suicide prevention, enhanced accessibility and quality of data from vital registration, hospital information system (HIS) and routine surveys are essential. Also, another important aspect in suicide prevention efforts is restricting the access to the means of committing suicide. The quality of the information about suicide in India is quite limited. Thus, periodical efficient researches in this domain are advocated for regular observation of patterns of suicidal deaths and effective planning and implementation of preventive measures planned according to observed parameters.

There is need for further evaluation of sequence to be included in the forensic measurement and observation analysis sequences as it can provide useful information about recent trends. There is an urgent need for devising feasible method for prevention of suicidal death and strategic implementation of those preventive measures.

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ORIGINAL ARTICLE

Medico legal study of female burn victims: A circumstantial context

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Abstract

Female burns are the burning problem of Indian society. Accidental, suicidal and homicidal burns have been reported in the women. A circumstantial approach is required to analyse the circumstances of female burns. A retrospective study of medicolegal autopsies was carried out for autopsies conducted between January 2016 and December, 2018 in the mortuary of the Government Medical College, Anantapuramu. The majority of incidents happened in the kitchen; frequently in the evening hours. Most of the homicidal and accidental burns were first noticed by their husbands or in-laws. The majority of them rescued either by in-laws, husbands or neighbors. In large number of cases police was intimated by the medical officer as a part of their duty.

Keywords

Burning; Kerosene stoves; Rescue measures; Injuries; Medicolegal autopsies; Police intimation.

Introduction

Medico- legal study is the study of, relating to, or concerned with both medicine and law, as when medical testing or examination is undertaken for a legal purpose.[1] Burn is an injury which caused by the application of heat chemical substances to the external or internal surfaces of the body causing tissue destruction. [2] Fire was man's incidental discovery and acts as double-edged sword, it has served and destroyed mankind.[3] The term burn is popularly used for all injuries caused in the form of heat.[4] Human tissue can survive of limited range of temperature, 22-44^{o}C.[5] Burns are a major health problem worldwide, with annual estimated deaths of 180 000. The majority of these occur in middle- and lower-income groups. In India, over 1 million people are moderately or severely burnt every year.[6] In India around 7 million people suffer from burn injuries each year from 1.5 lakh deaths and 2.4 lakh people suffer with disability.[7] Female burning especially in India has become a major problem of our great concern. Day to day in life we find in the newspapers, news channels of young women either being burning by force to commit suicide or else they are being burnt by the husband or in-laws or by accidental burnings.

Material and Methods

A retrospective study of medicolegal autopsies was carried out for autopsies conducted between January 2016 and December, 2018 in the mortuary of the Government Medical College, Anantapuramu. Ethical approval was taken from our Institutional Ethics Committee prior to commencement of the study. The present work was restricted to the flame burns victims only. Various data in the aforesaid number of cases were collected from 1) Police Inquest 2) First Information Report 3) hospital records, 4). Interviewing husband and in-laws, parents, neighbors and friends, and 5) proper postmortem examination. Apart from these, the natures of deaths were also evaluated by the exclusion method, more so especially in the homicidal deaths. But some positive approaches were also used – like inconsistent statements by the different persons amongst in-laws and husband and their behavior, presence of suspicious injuries, bona fide statements made by dying persons etc. In this way various data related to the circumstantial nature of burning were collected, compiled and discussed as below.

Results

A total of 127 female burnt victims were examined during the study period. Most of the cases were suicides followed by homicidal burns (Table 1). The majority of incidents happened in the kitchen (N=74), followed by in the store rooms (N=17). Distribution of cases for the site of incident is show in Table 2. Most of incidents happened during evening hours (N=58) followed by morning hours (N=40), night hours (N=15), and mid-day (N=14). Distribution of cases according to the time of incidence are detailed in Table 3. Many incidents were due to the use of kerosene stoves (N=94). The distribution of cases for the causative agents is shown in Table 4. The maximum number of incidents were first noticed by in-laws in 55 cases followed by neighbors, husband, parents and children, as shown in Table 5.

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Table 1: Manner of death

Manner	N	%
Suicide	85	66.93%
Accident	38	29.92%
Homicide	4	3.15%

Table 2: Place of burn

Place	Suicidal		Accidental		Homicidal		Total	Percentage
	N	%	N	%	N	%		
Kitchen	42	49.41	29	76.31	3	75	74	73.37%
Living room	7	8.23	4	10.52	1	25	12	9.45%
Water closet	13	15.29	Nil	Nil	Nil	Nil	13	10.24%
Storeroom	16	18.82	1	2.63	Nil	Nil	17	13.39%
Verandah	2	2.35	1	2.63	Nil	Nil	3	2.37%
Corridor	3	3.52	1	2.63	Nil	Nil	4	3.15%
Open space	2	2.35	2	5.26	Nil	Nil	4	3.15%
Total	85		38		4		127	100

Table 3: Time of incident

Time of incident	Suicide		Accident		Homicide		Total	Percentage
	N	%	N	%	N	%		
Morning 4am-10am	21	24.70	18	47.37	1	25	40	39.79%
Midday 10am-4pm	12	14.11	2	5.27	Nil	–	14	11.02%
Evening 4pm-6pm	45	52.94	13	34.21	Nil	–	58	55.24%
Night 6pm-4am	7	8.23	5	13.15	3	75	15	14.37%
Total	85		38		4		127	100

Table 4: Source of the burns

Source	Suicide		Accident		Homicide		Total	Percentage
	N	%	N	%	N	%		
Kerosene	79	93	14	36.8	1	25	94	93.79%
LPG gas	2	2.4	5	13.1	1	25	8	6.30%
Petrol	4	4.7	2	5.2	2	50	8	6.30
Diwali cracker	Nil	_	6	15.8	Nil	_	6	4.72%
Wood cooking	Nil	_	11	28.9	Nil	_	11	8.67%
Total	85		38		4		127	100

In the majority of the cases (N=74) no rescue measure was taken. while in others, some kind of rescue were reportedly provided either by in-laws in (N=18), parents (N=13), husbands (N=11), neighbors (N=9) and by children in 2 cases. In the present study the majority of the persons (N=29), who tried to rescue the victims sustained no burn injury. In 49 cases, police were informed about the incidents, of burnt victim within 6 hours, followed by 6-12 hours in 39 cases, 12-24 hours in 31 cases, and after 24 hours in 8 cases. In large number of cases (N=82), medical officer was the first person to inform the incident to police followed by neighbors (N=15), parents (N=13) in-laws (N=11), and husband (N=2).

Table 5: Person who noticed the incident at first

Person	Suicide		Accident		Homicide		Total	Percentage
	N	%	N	%	N	%		
Husband	8	9.41	7	18.4	1	25	16	17.79%
In-Laws	34	40	19	50	2	50	55	43.31%
Children	4	4.7	3	7.9	1	25	8	6.30%
Parents	11	12.9	5	13.1	Nil	–	16	12.60%
Neighbors	28	32.9	4	10.5	Nil	–	32	25.20%
Total	85		38		4		127	100

Discussion

In our study, deaths due to suicide were more common. This is consistent to the study of Vidhate and Pathak.[8] On the contrary, various other studies[9,10] reported majority deaths from accidental burns. Most of the victims were married females. This is consistent with studies done by Kumar,[9] and Daruwalla et al.[11]

As far as the place where the burn injury is sustained, most of the incidents happened in the kitchen. The reason is Indian females are involved in kitchen and kitchen related activities place them at high risk of fatal burn either in suicidal or accidental burns. More than half of the suicidal burns and accidental burns occurred in kitchen, which is self-explanatory whereas about three fourths (75%) of homicidal victims were burnt in the kitchen in an attempt to make them look like cases of accidental burns while cooking etc. Gupta and Shrivastava[12] reported half off the deaths were due to cooking on open fires and loose synthetic sarees of the victims.

Kerosene stove and wood cooking were responsible for the majority of accidental burns which are the most common means of cooking in rural areas But the suicidal and accidental burnings with kerosene (21 and 4 cases respectively) is highly suspicious and probably were family quarrels and marital disharmony are the two important predisposing factors.[13] Kerosene lamps that are still frequently used for light during dark hours. Natu etal.[14] in her study of 409 married burn cases reported that the pressure stoves were the source of fire in about 129 cases, fire wood gas or petrol in 78 cases, kerosene lamps in 61 cases and match stick in 3 cases and in the rest of the victims some other factors were responsible. Singh et al.[15] detected that majority of the suicidal burnings were performed by soaking the clothing and the body with some inflammable substance such as kerosene oil, and then setting fire with

matchstick. Dasgupta and Tripathi[16] in their study found that the largest number of burn deaths were due to the use of match sticks (35.6%) followed by wood cooking (28.7%), stoves (18.39%), angithi/coke oven (11.49%) and kerosene lamp (5.75%).

The maximum number of suicidal burning victims were first noticed by in-laws in 34 (40%) cases and neighbours in 28(22.04%) cases. As being involved in the criminal act, in-laws are most frequently present at the scene also to mask the incident as accidental one; and also few suicidal incidences occurring in a closed space and frequently bolted room from inside, usually in the lonely house, were first noticed by the neighbors. In the 4 cases of homicide, 2 were noticed by in-laws, and 1 each by husband and children.

Amongst homicidal burns, in half off the cases no rescue measures were attempted, while some kind of rescue measures were reportedly given either by husband in one case and in-laws in one case. Rescue measures attempted by in-laws and husbands in homicidal deaths might be just a false statement or might have been actually attempted only when neighbors reached on the spot just to cover the homicidal nature of the crime. But on further investigation the injuries sustained by the husband and/or in-laws in abetment cases were not due to rescuing, as stated by them, but it was due to struggle while burning the victims. As people have become a bit cautious in regard to law about married female burnings, hence in most of the cases police are informed as early as possible if it is not unfavorable to them. Since burning incidents are always associated with medicolegal implications, hence in most of the burn deaths medical officer was the first person to inform it to police.

Conclusion

Female burns are a burning problem of our society. Medicolegal expertise is required to look into the complex nature of circumstances of burn injuries sustained by the victims. Henceforth every medico legist must be thoroughly conversant with the circumstantial nature of the burn injuries as he will be frequently called upon by the court of law to help in the administration of justice.

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The pattern of unnatural female deaths in Lucknow district – A post mortem study

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Abstract

Uttar Pradesh has topped the list with 56,011 cases of crime against a woman in 2017, this includes murder, rape, dowry death, suicide, abatement etc. A steady increase in the number of road traffic accidents, accidental burns, poisoning, drowning, electrocution, as well as increase in crime &domestic violence against females or dowry deaths has also been observed in last few decades. So the aim of our study was to study and compare the pattern of unnatural deaths in female autopsy cases brought in the mortuary of KGMU, Lucknow from year November 2017 to October 2018 and November 2018 to October 2019. A total 2,437 female autopsy cases with 1239 cases in Year 1 and 1198 cases in Year 2, was brought. Parameters such as age, religion, region (rural or urban), seasonal variation and cause of death were analyzed. The results in our study showed that out of total 10,458 cases, 2,437 (23.30%) were female deaths. Majority of females deaths were from rural areas. The most common age group affected in both years was 21-30 years with 422 (34.06%) cases in Year 1 & 425 (35.48%) cases in Year 2. There was no specific seasonal variation. The deceased females were mostly Hindus followed by Muslims. Most common unnatural causes of death was seen to be due be blunt trauma, followed by burn, and asphyxial deaths, and the most common age group involved was 21-30 years, which suggest that drastic measures and strengthening of on-going means, like road safety measures, safe cooking, awareness and education of female child about sex and sex related offences are still needed at large.

Keywords

Female deaths; Unnatural deaths; Road traffic accidents.

Introduction

India is the 2nd largest populated country in the world. According to 2011 census, the female population of India is 497 million. In Uttar Pradesh, the female population is about 95,331,831. A number of deaths occur across the world due to unnatural causes.[3] Uttar Pradesh has topped the list with 56,011 cases of crime against a woman in 2017, this includes murder, rape, dowry death, suicide, abatement etc.[1] Lucknow being the capital city of Uttar Pradesh, is not only one of the most populous city of the state, but also cadres a large area of its district. Being a tertiary referral center, it also serves several small surrounding districts (Hardoi, Sitapur, Barabanki, Unnao etc.) for the treatment as well as the autopsy of various unnatural deaths. A steady increase in the number of road traffic accidents, accidental burns, poisoning, drowning, electrocution, as well as increase in crime & domestic violence against females or dowry deaths has been observed in last few decades.[2] With the growth of society with recent advances in science and technologies, the trend of unnatural deaths has been changing variedly. The main aim of present study is to study the pattern of female deaths who are vulnerable to various types of unnatural deaths, in Lucknow district. So stringent laws and regulations can be formulated and applied to reduce female deaths.

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Material and Methods

Present study is a retrospective, comparative study conducted at KGMU mortuary, Lucknow from available data from Year 1 (November 2017 to October 2018) and Year 2 (November 2018 to October 2019). Approval was taken from the Institutional Ethical committee, KGMU, Lucknow before the commencement of the study. The investigation was done on the basis of the detailed postmortem examination and various parameters like region (rural or urban), age, religion, seasonal variation, and causes of death were studied.

Results

In the year (2017-2019), a of total 10,458 cases were brought to the mortuary. out of which 2437 (23.30%) were female deaths and out of which 1,239 (50.84%) female deaths were seen in Year 1, while 1,198 (49.16%) female deaths in Year 2. Majority of the cases in both years belong from rural areas with 916 (73.93%) in Year 1 and 862 (71.95%) cases in Year 2. Only 26.07% cases in Year 1 and 28.05% cases in Year 2 were from Urban areas (Table 1))

Table 1: Regional distribution of the study population

	Year 1	%	Year 2	%
Rural	916	73.93%	862	71.95%
Urban	323	26.07%	336	28.05%
Total	1239		1198	

Table 2: Age distribution of the study population

Age groups	Year 1	Percentage	Year 2	Percentage
0-10	41	3.31%	44	3.67%
11-20	259	20.90%	183	15.27%
21-30	422	34.06%	425	35.48%
31-40	216	17.43%	201	16.78%
41-50	119	9.60%	142	11.85%
51-60	97	7.83%	109	9.10%
61-70	49	3.95%	62	5.18%
71-80	25	2.02%	22	1.84%
>80	8	0.65%	4	0.33%
Fetus	3	0.24%	6	0.50%
Total	1239		1198	

Table 3: Seasonal variation on number of female deaths in years 1 and 2

Months	Year 1	Percentage	Year 2	Percentage
Nov - Jan	261	21.07%	282	23.54%
Feb - Apr	288	23.24%	352	29.38%
May - Jul	358	28.89%	299	24.96%
Aug - Oct	332	26.80%	265	22.12%
Total	1239		1198	

Table 4: Distribution of study population based on their religion

Religion	Year 1	Percentage	Year 2	Percentage
Hindu	1132	91.36%	1098	91.65%
Muslim	104	8.39%	92	7.68%
Christian	0	0%	2	0.17%
Unknown	3	0.24%	6	0.50%
Total	1239		1198	

The most common age group affected in both years was 21-30 years with 422 (34.06%) cases in Year 1 & 425 (35.48%) cases in Year 2. While the least no. of cases was seen in elderly females of >80 years with only 8 (0.65%) cases in Year 1 and 4 (0.33%) cases in Year 2. A total of 9 cases of female fetal deaths, 3(0.24%) cases in Year1 and 6 (0.50%) cases in Year 2 were also seen (Table 2). No specific seasonal variation was seen during both year (Table 3). Majority of the cases in both year belong to Hindus with 1132 (9136%) cases and 1098 (91.65%) cases and religion could be not be ascertained among 9 female fetuses in both the years (Table 4).

Table 6: Cause of death in relation to age group from November 2017 to October 2019

	Age groups (in years)								
	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	>80
Blunt trauma	46 (1.89%)	99 (4.06%)	179 (7.35%)	166 (6.81%)	143 (5.87%)	140 (5.74%)	64 (2.63%)	26 (1.07%)	5 (0.21%)
Burn	11 (0.45%)	121 (4.97%)	328 (13.46%)	125 (5.13%)	38 (1.56%)	21 (0.86%)	10 (0.41%)	10 (0.41%)	4 (0.16%)
Drowning	6 (0.25%)	11 (0.45%)	13 (0.53%)	4 (0.16%)	2 (0.08%)	2 (0.08%)	2 (0.08%)	0	0
Smothering	2 (0.08%)	0	2 (0.08%)	0	0	0	2 (0.08%)	0	0
Strangulation	0	2 (0.08%)	4 (0.16%)	0	2 (0.08%)	0	0	0	0
Hanging	0	135 (5.54%)	190 (7.80%)	39 (1.60%)	25 (1.03%)	5 (0.21%)	8 (0.33%)	0	4 (0.16%)
Throttling	0	2 (0.08%)	2 (0.08%)	2 (0.08%)	0	2 (0.08%)	0	0	0
Suffocation	4 (0.16%)	0	4 (0.16%)	0	0	0	0	0	0
Electrocution	8 (0.33%)	2 (0.08%)	8 (0.33%)	7 (0.29%)	4 (0.16%)	0	0	0	0
Firearm	0	2 (0.08%)	7 (0.29%)	0	5 (0.21%)	0	0	0	0
Cut throat	2 (0.08%)	0	0	2 (0.08%)	0	0	0	0	0
Snake bite	0	4 (0.16%)	7 (0.29%)	0	0	0	0	0	0
Poisoning	0	2 (0.08%)	2 (0.08%)	4 (0.16%)	0	0	0	0	0
Natural Causes	2 (0.08%)	0	11 (0.45%)	8 (0.33%)	10 (0.41%)	8 (0.33%)	10 (0.41%)	10 (0.41%)	2 (0.08%)
Total	2437								

Table 5: Distribution of study population based on cause of death

Cause of Death	Year 1	Percentage	Year 2	Percentage
Blunt Trauma	458	36.97%	404	33.72%
Burn	342	27.60%	324	27.05%
Hanging	212	17.11%	190	15.86%
Drowning	20	1.61%	18	1.50%
Smothering	3	0.24%	2	0.17%
Throttling	4	0.32%	2	0.17%
Strangulation	0	0	8	0.67%
Suffocation	0	0	8	0.68%
Electrocution	10	0.81%	20	1.67%
Fire Arm	6	0.48%	8	0.68%
Snake Bite	9	0.73%	2	0.17%
Poisoning	4	0.32%	2	0.17%
Cut throat	0	0	2	0.17%
Natural	27	2.18%	38	3.17%
Unknown	144	11.62%	170	14.19%
Total	1239		1198	

On studying the pattern of cause of death it was found the most common cause of death was seen to be due to blunt trauma with 458 (36.97%) cases in Year 1 and 404 (33.72%) cases in Year 2 and the second most common cause of death was due to burn with 342 (27.60%) cases in Year 1 and 324 (27.05%) cases in Year 2. Asphyxial deaths were amongst the third most common cause of deaths and in majority of the asphyxial deaths, hanging was most prevalent in both the years with 212 (17.11%) cases in Year 1 and 190 (15.86%) cases in Year 2. In 144 (11.62%) cases in Year 1 and 170 (14.19%) cases in Year 2 cause of death could not be ascertained (Table 5). On studying the causes of death in different age groups, it was found to be that in between 21-30 years, burn 328 (13.46%) cases are the most common cause of death followed by hanging 190 (7.80%) cases and then blunt trauma 179 (7.35%) cases (Table 6).

Discussion

In the present study comparative study of pattern of cases in both years was also done, but significant change in pattern was not observed, which suggests that drastic measures are still required and strengthening of on-going means, like road safety measures, safe cooking, awareness and education of female child about sex and sex related offences etc. are needed.

Our study revealed that the age group which was most commonly affected was 21-30 years which was consistent with findings at Manipur, by Meera et al.[2] where 36.3% females lie in this age group. It is also similar with the study performed by Sane et al.[4] in South Bangalore, which said that third decade of life was the most common age group. According to another study by Sharma et al.,[5] the age group of 21-25 years accounted for the maximum victims, 436 (26%), followed by the age group 26-30 years, 376 (23%) at Chandigarh. Similarly, according to a study conducted by Ijomone et al.,[6] in Niger delta, the peak incidence of unnatural death occurred in the third decade (27.1%) which is consistent with our present study with 34.06% in year 1 and 35.48% in year 2, as this age group is the most active group both in indoor and outdoor activities.

In our study blunt trauma was seen to be the common cause of death with 36.97% in year 1 and 33.72% in year 2, which was similar to study at Chandigarh by Sharma et al.,[5] saying that Road traffic accidents (RTA) accounted for the maximum cases. Similarly, Meera et al.[2] also said that in their study that 68.4% of the cases were victims of road traffic accidents. Ijomone et al.[6] in their study at Niger delta also said that Road traffic accident (RTA) accounts for 59.6% of accidental deaths and 29.1% of unnatural deaths. Burns is the second leading causes of accidental deaths representing 11(23.4%) by ljomone et al.,[6] which is similar to our study where burns (27.60% in year 1 and 27.05 % in year 2) appeared to be second leading cause of death. In the study by Sane et al.[4] in South Bangalore, hanging was the most common cause of death (71.8%,), followed by poisoning (11.8%,) which is not consistent with our study.

In our study rural cases with 73.93% in year 1 and 71.95% in year 2 were more common than urban cases, while in study at Chandigarh by Sharma et al.,[5] the urban:rural ratio of various unnatural deaths amongst was 1.7:1 which was varying from our study as the majority of the population in our study stays in rural areas.

In present study, the deceased females mostly belonged to Hindu religion, followed by Muslims similar to Sane et al.[4] in South Bangalore saying that, Hindus (92.9%, n=79) comprised the single largest category followed by Christians and then Muslims.

Conclusion

In comparing the both years it was observed that pattern of death was quite similar, and only a slight decrease in number of case was observed, so in order to curb down rising female death, there should be development of proper road traffic system, proper traffic guidance among all the communities & strictly abiding traffic rules in cities as well as on highways, in home front female needs to be educated about the concept of safe cooking and adoption of safer cooking means, strict laws to be developed for female protections against all kinds of atrocities, a modern females is suffering and last but not the least is compulsory education of female child.

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ORIGINAL ARTICLE

Psychosis in alcohol addicts

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Abstract
Psychosis is the commonly reported psychiatric condition in the psychiatry department. With the social and some traditional ways of treating this psychosis is by consuming alcohol. But many of them are not aware that alcohol itself can take them into psychotic conditions. To make the differentiation between the real psychosis patient and those who are victim of psychosis by consuming alcohol in heavy quantity. The study is to know the possibility of alcohol induced psychosis reporting without really knowing the fact that alcohol can also induce psychosis. This was a clinic-based cross-sectional descriptive study. The study consisted of 1000 alcohol-dependent patients. The main aim of the study was to find out the prevalence of alcohol-induced psychosis in society among the alcohol users. The mean age of the sample was 30.74 years and the majority of the patients were below 40 years. The majority of the patients were males (92%), married (88%), Hindus (92%). The majority were from below class II socioeconomic class as per the classification by Prasad. About 68% of patients initiated the consumption of alcohol between the age group of 30-40 years. About 52% were consuming alcohol for a period between 10-20 years. Female alcoholics had later age initiation of alcohol consumption, long duration of alcohol consumption and longer years consumption prior to becoming alcohol dependent. Alcohol-induced psychosis was present in 37% of patients. The age at initiation of alcohol consumption, the duration of consumption, and the duration of consumption prior to becoming dependent did not have any bearing on the onset of alcohol-induced psychosis.

Keywords
Alcohol; Psychosis; Alcohol dependence

Introduction

Alcohol is being used and abused throughout the history of mankind. The Old Testament prescribed the use of wine in religious rituals.[1] Alcoholic beverages have been used since the dawn of civilization. The common use of alcohol is well documented in the earliest writings of Mesopotamia & Egypt. In those writings, descriptions of drunkenness were frequent, as were prescribed remedies.[1,2] Ancient Cuneiform and Hieroglyphic inscriptions describe both the normal and abnormal use of alcohol.[1] The widespread use of alcoholic beverages was characteristic of all early civilizations, the oriental, the Greek and the Roman although the attitudes towards the drunkenness varied widely from place to place[1]. Long term alcohol consumption is associated with medical, neurological, and psychosocial complications.[3] One of these complications involves Alcohol-Induced Psychosis, a secondary psychosis in which contact with reality is compromised by delusions and hallucinations that occur during alcohol-related conditions such as acute intoxication, withdrawal, alcohol idiosyncratic intoxication, or when there is a major reduction of alcohol consumption. Among these one category alcohol psychosis is the unusual condition called idiosyncratic intoxication that occurs when even a small quantity of alcohol causes severe reactions and intoxication. This is characterized by aggression, impaired consciousness, prolonged sleep, transient hallucinations, illusions, and delusions. These are the most common symptoms reported in elderly people and are followed by amnesia. Alcoholism is risk factors for violent behavior, and several studies provide support this contribution of substance abuse to lethal violence by individuals with psychosis.[4, 5]

In the literature search about the psychosis, substance abuse in individuals with Capgras syndrome, with symptoms of delusion and misidentification, who have committed severe violence, including homicide are high in number.[6,7] Hence to differentiate the alcohol induced psychosis from the other origin for psychosis this study is undertaken.

Materials and Methods

Aims and objectives**:** To find out the prevalence of psychosis in alcohol-dependent syndrome individuals, and also to differentiate the violent behavior of the individual due to alcohol consumption from other psychiatric/medical conditions.

After obtaining the Ethical committee clearance from the psychiatric hospital and these are the subjects who never came to the hospital, but they have been interrogated in the community. The sample subjects who fulfilled the criteria for

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"Alcohol Dependence Syndrome" were selected from different Villages, near Davangere. 1000 patients from the community. Since the sample size was defined to have 1000 individuals the duration of the study was not noted accurately.

Duration of the study: Approximately 3 years, Sample selection: consecutive patients who fulfilled inclusion criteria.

Type of study: Cross-sectional.

Inclusion criteria: All the Patients who meet ICD-10 Criteria for "Alcohol Dependence Syndrome"in the age group: - 18-55 years.Belonging to both genders. And consent was taken: Agreed to participate in the study (consent of the Parents/relatives/ attendee of the individual was obtained in the presence of witnesses).

Exclusion criteria: Chronic physical illnesses: Hypertension, Diabetes Mellitus, Cerebro-Vascular Accidents, Endocrine & Neurological disorders except peripheral neuropathy, history of psychotic illness prior to Alcohol use and Co-existing other drug abuse/ dependence.

Table 1: Socio-Demographic Details: Gender wise distribution of Sample

Characteristics	Sample N=1000	Male N=920	Female N=80
Age: Mean& S.D (in Years)	37-64± 9.10	35.81 ±7.69	51.5 ±2.18
20-30 Years	280	280	--
30-40 Year	520	480	40
40-50 Years	120	120	--
>50 Years	80	40	40
Marital Status			
Married	880	800	80
Unmarried	120	120	--
Religion			
Hindu	920	840	80
Muslim	80	80	--
Education S tatus Mean & S.D	8.04 ±3.40	8.73 ±4.88	--
Nil	200	120	80
Up-to S.S.L.C	560	560	--
PUC to Degree	240	240	--
Occupation			
Agriculture	320	320	--
Business	200	200	--
Employed -G	040	40	--
Employed -P	120	120	--
Coolie	280	240	40
Household	40	--	40
Social Class			
I	80	80	--
II	400	360	40
III	240	200	40
IV	200	200	--
V	80	80	--

Procedure: Patients in the community who fulfilled the ICD-10 diagnostic criteria for Alcohol Dependence Syndrome were screened for inclusion and exclusion criteria.[8] Those who qualified for inclusion and gave consent for the study were interviewed. The general information was collected using a pre-designed general information sheet. Socioeconomic status was determined using the Classification of Social Class by Prasad. The subjects were assessed for ICD-10 criteria for alcohol-induced psychosis. The severity of psychotic symptoms was rated using the Brief Psychiatric Rating Scale.

Results

The mean age of the sample was 37.64 ± 12.23 years when it was split into different age groups the majority (80%) were below 40 years of age. And about 52% were between 30-40 years. A large number of patients in the age group between 30-40 years may be due to the emergence of alcohol-related problems and the need to seek help in that age group. The pressure from the family members, peers and superiors might

Table 2: Comparison between age at initiation, duration of alcohol intake & Dependence of Alcohol.

	Total N=1000	Male N=920	Female N=80	Significance t test df =98	Confidential Interval 95%
Age at Initiation Mean & S.D (Years)	19.32±5.44	19.96±5.3	27 ±8.55		
< 20 Years	680			"t"=3.41	2.95 - 11.4
20-30 Years	240	680	--		
30-40 Years	080	240	--		
		--	080	P<0.002	
				Significant	
Duration of Alcohol intake					
Mean& S.D (Years)	15.24±9.17				
<10 Years	360	13.7±5.99	24.5±15.73	"t" =4.10	
10-20 Years	520				
>20 Years	120	360	--		5.58 – 16.03
		520	040	P<0.01	
		120	040		
				Significant	
Dependence of Alcohol Mean & S.D (Years)	6.32± 4.71	6.14±4.87	8.5±1.60	"t=1.37	
1-5 years					
5-10 Years	640				
10-15 years	240				
15-20 Years	040	640	--	P<1.07	
	080	160	080		1.06 - 5.8
		040	--	Not	
		080	--	Significant	

force this group to seek medical help as it is in this group they are expected to take up an independent career. Though the study was open to both genders, predominance was of the male population. Female patients were few. Majority of married persons (88%) is in agreement in many studies. 92% of the subjects were belonging to the Hindu religion and 8% were Muslim religion. The mean education of the sample was 8.04±3.40 years, about 76% of them had less than 10 years of education. 32% were agriculturists, 28% were laborers and rest were either employed or businessmen which is understandable from the sample which had rural and semi-urban populations.

Table 3: BPRS score in ADS

BPRS Score	Psychosis N=370	Non Psychosis N=360	Only ADS N=270	Statistics. One way Anova,
Mean & S.D	80.51± 8.52	41±8.9	38.94±8.73	F=255.17, df=2,97 P<0.001 Highly Significant

Table 4: Age at initiation, duration of consumption and duration of consumption prior to dependence and alcohol disorders

	Total N=1000	Psychosis N=370	Non-Psychosis N=360	Only ADS N=270	Significance
Age at Initiation Mean & S.D (Years)	20.52±5.89	19.95±4.59	20.42±6.18	21.44±7.08	F= 0.50 df=2,97 P>0.05 Not Significant
Duration of Alcohol intake Mean & S.D (Years)	15.24±9.17	14.68±5.87	14.89±10.22	13.94±8.27	F=0.33 df=2,97 P>0.05 Not Significant
Dependence of Alcohol Mean & S.D (Years)	6.32±4.71	5.95±3.79	6.64±5.43	6.40±4.97	F=0.20 df=2,97 P>0.05 Not Significant
Bonferroni Test Not Significant					

Discussion

Though the study was open to both genders, predominance was of the male population. Female patients were few. This may be due to socio-cultural factors prohibit females from drinking and probably, there may be some genetic factors too. These results were also seen in a study by Zaninelli.[8] Preponderance of married persons (88%) is in agreement in many studies. This may be due to the age at which treatment is sought is part marriageable age and the majority of people get married. In this regard, a study by Dick DM is published in the Journal of studies on alcohol.[9] It may also be due to the family perception that marriage may bring responsibility to the person and others indirectly abstinence.

92% of the subjects were belonging to the Hindu religion and 8% were Muslim religion. This is in accordance with the ratio of the respective religions in the general population. The mean education of the sample was 8.04±3.40 years, about 76% of them had less than 10 years of education. This may be due to the fact that the present sample is from a rural and semi-urban background where educational opportunity is less and motivation for education is less. 40% were belonging to Class II and 52% were from lower-income groups. A higher representation of these groups suggests that individuals with higher socioeconomic status are more aware of the consequences of their behavior and therefore make the healthier choice. It may also be possible that alcohol consumption may lead to a lower income, occupation and educational status in some of the people.

About 68% of the sample initiating consumption of alcohol between the age group of 30-40 years in the present study supports the view that alcohol use starts at the formative years of early adulthood. When age at initiation of consumption of alcohol was compared gender-wise, females had late onset of alcohol consumption. This difference was statistically significant (P<0.002), with "t"= 3.41 value. About 52% of the sample were consuming alcohol for a period of 10-20 years. The chronicity of alcohol consumption is one of the factors seeking treatment. The females had a long duration of alcohol consumption. The difference was statistically significant (P<0.01), having a "t" value of 4.10.

Mean years of alcohol consumption prior to becoming alcohol dependent was 6.14 years in males and 8.5years in females. And the majority of male subjects became alcohol dependent within 1-5 years of alcohol consumption and females became alcohol dependent after a relatively long duration of consumption of alcohol i.e., 5-10 years. However the gender difference was statistically not significant (P<1.07), having a "t" value of 1.37.

Later age of initiation of alcohol consumption, long duration of alcohol consumption and longer years of consumption of alcohol prior to becoming alcohol dependent in females may be due to social restriction for alcohol consumption for them and those who break the social restriction may consume it for a long time. There may be also some differences in the metabolism of alcohol in females.

Finding that 37% of the sample having a diagnosis of alcohol-induced psychosis is comparable with the earlier literature.[10] All the patients had the psychotic manifestations either after acute alcohol intoxication or withdrawal. The prompt treatment with benzodiazepines during the detoxification phase might have

suppressed its emergence in alcohol withdrawal patients as seen by the higher incidence of psychosis in alcohol intoxication than in withdrawal. Our results are similar to the study conducted by J Perlala.[11]

Statistical comparison of BPRS score between Psychosis, Non-Psychosis and only ADS diagnosed group, by One Way ANOVA was highly significant (P<0.001) having an "F' value of 255.17. The BPRS is relatively high when compared in all groups of the study to the BPRS score in Schizophrenia as reflected in literature. The high BPRS score in the present study may be due to the fact that in the present study the BPRS score was aligned from 1 to 7 were possible score was between 18 to 126. There is also another method followed in BPRS scoring where the score is aligned from 0 to 108. It may also be one reason that the disturbance in alcoholics will be at a psychotic level rather than a neurotic level as alcohol dependents usually have disturbed routine and fail to carry out their responsibilities appropriately. Out of 370 alcohol-induced psychotic patients, 330 (35.86%) had a personality disorder. The interplay of personality, alcohol and inherited predisposition may play a role in persons developing alcohol-induced psychosis. Age at initiation of consumption of alcohol when compared in Psychosis, Non-Psychosis and Only ADS group of patients. The difference was statistically not significant. P<0.05 with 'F" value 0.50. Similarly, the duration of alcohol intake and duration of alcohol consumption prior to the development of dependence of alcohol were statistically different in Psychosis, Nonpsychosis, and only ADS group of patients. It means that age at initiation, the duration of consumption and duration of consumption prior to the development of dependence does not determine the onset of alcohol-induced psychosis.

Conclusion

Most of the subjects (52%) were between the ages of 30 to 40 years, a majority of whom started alcohol intake in the twenties, which may suggest that it takes time to develop alcohol-related problems and reporting for treatment. A majority had education till S.S.L.C or below (56%) and most of the subjects were agriculturists. In the literature, there is a correlation between the lower level of educational, occupational and economic status and alcohol consumption. The results of the present study suggest that education and occupation are important factors related to alcohol-related problems. Alcohol-induced psychosis is a frequent alcohol-related problem and is important in differentiating from psychosis in other illnesses and has implications in the treatment strategies.

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REVIEW ARTICLE

Study of nutrient foramina in fibula: its applied importance

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Abstract
The external opening of the nutrient canal is usually referred to as the nutrient foramen. The term 'Nutrient' itself describes the role of nutrient foramina in the nutrition and overall growth of the bones. The diaphyseal nutrient artery is the primary source of blood to entire osteal tissue and bone marrow of a long bone, especially during its active growth period and the early stages of ossification. Therefore, they play a very significant role in the healing of fractures and prevention of avascular bone necrosis. Every nutrient foramen has a particular position in each bone and fibula is of no exception. However, the number and location of nutrient foramina may very sometimes. In bone graft and vascularised surgery, the fibula is commonly used. Therefore, an understanding of the position and number of nutrient foramina in fibula is essential. Moreover, fibula flap is the most widely accepted flaps used in the mandibular reconstruction surgery, especially in the malignancy of oral and oropharyngeal regions. This review paper outlines the anatomical variation of the nutrient foramen of the fibula and its applied importance in clinical practice.

Keywords
Bone graft; Vascular surgery; Fibular flap; Applied importance

Introduction

The nutrient arteries are the primary source of blood supply for long bones. They pass through the nutrient foramina, which is usually present in the shaft of the long bones. The nutrient arteries are essential during the initial phases of ossification and early period of bone growth. Proper knowledge of the anatomical variations of nutrient foramina is necessary for various surgical procedures like bone grafting, tumour resection, bone transplants and treatment of injuries to avoid any medico-legal issues.[1]

Studies on vascularisation of long bones in different population have been found to be helpful in analysing the morphometry of nutrient foramina.[2] The knowledge of the distribution of nutrient foramen is vital for the surgeons to select the osseous sections to be used as a graft for a successful outcome in transplant surgery.[3]

The growing end of the bone determines the direction of the nutrient foramina. As a rule, the diaphyseal nutrient vessels move away from the growth extremity dominant in the bone.[4] The fibula reverses the ossification pattern concerning other long bones.[5] A thorough knowledge about position and variations of the nutrient foramina of the fibula is essential in the preparation of vascularized bone graft. In bone transplant surgeries fibula has least complications in comparison to other long bones. The middle third of the posterior surface of the fibula is an ideal location for the nutrient foramen. Therefore, the middle third of fibula is used in transplant surgery for reconstruction and stabilisation of mandible, spine and tibia as well as for dental implants. This segment of the fibula is always taken as a graft because of its reliable anastomosis which involves the endosteal and periosteal vessels along with a constant arteriovenous system.[6]

The characteristic shape and mechanical properties of fibular grafts make it particularly useful in the restoration of significant diaphyseal defects.[7] Hence the distribution and exact position of the nutrient foramina in fibular diaphysis is essential to avoid damage to the nutrient vessels during various surgical procedures as well as in medico-legal cases.

Location of nutrient foramina of the fibula

In fibula, the location of the nutrient foramen is in its posterior surface, which is little proximal to the midpoint. The direction of the foramen is towards the distal end of the fibula. A branch of the fibular artery provides the blood supply. An appreciation of the detailed anatomy of the fibular artery about the fibula is fundamental to the raising of osteo-fascio-cutaneous free flaps incorporating segments of the bone. Free vascularized diaphysis grafts may also be taken on a fibular arterial pedicle. The proximal and distal ends receive metaphyseal vessels from the arterial anastomosis at the knee and ankles, respectively.[8]

Akbari and Chavda[9] in their study on 150 dried fibulae observed that 98.71% of the nutrient foramina were present on the posterior surface and 1.29 % on the medial crest. They also

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found that most (98.06%) of the foramina present in zone II followed by zone III (1.29%) then by zone I (0.65%). All foramina were directed toward the upper end of the fibula. The position of a nutrient foramen in mammalian bones are variable and alter during growth. Though the foramina are directed away from the growing end, their topography might vary at the non-growing end. So the topographical anatomy of the nutrient foramina may be worth.[10]

Sharma et al. observed that most common location of the nutrient foramen (NF) in fibula was a medical crest in 43.5% (20 out of 46), between the medial crest and interosseous border in 26.1% (12 out of 46), between the medial crest and posterior border in 17.4% (8 out of 46) and in 13% (6 out of 46) it was located on the interosseous border.[11] Pereria et al. in their study on 114 adult fibulas observed that the predominant location of nutrient foramen was facies lateralis (98.2%), whereas in only 1.8% of fibula had nutrient foramen in facies posterior.[1] The predominance of nutritional foramina in facies posterior was reported in a few other studies.[12-15] Occurrences were rare in other sites, i.e. median edge (7.93%), rear edge (2.11%) and cristae median (8.99%).[14] Bhatnagar et al. in their study observed that 96.96% fibulas had NF in the middle third and 3.3% in the distal third of the diaphysis.[16] Kumar et al. noticed NF in the proximal third of the diaphysis on 29.62% fibulas, in the middle third on 38.62% fibulas and the distal third on 29.10% fibulas.[14]

The direction of the nutrient canal

Humphrey in 1861 suggested that the position of nutrient artery and direction of its canal are determined by the interaction of interstitial growth of periosteum and oppositional growth of bone. He put forward the periosteal slipping theory, i.e. sliding over of the periosteum on the surface of the bone, more particularly towards the growing end. An oblique canal thus laid down for the nutrient artery, the outer opening of which is nearer the growing end of the bone.[17]

During the growing period of the bone, the nutrient canal becomes slanted. The direction of the slant is from surface of the bone to marrow cavity which points away from the growing end of the bone.[18] Though the rule, 'to the elbow I go, from the knee I flee' is being followed by most of the nutrient arteries yet there are variations in position.[19]

Most of the researchers reported predominance of distally directed nutrient foramina in the fibula. Dervisevic et al. observed the obliquity of the nutritional canal through the diaphysis, which was directed distally in 90.5% fibulas and proximally in 9.5% fibula.[12] Rakesh et al. in their study on 112 fibulae, observed that 79.70% canals were oriented towards the distal end and 20.3% towards the proximal end of the diaphysis.[20] Kumar et al. reported distally oriented in 187 of fibulas, and only two fibulas had proximally oriented canals.[14]

Numbers of nutrient foramina

A variation in the number of a nutrient foramen in fibula has been reported in various studies in the past. McKee et al. in their study of nutrient foramina on 322 fibulae observed the occurrence of a single nutrient foramen in most of the samples(86.4%) followed by double foramina in 7.7%, three foramina in 0.3%and absent nutrient foramina in 5.6% samples.[21] Sendemir Cimen reported a single nutrient foramen in 74% of the fibulae and absence of nutrient foramina in 18.9% of specimens examined.[22] Commonest occurrence of a single nutrient foramen in fibula was also reported in other studies.[9,23,24]

Conclusion

A good understanding of the characteristic morphological features of the nutrient foramina by the orthopaedic and plastic surgeons is highly recommended for various surgical procedures. Anatomical knowledge of the position and number of the nutrient foramina in long bones is important in various orthopaedic surgical procedures such as joint replacement therapy, fracture repair, bone grafts and vascularized bone microsurgery. Knowledge of the position of nutrient foramina is important in the management of longitudinal stress fractures. Because this surgical procedure can be initiated either from the nutrient foramen or its superomedial aspect. Anatomical knowledge regarding the exact position and distribution of the nutrient foramina in bone diaphysis is important to avoid damage to the nutrient vessels. This is an essential step during surgical procedures to plan for vascularized free fibular grafts. So considering all these above factors so far discussed, the morphometric study of nutrient foramen concerning the number, location and position is assumed to be of great importance for clinicians, radiologists, orthopaedics and vascular surgeons.

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CASE REPORT

Stillbirth due to unrecognized transposition of the great arteries

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Abstract
Congenital cardiac anomalies attributed to 4.2% of all neonatal deaths globally, whereas transposition of the great arteries were 5-7% of all congenital cardiac anomalies. The vascular system of the foetus starts to develop by day 17 of the embryonic life. This early development of the vascular system provides the opportune window for disruption to the normal development. The anomalies can range from being minor to fatal. Review of the medical literatures, stated a two – to threefold increase in malformation rates related to infants of insulin dependent diabetic mothers. Fatal malformations in infants of diabetic mothers compared to infants of non-diabetic mothers were 2.1% and 0.3% respectively. We discuss the importance of conducting an autopsy on stillbirths in determining the true cause of death and keeping in mind the possibility of genetic anomalies, environmental factors, foeticide or non-accidental injuries being a contributing factor. Here we report a case of a 23-year-old married; primigravida woman whom delivered a foetus at home. This was an unregistered pregnancy. The woman was on insulin therapy for her underlying Type 1 Diabetes Mellitus. Post-mortem examination determined the cause of death. The internal examination revealed transposition of the aorta and pulmonary artery. The cause of death attributed to stillbirth due to transposition of the great arteries in infant of a diabetic mother.

Keywords
Autopsy; Stillbirth; Congenital Heart Anomaly; Transposition of Great Arteries.

Introduction

Congenital cardiac anomalies attributed to 4.2% of all neonatal deaths globally. Maternal insulin – dependent diabetes is highly associated with congenital malformation and notably effects the development of the embryo. Congenital malformations do not appear to be solely genetic in origin since the number of malformed offspring is not increased in diabetic fathers.

Fatal malformations in infants of diabetic mothers compared to infants of non-diabetic mothers were 2.1% and 0.3% respectively. Whereas cardiac anomalies commonly occur to foetus that are exposed to environmental factors such as rubella virus, drugs and alcohol; maternal medical conditions such as diabetes and hypertension; genetic causes such as Trisomy 18 and Goldenhar Syndrome.[1]

Transposition of the great arteries corresponds to an incidence of 5-7% of all congenital cardiac anomalies. This malformation is incompatible with life in the absence of surgical treatment, whereas prognosis appears encouraging when arterial switch operation is opted with a survival rate of 88%.[2] Transposition of the great arteries is one of the many congenital heart anomalies seen in stillbirths, where the aorta arises from the right ventricle rather than the left ventricle and pulmonary artery arises from the left ventricle instead of the right ventricle. This malformation will lead to de-oxygenated blood being carried back to the body and oxygenated blood pumped back to the lungs instead of the body.

External mark of injuries due to beating, shaking, throwing or dropping the foetus must also be ruled out beforehand since these injuries are useful indicators in differentiating non-accidental injuries (NAI) from accidental injuries. Higher risk for NAI is seen in children born prematurely or with multiple medical conditions.[3]

Thus, these potential biases are vital in determining the cause of death and facilitate investigation.

Case Report

A 23-year-old woman with underlying Type 1 Diabetes Mellitus on insulin therapy; married; primigravida; unregistered pregnancy. She delivered a foetus at home but was unable to seek medical attention immediately due to being alone at home and subsequently sought medical attention at the Accident and Emergency Department the next morning. The foetus was wrapped in a bed sheet.

A post mortem examination was performed within 24 hours. The foetus examined was of a non-macerated male foetus weighing 715 g. Foetus was cyanosed. The crown heel length was 32cm, crown rump length was 22 cm, head circumference was 22 cm, abdominal circumference was 19 cm and the chest circumference was 21 cm. The estimated gestational age of the foetus was about 6 months according to Haase Rule. There were no dysmorphism, low set ears or spina bifida. No

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abnormalities or injuries seen externally. The umbilical cord was cut.

Bilateral conjunctiva was congested with no petechial haemorrhage. The skull was not fractured and no meningeal haemorrhage seen.

Bilateral lungs were not expanded, collapsed and the floatation test was negative. No significant pathologies of the lungs were detected microscopically. The heart weighed 5 g. There was transposition of the aorta and pulmonary artery. The aorta arises from the right ventricle (Figure 1) whereas the pulmonary artery arises from the left ventricle (Figure 2). There was no atrial or ventricular septal defect. All the other organs were in the normal anatomical position with no anomalies.

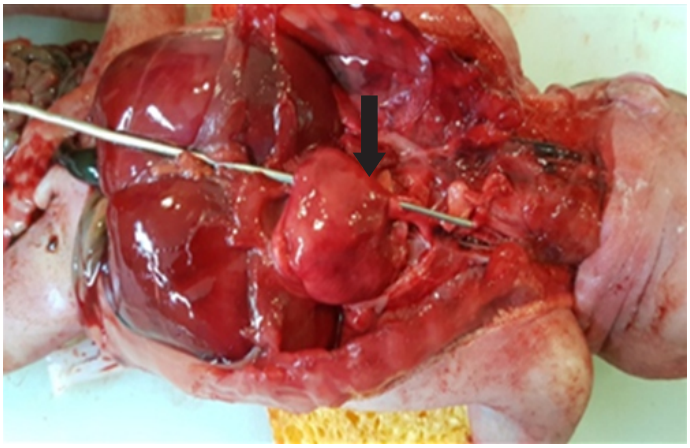

Figure 1: Aorta rising from the right ventricle (as marked by the arrow)

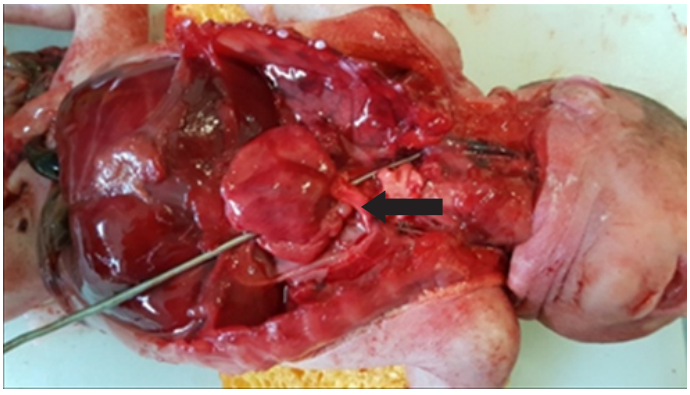

Figure 2: Pulmonary artery rising from the left ventricle (as marked by the arrow)

No other significant pathologies of placenta and umbilical cord detected. Maternal blood investigation revealed poor glycaemic control where HbA1C measured 8.8%, whereas fasting plasma glucose was 8.2 mmol/L (Table 1). It was concluded that the cause of death was stillbirth due to transposition of great arteries in infant of a diabetic mother.

Table 1: Maternal blood investigation reports

	January 2018	**November 2018**
HbA1C	9.4%	8.8%
Fasting Plasma Glucose	8.0 mmol/L	8.2 mmol/L
2 Hour Post Load Glucose	11.8 mmol/L	11.4 mmol/L

Discussion

Transposition of the great arteries is a very specific congenital heart anomaly without additional extracardiac anomalies as seen in this case. Transposition of the great arteries is also called “blue-baby syndrome” due to the low amount of oxygen provided to the body.[3]

Heart anomalies such as atrial or ventricular septal defect provide some oxygen to the body when oxygen-poor and oxygen-rich blood mixes through the septal defects. Without such heart anomalies mentioned, this condition will be fatal to the growing foetus leading to miscarriages and stillbirths which is evident in this case.[4]

Congenital heart anomalies are the most frequent malformations in infants of insulin dependent diabetic mothers which accounts for 21% of all anomalies.[5] Nearly all medical literatures are consistent in finding a significant increase risk for major malformations in infants of diabetic mothers. Despite superior healthcare service, incidence of congenital malformations has not declined.[6]

Most of the stillbirths are preventable with adequate antenatal care by identifying, treating or preventing pregnancies due to maternal condition, congenital malformations, genetic factors or infections. Antenatal care provides a natural contact with healthcare providers through which requisite interventions can be facilitated. Stillbirth is more common in the maternal age of 18-29 which is 61%; more common in boys and maternal medical condition such as diabetes.[7]

Acute injury, fractures, burns or bite marks are physical injuries evident in NAI. The victims are mostly less than 3 years of age. Head and abdomen are the two most common regions for injuries. Subdural and subarachnoid haemorrhages are customary with or without skull fractures, which are commonly associated with retinal haemorrhages.[1,7] Post mortem examination in this case revealed no such injuries.

In conclusion, the findings of the forensic autopsy facilitated the investigation, established stillbirth and its cause. Forensic pathologists are encouraged to perform detailed heart examination at autopsy of perinatal deaths in order to ascertain related anomalies.

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CASE REPORT

Unusual Presentation of Jimson's Weed Toxicity- A Case Report

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Abstract

The characteristic features of toxicity help clinician diagnose the case in time and start treatment immediately. However, in many instances, unusual presentations of symptoms and signs not only cause difficulty in diagnosis the condition but also cause delay in starting effective treatment. In such cases there is always a threat of fatality. Knowledge about such unusual presentations is essential in managing such cases. We present one such unusual presentation in a case of Jimson's weed poisoning case. Timely diagnosis of case through recognizing unusual presentation saved the life of a boy.

Keywords

Toxicity; Unusual presentations; Jimson's weed.

Introduction

Datura Stramonium (DS) better known as datura or Devil's trumpet or Jimson's Weed is basically a weed from solanaceae or nightshade family which may sometimes be also called as moonflowers, Jimson's weed, Devil's weed, Hell's bells, thorn-apple etc.[1] The highest species of datura occurs in parts of America and North Africa. Datura belongs to "witches weed" family along with deadly nightshade, mandrake and henbane family. This plant, well known as essential ingredient of potions and witches' brews has a long history of causing insane state of mind after consumption and finally leading to death.[2] The seeds and flowers of all datura plants contain tropane alkaloids such as scopolamine, hyoscyamine, and atropine which are lipophilic in nature and cross the blood brain barrier. There is likely a 5:1 toxin variation between datura plants which makes it hazardous as a drug and can also be used as a poison in some cultures for centuries.[2,3] Severe mydriasis with resultant painful photophobia, anticholinergic delirium hyperthermia, pronounced amnesia,sinus tachycardia, bizarre and possibly violent behaviour can be caused due to the potent combination of anticholinergic substances.[4] Maximum datura poisoning cases are because of voluntary ingestion of plants. Hallucinogenic and euphoric effects are seen after consumption of the plant by the teenagers. The effect of poison is inhibited by the drug physostigmine. The patient's agitation can be curbed by giving benzodiazepines and by treating the patient symptomatically with supportive oxygen support. The patient is kept under observation after 24-36 hours of ingestion of the plant. This report illustrates an unusual case of DS poisoning occurring in a 16 year old boy after accidental ingestion of "Badam fruit" as a mistaken identity from his home garden.

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Case report

A 16 year old boy was brought to the pediatric emergency triage in the early morning hours in a state of altered consciousness from a nearby village to a tertiary care hospital. The history given by the father revealed that the boy started abdominal pain following consumption of "Badam fruit" as claimed by the boy about 12 hours prior to the admission to the hospital. It was further revealed that there was abdominal pain associated with 2-3 episodes of vomiting 4 hours following consumption of fruit and the boy went into a state of altered consciousness in next 4 hours. Then he was brought to the hospital. On examination, the boy was in unconscious state (Glasgow coma scale 7/15). Bilateral pupils were reactive to light with size of the left side pupil was 2mm more than the right side (3mm). Clinical examination done revealed Glasgow Coma Scale of 8/15 with anisocoric pupil, exaggerated deep tendon reflexes (DTRs) in upper limbs and absent in lower limbs with Right extensor plantar. There was reduced air entry in right infra-capsular and infra-axillary regions. He was shifted to Intensive Care Unit (ICU) and had persistent desaturation and one episode of bradycardia and hence was intubated and mechanically ventilated. The chest x-ray (CXR) was done which showed aspiration features containing right sided consolidation. The froth was present in the oral cavity. The heart rate (128 beats/min) and respiratory rates (42/min) were increased. Blood pressure was 130/90mmHg. The oxygen saturation (SpO_2) was found to be 82% on room air. No pallor, cyanosis, clubbing, lymphadenopathy and edema were found. Ear, nose and throat (ENT) evaluation done revealed vocal cord

granuloma probably due to intubation. The systemic examination revealed coarse crepitation over lung fields bilaterally. The boy was arrested during the examination, who was revived back by cardiac resuscitation. The fingers of both the hands were stained with some blackish material. These atypical signs and symptoms posed a diagnostic problem for the pediatric resident doctor. Initially he was managed symptomatically with 2/3 maintenance IV fluids, mannitol. But as no signs of improvement were seen immediately he contacted the on-duty faculty of Clinical Forensic Medicine Unit (CFMU) of the hospital for the possible diagnosis. The CFMU faculty with the suspicion of datura toxicity, advised the resident to collect blood, urine and stomach wash along with the swabs from the fingers and to send to the Poison Detection Centre (PDC). The samples were sent for analysis in PDC. The standards of datura were prepared and the thin layer chromatography (TLC) was performed using the samples. The results of the TLC were as per our assumption which showed the suspected compound to be datura.

Laboratory findings

Biochemical investigations like hemoglobin- 13.8 g/dl, TC-18400 cmm, Pit- 393000/cmm, ESR- 4mm/hr, MCV- 83.5fl, RDW- 12.8%, RBS- 197mg/dl, sodium- 141meq/l, potassium-3.6meq/l, calcium- 9mg/dl, magnesium- 1.9mg/dl, phosphate-6.5mg/dl, urea- 12mg/dl, creatinine- 0.5mg/dl, CRP- 0.2mg/l, T.B- 0.2mg/l, D.B-0.1 mg/dl, AST- 49U/L, ALT- 13U/L , ALP-278U/L, albumin- 4.48 g/dl, prothromin time- 12.4, INR- 1.15, APTT- 31.9, urine – sugar 3+, blood 2+, WBC- increased in number, neutrophil- 69%, lymphocyte- 22%, monocyte-9%, CK-1428U/L, CK-MB- 20.9ng/ml, pseudocholinesterase- 9382 U/L and toxicology reports were found positive for datura poisoning after thin layer chromatography was performed.

Discussion

Anticholinergic poisoning is due to consumption of black seeds of datura. In the parasympathetic nervous system acetylcholine receptors are completely blocked by the belladonna alkaloids.[5] Clinical signs appear after 30-60 minutes of consumption of the plant. The clinical signs appear within 30–60 min of ingestion of the plant. At the initial stage symptoms include hallucinations, flushing, mydriasis, sinus tachycardia, hyperpyrexia, decreased bowel sounds, urinary retention, and neurological disorders with ataxia, impaired short-term memory, disorientation, confusion, dryness of mucous membranes, thirst, dilated pupils, and visual and speech disorders. In the further stages, symptoms including tachycardia, urinary retention, and ileus occur. Rarely hyperthermia, respiratory arrest, rhabdomyolysis and fulminant hepatitis and convulsions have also been described. Moreover, death occurs due to depression of the central nervous system. Collapse of circulatory system and hypotension may also occur.[6] In our case the boy was brought to the hospital in unconscious state with dilated pupils, froth in the oral cavity, abnormal increase in heart rate and respiratory rates. He was shifted to ICU and had persistent desaturation and one episode of bradycardia and hence was intubated and mechanically ventilated. He was managed symptomatically with 2/3rd maintainance IV fluids, mannitol. Since investigations done revealed leucocytosis and elevated CPK, CKMB the pediatrician was confused with the unusual symptoms. Blood, urine and stomach wash samples were sent to toxicology lab of the hospital for proper detection. The samples were tested positive for Datura toxicity. Generally, Physostigmine at a concentration of 0.5-2mg is administered intravenously in such cases to bring the situation under control but in our case one dose of neostigmine was given and also started on IV Ceftriaxone- Tazobactam and Amikacin. Hence, it is the duty of physician to take care of cases who come with unusual findings.

Conclusion

As Datura is easily available, the incidence of its toxicity is known in this region which can be kept in mind while treating the poisoning patients. Many a times, patients may present with unusual findings like anisocoria as in our case. Knowledge about such peculiar findings helps to achieve the effective outcome in these uncommon poisoning cases.

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CASE REPORT

Death due to lightning strike- An opinion of circumspection

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Abstract
Death due to lightning is an unusual occurrence in routine autopsy practice. Majority of lightning deaths are not witnessed or happen in situations that are either perplexing or surroundings are such that it may be challenging to reconstruct the actual events as they happened. Medico-legally, suspicions may be nurtured of foul play because of the existence of burns, wounds, fractures, lacerations and torn clothes in such cases. Autopsy findings are not ample for determination of manner of death in cases of lightning. Death due to lightning strike is an opinion of guardedness, especially when there is a single causality assumedas a consequence of lightning. Examination of the clothes and exploration of the scene of crime gives significant clues to the forensic pathologist. Witness testimonies and meteorology reports form a vital tool in the exploration of the manner of death for bodies found in outdoor, particularly in fields.

Keywords
Lightning; Burns; Keraunomedicine

Introduction

Keraunomedicine is the medical study of lightning injuries and casualties. Keraunósis, an ancient Greek word, means "lightning, thunderbolt". Death due to lightning is an unusual occurrence in routine autopsy practice. In such cases, suspicions may be nurtured of foul play medico-legally, because of the existence of burns, wounds, fractures and frayed clothes.[1] Lightning causalities are not witnessed in the majority. They may happen in situations that are either perplexing, or surroundings are such that it may be challenging to reconstruct the actual events as they happened.[2] Here, we present a case in which burns were present over the deceased consequent to lightning.

Case Report

A dead body was referred to the Department of Forensic Medicine for medico-legal autopsy. An elderly farmer was found in a burnt condition in his fields. As per the inquest report, the cause of death appeared to be due to burns. However, the relatives alleged that the deceased was set on fire by some other people due to animosity. As per the statement of deceased's son, the deceased was watering his fields when he went at preceding night around 8-9 PM. Next day during early morning hours when he again visited the fields, he found his father burnt.

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Figure 1: Presence of burnt clothes over the person of the victim

Figure 2: Deep burns over the left side of head, neck and shoulder region

During the post-mortem examination, the clothes worn by the deceased were partially burnt off (Figure 1). The left side of the scalp over the frontal and left temporal region, left side of the neck and left external ear were charred. Scalp hairs were burnt

off (Figure 2). Dermo-epidermal burns were present over the left side of the trunk and left-back (Figure 3). Singeing of hairs was observed over the front of the thighs. Blisters were noticed around the burnt area at places. Erythema was present over the front of the right chest, right shoulder and right upper arm region (Figure 4). Diffuse subarachnoid haemorrhage was evident over cerebral hemispheres. Clothes were preserved for the detection of any inflammable residue and viscera was preserved for chemical analysis and histopathological examination.

Figure 3: Dermo-epidermal burns over the left side of the back of the trunk

Figure 4: Erythema over the right side of chest and arm

No common poison was detected in the viscera report received from Forensic Science Laboratory. Histopathology report of heart, lungs and kidneys was insignificant. No petrol, kerosene, diesel or their residues detected over clothes. Crime Scene Report was asked from the investigating officer of the case along with the scene of crime photographs.

As per crime scene report, the deceased waslying in the burnt condition in his fields in a supine position, six feet away from the neem tree planted there. One blue cloth mattress was seen to lie under the back of the deceased, which was burnt off. No footwear/ footprints were seen at the scene of a crime or near the deceased. No suspected container was observed at the crime scene. Burnt patches of land were observed around the deceased with no or scant debris. It was observed that rain had occurred early in the morning. Statement of local personnel produced by police confirmed thunderstorms and rain during the preceding night. Crime scene report also affirmed the evidence of rain in the area.

Keeping in view of crime scene report, viscera report, and statement of local personnel, it was opined that “the possibility of burns present over the body due to lightning strike could not be ruled out".

Discussion

Lightning strikes are frequent in India during monsoon. According to the National Crime Records Bureau, at least two thousand people have died in lightning strikes in India every year since 2005, which is far higher than that in developed countries such as the United States.[3]

A lightning flash ensues when the potential that is fostered up in the clouds is adequate to conquer the resistance of intervening air. It then passages from clouds to earth, to the nearest and usually tallest objects in contact with the earth, where it is neutralized.[4] During a bolt of lightning, voltage exceeds 10 million volts with massive current typically between 30 thousand to 110 thousand amperes passes from clouds to earth. Victim's contact during lightning bolt ranges from 1/1000 to 1/10 of a second. Lightning injuries are classified as a direct strike, side splash, contact injury, or ground current.[5] A direct strike is generally lethal, whereas victims of side-flash strike or conduction through another object may well persist.[2]

Lightning can hurt an individual through numerous mechanisms. The effect of electric current on/ through body tissues, burns due to the transformation of electrical to thermal energy, mechanical trauma through an array of mechanisms are likely.[5] A person in buildings is seldom affected by the current, as the lightning with its very high potential tends to pass along the surface of the conductor rather than through it. Most casualties transpire in the open. The major burn is usually over the head and maybe diffuse. Metallic objects if worn may be found molten, fused or even magnetized.[4] Among the fatalities, different types of skin burns are regularly present, often at an entry site on or near the head, and at an inferiorly located exit site. These skin injuries often consist of superficial burns and singed hair; deep burns and charring are infrequent. Arborescent skin/ keraunographic markings/ Lichtenberg's flowers which are characteristic of lightning injury, occur less frequently. Internal findings at autopsy in such cases are nonspecific.[6]

Study of lightning deaths in Singapore by Chao et al. documented that no deaths due to lightning occurs in considerably well-protected buildings. One-third of the deaths occurred in the open, while two-thirds occurred in somewhat shielded areas. In their study, they observed that in many of the cases, clothing's were burnt, charred and torn to several degrees due to flashover effect. 84% of the cases the lightning passed through the head and chest, i.e. brain and heart thus resulting in death.[7]

While investigating a death due to lightning, meteorological data about the scene at an incident time from eyewitness testimonials and reports from the meteorology department has to be marshalled. Crime scene report for damage to proximate trees or burning of grass around the body is vital clues in such cases. Findings attained from clothing examination are also relatively precious which may be burned, or torn and shredded due to the likely explosion effect of lightning. Singed hair due to the thermal effect of lightning may be seen in sufferers.[8]

In the present case, the occurrence of rain and lightning events in the place where the death occurred was confirmed by witness statements. Clothes of the deceased were burnt, and hairs were singed.

Death due to lightning strike is an opinion of caution. Autopsy findings are not adequate for determination of manner of death in cases of lightning. Examination of the clothes and investigation of the scene of crime gives essential clues to the forensic pathologist. Witness statements and meteorology reports form anessential tool in the exploration of the manner of death for corpses found in outdoor, especially in fields.

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CASE REPORT

A Case of Freakish Friction Burn

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Abstract
The role of a forensic physician in identification of the type of mechanical injury and the manner of causation is important for the legal system. Injuries sustained to the neck, often in isolation (without any associated injuries on body) in a living or dead victim can appear suspicious to clinicians who lack forensic training. The suspicion is doubled if the patient or victim is a female. If the manner of causation is dubious, the treating doctor is required to notify the nearest police station along with preparation of a wound certificate. Unnecessarily burdening the judicial system by intimating all cases of wound certification can be avoided. This is possible by only referring those cases that actually require an investigation by a police officer. Therefore, arriving at a reasonable conclusion about the manner of injury causation in a casualty is very important. Neck injuries may be from assault by another, self-inflicted as in suicidal attempt or accidental. This case report is the first published work on the forensic assessment of a suspicious friction burn on the neck of a female patient.

Keywords
Abrasion; Clinical Forensic Medicine; Friction Burn; Neck Injury

Introduction

In India, the Clinical Forensic Medicine Units (CFMUs) have started handling the responsibility of medico-legal duties at the Emergency Management Centres of Hospitals.[1] The involvement of such units, under the leadership of faculty members from Forensic Medicine Departments (forensic physicians) has been found to aid the proper referral of cases to the entire judiciary system. One of the most important tasks of a forensic physician is accurate identification of injuries on patients presenting to the emergency department.

Abrasion is the most superficial form of a mechanical injury. A brush burn or friction burn occurs when heat is generated at the time of scraping off of the skin during contact with a rough surface/hard object.[2] Such friction burn injuries are very common in road traffic accidents involving two-wheeled vehicles.[3,4] They can also be seen in injuries caused by treadmills, or fast-moving belts in the industrial setting.[5] Friction burns are most commonly seen on bony areas of the extremities, such as knees, elbows, or hands. Such scrapes are more painful than cuts due to their larger area of involvement, which exposes sensitive superficial nerve endings.

The coefficient of friction depends on the material coming in contact with the body, and the severity depends on the velocity of the applied frictional force.[6] In the majority of the situations the friction burns are associated with other concurrent, more severe injuries and may gets unrecognised or under-reported in medical records. When the burns are of second or third degree, the chances of infection due to wound contamination and scar formation increase. Full-thickness friction burns require surgical intervention.[4]

Case Report

A 24-year-old female patient had come to the Out-Patient Department of a Primary Healthcare Centre (PHC) for treatment of an injury sustained to the back and sides of her neck (Figure 1: a to d).

Figure 1: Friction burn abrasion 16 x 2-3.5cm long horizontally placed involving the back and sides of the neck. The left end was placed 3cm below the ear, the middle portion was 12cms below the occiput and the right end was 3cm below and 1cm behind, the ear

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She was accompanied by her husband and her neck was clad in a shawl. The history, as provided by her (in the presence of her husband), was that she sustained the injury when she lost her balance while riding as passenger on a two-wheeled vehicle; and that her shawl had produced the injury. She had gone home, changed her clothes and shawl, and had now come for treatment. She had no other associated injuries on the body. The second author after examining the patient; treated her with local application of silver sulfadiazine ointment (*Silverex*), injection TT (tetanus toxoid), and provided her antibiotics for five days (*Amoxicillin*). The second author wanted to prepare the 'wound certificate' and had to take a call on whether to notify the nearest police station or not. Other clinical physicians in the PHC were concerned about intimate partner violence and attempted strangulation (concealed neck violence). The first author was contacted for expert opinion on the nature of causation of the injury (manner).

Discussion

Upon examination of the photographs, and from further medical history it was apparent that the manner of causation was consistent with the history given by the patient. The wound (Figure 1a) is a friction burn/brush burn of second degree (epidermis and dermis involved). The patient had used a 'chiffon' shawl which produced the friction burn. This type of fabric is rough and highly abrasive.[7] Since the patient was wearing a helmet, the shawl was twisted over the head and was worn from behind the neck like a scarf, reducing the area of contact to the back aspect of the neck. Here the frictional force was focussed on a thin band of skin. This is similar to a published case report of causation of friction burns on thighs (during limb surgery), due to slippage of a pneumatic tourniquet.[8]

Upon further questioning, the patient described that while the vehicle was being driven at a low speed (of approximately 40kmph); her scarf had gotten hooked on a branch of tree resulting in a loss of balance but no fall. The vehicle was stopped and therefore she did not sustain any other injuries on her body. The direction of pull of the scarf was from left to right – Figures 1b and 1c (left end of the wound – least width) shows the graze marks of the abrasion (on upper margin) backwards and downwards; whereas Figure 1d shows no graze marks, and the edge of wound (right end – maximum width) showed maximum depth indicating the fulcrum of pull of the scarf. Since the injury sustained was consistent with the detailed medical history, the manner of causation was concluded to be accidental, ruling out any foul play/suspicion.

In prior research,[2,4] females were found to be fewer common victims (~30%) of friction burns and second-degree burns were uncommon (~20%). In the prior studies patients had several other associated injuries, and the neck was never the site of occurrence of any sort of friction burn. The current case report is unique in that regard, and contributes to our understanding of accidental versus inflicted injury.

Conclusion

This is the first case of an isolated friction burn injury to the neck. Protective clothing/gear (helmets, protective pads on knees/elbows etc.) are expected to reduce friction burns in motorcycle accidents.[2,3] This case report highlights the risk associated with the use of a scarf or shawl while riding on a two-wheeled vehicle. Such an atypical friction burn presentation on neck with no associated injuries anywhere on the body can provoke suspicious thoughts of foul play or intimate partner violence.

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SHORT REPORT

Bibliometrics and Scientometrics: Evaluating the research

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Abstract

The evaluation of research performance is essential to check the productivity, visibility, and quality of research. In the past, recognition in the peer group was limited due to the print format of the journal articles and conference proceedings etc. The advent of web technology has drastically changed the platform of research exchange worldwide. The research communications have greater reliability on online databases for the search of the academic literature. The all-time availability of the literature in bibliographic databases, have an immense impact on the individual researcher, journal, and the institution. Oxford Dictionary defines impact as "the effect or influence of one person, thing, or action, on another". Therefore, the assessment of research is the need of the hour, to know how an individual researcher is contributing to the field of his/her interest and what the level of one's productivity is. The present communication discusses the various tools and databases that have emerged to assess the impact of a research/ researcher in recent times.

Keywords

Author metrics; citation database; Quality publications; Indexing

Introduction

Bibliometrics and scientometrics are the two 'research measuring terms' generally used for the assessment of scientific publications and their impact. It is the measurement of publications in the form of books and articles in a journal and the researcher as well by employing statistical methods and techniques. When the statistical measures are used to measure the citations and analyse the content matter in the field of science, it is known as scientometrics.[1,2]

The impact is often related to the impact of a journal, measured as the impact factor. Despite its significance in scientific progress, rarely is the word 'impact 'used in terms of the impact of research or the researcher. Articles published in indexed journals with high impact factors are considered to be of superior quality and standard and hold high recognition among the peer groups.[3] The publication of good quality research is not only important for the dissemination of own work but also to apply for a research grant for innovative projects, recruitment and hiring for the academic posts and subsequent promotions.[4-8]

The new methods, research, and publications are also necessary for the society and the industry so that the generated methods can be immediately put to use. Therefore, new ideas and work should be published in indexed journals with high visibility among the peer-review group. Several indexing services are available to the researchers to access the newly published and existing literature on a particular topic, for instance, Web of Science, Scopus, Google Scholar, PubMed, Medline, etc. to name a few highly employed databases for literature search and citation measurement.[9] The evaluation of a scholar's research performance is usually based upon the citation analysis. Citation counts are an efficient and reliable method for analyzing the impact and quality of the work performance of the author, principal investigator of the project, academic institution as well as the nation.[10] Another term is Altmetrics-Alternative metrics which is a digital platform of science and companies monitoring the research outputs of scholars indulging in online activities including Wikipedia, twitter, research blogs and in online reference managers.[11] The results obtained by considering altmetrics with traditional metrics and expert judgement together are less valuable.[12] Thus, the value of the researcher is assessed with the use of citation counts proving the competence of the work performed on the academic front. The online databases are used to get an overview of the citation summary of an author.[13]

Author metrics and citations

The Institute of Technology at the University of Ontario has defined Author metrics as "an author's overall impact based upon the author's publications and the number of times they were cited. It is used to track how often an author's work is cited, discover who is doing similar work, track the work of colleagues, explore the evolution of the literature, identify key scholars in the field, and build a profile so others can find your work".[14] The quantification of the author's productivity may be

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calculated with the help of online databases, some of the commonly employed ones in this regard are mentioned here:

1. Web of Science (Thomson Reuters)[15]

   The web of science is one of the oldest platforms and now has powered others such as Publons,[16] Orcid,[17] Endnote[18] to highlight the research impact by managing citations and bibliographies.

2. Scopus (Elsevier)[19]
3. Google Scholar (Google Scholar Citation)[20]

   Such web service providers generate the summary of the researchers work potential along with its collaborators and institutions with use of various article metric indicators, which are as followed:

1. h-index (n number of papers cited at least n times)[21]
2. i-10 index (Measures the total number of published articles with at least 10 citations)[22]
3. i-20 index, (Measures total number of articles published with at least 20 citations)[23]
4. g-index, ("Publications ranked in descending order by times cited. G is the highest number g of papers that together received g2 or more citations")[24]
5. Articles with citation data
6. Average citation per article
7. Total citation count
8. Cited versus un-cited paper[10]

The above-mentioned indicators are devised to assess the performance of an academician/ researcher. Diana Hicks and colleagues[25] have academically demonstrated the research evaluation using 10 principles as described under "The Leiden Manifesto". It accurately considers qualitative as well as the quantitative aspects of the research metrics, therefore, the evaluation is objective. It could be the preferred method of conducting a research evaluation.[26] The foremost indicator to document the research activity of the researcher is the number of publications authored as the first author and in others as co-author, and the number of times it has been cited in refereed and reputed journals of the concerned discipline. A single indicator like H index or citation count etc. cannot give an accurate performance output, therefore, Martin and Irvine[27] recommended the use of different author metric indicators together to ascertain the publication activity of a researcher. Wildgaard et al.[28] have categorized these author metric indicators into five sub-heads such as Output as publication count, Output as Journal Impact, Effect of citation output, Ranking of publication through indicators, and indicators of impact over time.

The citation count analysis using citation indices have a limitation that such databases will differ in their quantitative result, depending on the disciplines being covered and version of the database in use.[29] Besides, ascertaining the standardized Journal Impact Factor of the journal within and/or between disciplines, which reflects the prestige of a journal.[4] Further, h-index,[21] i-10 index,[22] Max C (highest cited paper),[28] w-index,[30] g-index[24,31] clubbed together gives an approximate accurate output of the publication performance of a researcher. Though limitations such as the performance over time, citation earned over time, uncited articles, related or unrelated disciplines/field, and visibility to the academic community do exist, the aforementioned author metrics probably remain the only way to assess research.

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Cover your nose and mouth with handkerchief/tissue while sneezing and coughing

Throw used tissues into closed bins immediately after use

See a doctor if you feel unwell (fever, difficult breathing and cough). While visiting doctor wear a mask/cloth to cover your mouth and nose

If you have these signs/symptoms please call State helpline number or Ministry of Health & Family Welfare's 24X7 helpline at 011-23978046

Avoid participating in large gatherings

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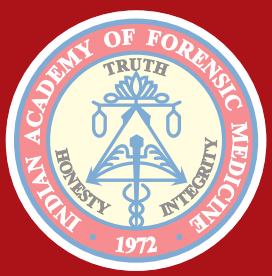
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