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ORIGINAL ARTICLE

Profile of Blunt Abdominal Injuries: An Autopsy Study

Alpesh B. Bambhaniya[1], Mehul C. Upadhyay[2], Rahul A. Mehta[3]

ABSTRACT

INTRODUCTION

Background: Many vital organs (Liver, spleen, kidney etc) and also vital vessels like aorta and many major veins are in the abdominal cavity, so injuries to abdominal cavity are mostly fatal in the form of hemorrhagic shock or neurogenic shock. Blunt or sharp objects may causes these type of injuries. Which are due to any mode of death.

Aims: To study the epidemiological aspect of fatal blunt abdominal injuries.

Material and Method: In this study 140 cases of abdominal injuries by blunt objects are studied for their various aspect.

Results: Most cases are of road traffic accident (RTA) or any other form of accidents. Most of them are young male between 20-40 years of age. Though majority of them died within in 1-2 hrs, on the spot or on the way. Nature of injuries are correlated with the history and incident. Involvement of spleen and liver shows multiple laceration. Kidney and retroperitoneal were also involved in significant number of cases. Vertebral, bladder and uterine injuries were rare.

Conclusion: Most of the fatal blunt abdominal injuries were of road traffic accidents majority of them have liver or spleen and hemorrhagic shock is the cause of death in almost all cases.

keywords | RTA; Retroperitoneal; Hemorrhagic Shock; Splenic laceration.

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INTRODUCTION

Routinely fatal blunt injuries seen over head, chest and abdomen. Blunt injuries are in the form of abrasion, contusion, laceration or fracture, they are mostly seen in road traffic accident. Many times abdominal damage occurs without any external visible injuries and diagnosed only during meticulous internal examination.[1-6]

Run over accidents and fall from a height can leads to multiple abrasion on either sides. Hitting by hard and blunt object also cause causes liver and spleen lacerations.[4,5]

Here in this study the epidemiological aspects of blunt abdominal injuries are studied in the cases brought to the autopsy room of the Department of Forensic Medicine Shri M.P. Shah Govt. Medical College, Jamnagar during the period of January 2015 to December 2015.

MATERIALS AND METHODS

The materials for the present study were the dead body of blunt abdominal injuries brought to autopsy room of the Department of Forensic Medicine Shri M.P. Shah Govt. Medical College, Jamnagar during the period of January 2015 to December 2015.

Exclusion criteria are those cases of skeletonised body, decomposed and cause of death is other than abdomen injury. All the information related to epidemiological aspect of the cases like incident, type of vehicle, treatment taken or not, survival period etc were collected from the close relatives, and police officer accompanying the dead body and also from the police papers.

Detail external and internal injuries were noted and tabulated according to the type of injury, involvement of abdominal organ and cause of death.

OBSERVATION & RESULTS

140 cases of blunt abdomen injuries are studied of which majority of the victims (49.3%) were young adult male between 21-40 years of age group. Age wise the maximum number i.e., 36 (25.7%) of the victims were from 31-40 years of age, followed by 21-30 and 41-50 years of age group i.e., 23.6% & 16.4% cases respectively. At the extreme of age cases were few. Sex-wise there is a clear predominance of male over female i.e., 102 (72.9%) & 38 (27.1%) cases respectively.(Table 1)

Table 1: Age and Sex wise distribution

Age	Male		Female		Total	
1-10	8	5.7%	1	0.7%	9	6.4%
11-20	11	7.8%	1	0.7%	12	8.5%
21-30	19	13.6%	14	10%	33	23.6%
31-40	25	17.9%	11	7.9%	36	25.7%
41-50	16	11.4%	7	5%	23	16.4%
51-60	13	19.3%	3	2.1%	16	11.4%
61-70	6	4.3%	1	0.7%	7	5%
Above 70	4	2.9%	0	0%	4	2.9%
Total	102	72.9%	38	27.1%	140	100%

Among blunt abdomen injuries 70.8% are caused by road traffic accidents, of which 2/3 (57.1%) by direct impact of the vehicle. Other blunt abdominal injuries were caused by, fall from height (7.9%) and by blunt weapon (9.2%) in homicidal assault.(Table 2)

Table 2: Manner of injuries

S No.	Manner	No. of Cases	No. of Cases (%)
1.	RTA	99	70.8%
	Impact	80	57.1%
	Run over	19	13.5%
2.	Fall from Height	11	7.9%
3.	Fall of object (Wall or any)	7	5%
4.	Blunt Weapon (Homicidal)	13	9.2%
	Total	140	100%

More than half (55.7%) of the victims were died on the spot just after the incidence. Another 34 (24.3%) were died within 6 hours. Only 6 (4.3%) of the victims survived more than 24 hrs.(Table 3)

Table 3: Survival Period

Sr. No.	Period	No. of cases	No. of Cases (%)
1.	Spot Death	78	55.7%
2.	Less than 1hr	21	15%
3.	1hr to 6hr	13	9.3%
4.	6hrs to 12hrs	9	6.4%
5	12hrs to 24 hrs	9	6.4%
6	More than 24 hrs	6	4.3%
	Total	140	100%

Injuries are caused externally front of abdomen in 45.7% and mostly on left side in 22.1% Back of abdomen involved in 24.3% cases and both front and back seen in 20% cases. Least cases seen on right back (5.7%).(Table 4)

Table 4: Involved areas (External Examination)

Sr. No.	Body Parts	No. of cases	No. of Cases (%)
1	Front of abdomen	64	45.7%
	Right	16	11.4%
	Left	31	22.1%
	Both	21	15%

2	**Back of abdomen**	34	24.3%
	Right	8	5.7%
	Left	21	15%
	Both	7	5%
3	**Front & Back**	28	20%
	Total	140	100%

Abrasion was the most common injury in 87.9% followed by contusion (65.7), least common was fracture (6.4%). (Table 5)

Table 5: Involved areas (External Examination)

Sr. No.	Injury Type	No. of cases*	No. of Cases (%)
1	Abrasion	123	87.9%
2	Laceration	69	49.3%
3	Contusion	92	65.7%
4	Fracture	9	6.4%

*= Multiple response

Internally spleen was the most common internal organ (59.3%) followed by liver (51.4) Least common was aortic (4.3%) and intestinal (0%) injury. Among splenic injury multiple laceration was common near the pedical (42.9%), in liver right lobe (42.1%) laceration was common. (Table 6)

Table 6: Involved areas (Internal Examination)

Sr. No.	Involved Organ	No. of cases*	No. of Cases (%)
1	Spleen	83	59.3%
2	Liver	72	51.4%
3	Right kidney	30	21.4%
4	Left kidney	26	18.6%
5	Aorta	6	4.3%
6	Retroperitoneal	42	30%
7	Bladder	3	2.1%
8	Uterus	5	3.5%

*= Multiple response

DISCUSSION

Mordernization leads to increase in the transportation which leads to increase in road traffic accidents and it is the cause for most of blunt injuries and it is a leading cause of death in autopsy.

Increase industrialization leads to increase in industrial injury in which most of them are of blunt injury. Some of cases of blunt trauma on abdomen are also seen in assault between persons or group with the hard and blunt objects.

In this study shows majority of the victims are young adult males, rarely seen in children, mostly RTA and accidental is the main cause behind such deaths. This is similar to the observations made by other study.[1-4]

In present study it shows that in RTA direct impact by the vehicle is most common cause of blunt trauma to the abdomen. Meera Th et al., Pathak A et al., Kumar S et al., Benerjee K K et al. and Singh M et al. also shows similar results.[5,7,8,10,12] Injuries to spleen or liver were found fractured in almost all the cases , of which of these splenic injury were most common internal injury. This is also consistent with the observations made by Pathak A et al. and Mohd et al. in their study.[7,13] In splenic injury multiple lacerations were common which is consistent with Pathak A et al., Benerjee K K et al. and Mohd et al.[7,10,13] In liver injury right lobe was common which is consistent with Kumar S et al., Benerjee K K et al. and Mohd et al.[8,10,13]

CONCLUSION

- More than 50% ofabdomen injuries were adult males between 21-40 years of age.
- More than 70% of the victims is of RTA most of them are of impact injuries.
- Splenic and liver injuries were seen in almost all cases. Bladder, uterus and colon were least involved.
- In the cases where spleen involved shows multiple laceration near pedical.
- More than 75% of the victim died either on spot or within 6hrs in the way or in casualty.
- Almost all cases hemorrhagic shock was the cause of death.

Conflict of Interest: *Nil*

Source of Funding: *Nil*

Acknowledgement: *Nil*

REFERENCES

1. ***Modi J P. Modi's***
   medical jurisprudence & toxicology. 22nd edition. New Delhi: Lexis Nexis Butterworth; 2004.p.523-29.
2. ***Park K. Park's***
   Texbook of Preventive and Social Medicine. 17th ed.Jabalpur: Banarasidas Bhanot; 2002.352-54.
3. ***Saukko P, Knight B. Knight's***
   Forensic Pathology. 3rd ed. London: Arnold;2004.238.
4. ***Reddy KSN.***
   The Essentials of Forensic Medicine and Toxicology. 29th ed. Hyderabad: K. Suguna Devi;2020.112-113,139.
5. ***Meera Th, Nabachandra H.***
   A study of pattern and injury severity score in blunt thoraco-abdominal trauma cases in Manipal, j. medicolegal update 2005; 5(2):47-52.
6. ***A delson L.***
   The pathology of homicide. 1st edition. USA: Charles Thomas; 1974.p.437.
7. ***Pathak A.***
   Profile of Road Traffic Accidents & Head Injury in Jaipur (Rajasthan), JIAFM. 2007. 30(1), 6-9.
8. ***Kumar S, Suresh B, Kanchan T, Ritesh G, Shankar M, Bakkannavar, Vinod C, Nayak K, Yoganarasimha. Victim***
   Profile and Pattern of Thoraco-Abdominal Injuries Sustained in Fatal Road Traffic Accident. JIAFM 2012; 34(1):16-19.
9. ***Singh PK, Slong D, Devi M.***
   Pattern of Road Traffic Accidents in Imphal. J Indian Acad Forensic Med.2012;34(4);301-303.
10. ***Benerjee K K, Agarwal B.B.L and Kohli.***
    Study of thoraco-abdominal injuries in fatal road traffic accidents in North east Delhi. J Indian Acad Forensic Med. 1997; 4(1): 40-43.
11. ***Chandra J. et al.***
    Some medico-legal observations of fatal vehicular accidents in Delhi; International microform New York; Jour. of legal medicine. 1779; 3: 31 – 45.
12. ***Singh M, Kumar A, Verma A, Kumar A, Singh***
    A. Abdominal Organ Involvement in Blunt Injuries. J Indian Acad Forensic Med.2012; 34(1):24-26.
13. ***Mohd et al .***
    Trauma to Spleen: A Marker to Assess the Prognosis In Blunt Trauma to Abdomen Cases. J Indian Acad Forensic Med.2015; 37(4):385-87.

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ORIGINAL ARTICLE

Estimation of Stature from Maximum Head Length and Maximum Head Breadth among Adult Cadavers for Autopsy at Kolkata Police Morgue

Arundhati Saha[1], Chandan Bandyopadhyay[2], Saswata Biswas[3]

ABSTRACT

INTRODUCTION

Forensic identification from mutilated and fragmented body parts is a critical part of forensic investigation. Stature is a major criterion of identification and provides useful clues to the investigating agency. There are established correlations of stature with body parts such as extremities, head, trunk, vertebral column, etc. This study was formulated to find out correlation between maximum head length and maximum head breadth with stature in human and to calculate a regression equation to determine stature from head length and head breadth at Kolkata Police Morgue attached to Upgraded department of Forensic and State Medicine, Medical College, Kolkata. It is a cross-sectional, observational study. Total 32 deceased subjects (n= 32, m=26 f=6) were selected for the study depending on inclusion and exclusion criteria. Maximum head length and breadth were measured in each using spreading callipers and stature was measured using standard autopsy procedures. The results were tabulated in excel spread sheet and analysed using Stat Cal C software and SSS (online). The mean, stature of the study population was 162.54 cm, head length 17.78 cm and head breadth 13.75. cm r = 0.473 (head length, p <0.006) , 0.181 (head breadth, p <0.321). Regression equations: stature = 3.83 × head length + 94.43; 2.09 × head breadth + 133.69 and 3.76 × head length + 0.29 × head breadth +91.60. Head length and head breadth were correlated with stature. Regression equations can be used to estimate stature in forensic cases from head length and breadth.

KEYWORDS | Stature; Maximum head length; Maximum head breadth; Anthropometry; Cadavers

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INTRODUCTION

One of the very important parameters in medico legal forensic examination is stature.[1,6] There is established biological correlation of stature with all the body parts such as extremities, head, trunk, vertebral column, etc.[1] Positive identification of the deceased from human remains, mutilated bodies and fragmented body parts is an essential part of forensic investigation. Due to increased events of mass disaster and brutal murders, dismembered body parts are sent to post-mortem examination every now and

then.[6]

Stature being one of the criteria of personal identification, it helps in narrowing down the investigation process and thus provides useful clues to the investigating agency.

Dietary habits and climate of different regions of India are variable, racial and ethnic variations also exist in different geographical regions.[8] Hence conclusions based on the results of studies done in one population cannot entirely be applicable to other population.

There are variations in the length of limb bones relative to stature and according to race, sex, age, side of body, climate, heredity and nutrition.

Despite many research works, there is dearth of substantial data regarding estimation of stature from head dimensions for population in and around Kolkata region of West Bengal. Hence this study has been designed to correlate the relationship between dimensions of head like maximum length and maximum breadth with stature through statistical analysis.

AIMS AND OBJECTIVES

Primary

- To find out the correlation between head dimensions and stature.

Secondary

- To find a correlation between maximum head length and stature.
- To find a correlation between maximum head breadth and stature.

MATERIALS AND METHODOLOGY

Study design

This is an institution based observational and cross-sectional study.

Study period

3 months, 1/3/22 to 31/5/22.

Study population

Dead bodies which came to Kolkata police morgue under upgraded department of Forensic and State medicine, Medical College, Kolkata for autopsy during the period of study.

Inclusion criteria

Gender: male and female

Age: more or equal to 18 yrs of age.

Exclusion criteria

- Dead bodies with craniofacial deformities, either congenital or acquired.
- Beheaded body / transected body from thorax and abdomen / mutilated and fragmented bodies of different parts, in which head dimensions and stature cannot be measured properly.

Sample size

- After applying inclusion and exclusion criteria, 32 adult dead bodies were taken for the study.

Study tool and technique

After going through the inquest report and other relevant papers as per protocol of medicolegal autopsy, the study was started after satisfying all the inclusion and exclusion criteria as stated above. Age was known by the supplied documents furnished by the police and verified from Aadhar card. 32 dead bodies were chosen.

Stature is the length of the dead body (BL). The minimum axial distance between the vertex of the head and the heel with body in supine position.[3] (Fig. 1)

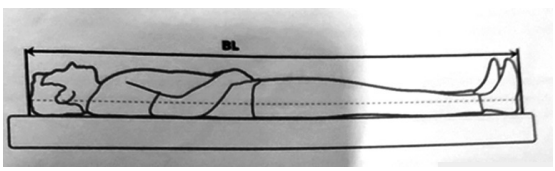


Fig. 1: Measurement of Body length (BL)

Source: Internet

Maximum head breadth (MHB) is the greatest transverse diameter from euryon to euryon.[5] (fig. 2)

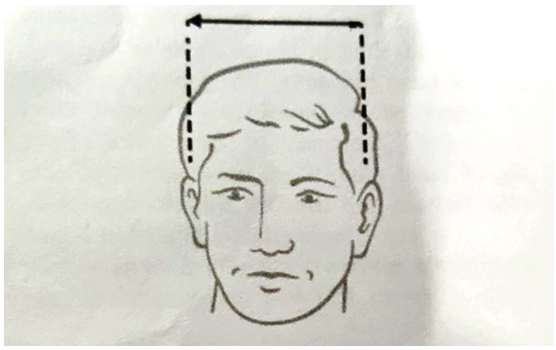


Fig. 2: Measurement of Maximum head breadth(MHB)

Source: Internet

Maximum head length (MHL) is straight distance between glabella and ophisthocranion.[5] (fig. 3)

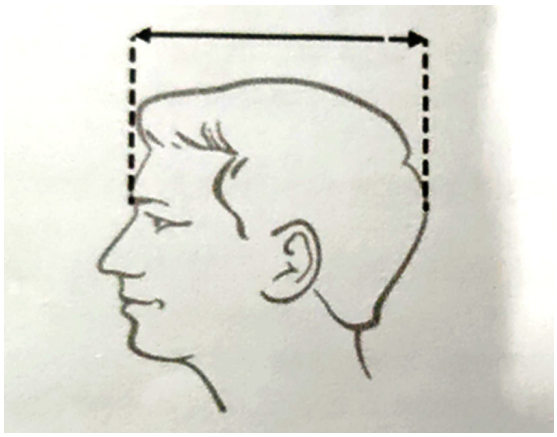


Fig. 3: Measurement of Maximum head length(MHL)

Source: Internet

The dead body was kept in supine position on the flat, hard surfaced autopsy table. Rigor mortis was broken, if had developed. The head was fixed in such a way that Frankfurt plane was at right angle to the autopsy table. Frankfurt plane is defined as plane adjoining the upper margin of the ear openings to the lower margin of the orbits of the eyes. Knee and hip joints were extended, and the neck and feet were kept in neutral position. Two wooden blocks were taken. One was kept at the vertex of the head and the other at the heel. Stature was measured between the two wooden blocks using a measuring tape (BL).[3]

For the measurement of maximum head length (MHL) and maximum head breadth (MHB) spreading callipers was used.[5]

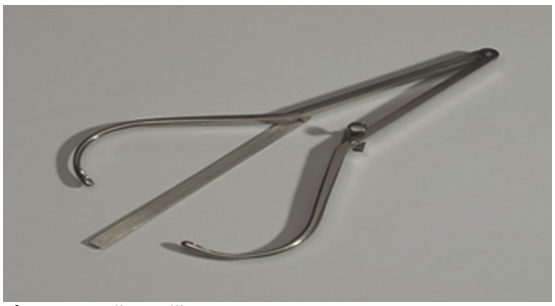


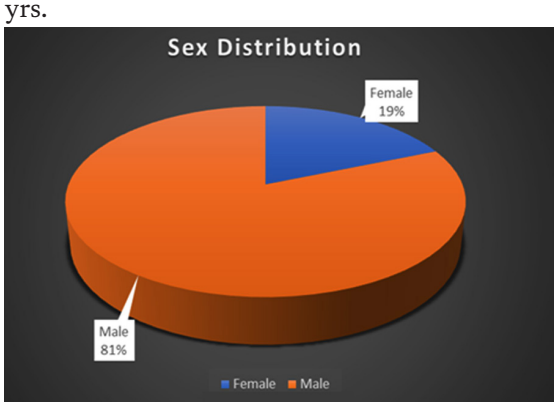
Fig. 4: Spreading callipers

Picture courtesy: Dr. Arundhati Saha

All the measurements were taken in a well lighted room. Measurements were taken up to the nearest 0.1 cm. The collected data was tabulated with the help of Microsoft excel spreadsheet. The mean and standard deviation for each parameter was calculated. The correlation coefficient and standard error of estimate were then calculated. Finally, the regression analysis was done. The results were analysed using Stat Cal C software and SSS (online).

RESULTS

In the study, 32 deceased subjects were taken, 6 females and 26 males. The mean age was 47.25 (standard deviation of 15.69). Minimum age of subjects was 21 yrs and maximum age was 77 yrs.



The mean stature was 162.53 cm. (SD of 8.17). The minimum stature of subjects was 147 cm and the maximum stature was 178 cm. The mean head length was 17.78 cm (SD of 1.0083). The minimum head length of the subjects was 16 cm and the maximum head length was 20 cm. The mean head breadth was 13.75 cm (SD of 0.7058). The minimum head breadth of subjects was 12 cm and maximum head breadth was 15 cm.

Table 1: Descriptive Statistics

Variables	Mean	Median	Standard Deviation	Range
Age	47.25	49	15.69	56
Stature	162.53	162.03	8.174	31
Head Length	17.78	17.75	1.008	4
Head Breadth	13.75	14	0.705	3

Table 2: Correlation of Stature with head length and head breadth.

-	Pearson's Correlation	P value
Head length	0.473	<0.006
Head breadth	0.181	<0.321

Simple Regression equation

$y = Bx + A$

y is stature, B is slope, x is head length or breadth, A is y intercept.

Table 3: Simple Regression Equation

-	Regression Equation	Standard Error of Estimate
Head Length	3.8307 × HL + 94.43	7.3171
Head Breadth	2.0973 × HB + 133.69	8.1677

Multiple logistic regression equation

Y is stature, X_1 is head length, X_2 is head breadth

$Y = (3.76 \times X_1) + (0.29 \times X_2) + 91.60$

DISCUSSION

The results indicate that one can successfully estimate stature from head length and head breadth. The stature estimation can supplement the other personal identification data like estimation of age, sex, race and thus identification of the dead body.

The measurements were taken very carefully. All instruments were checked regularly for accuracy and precision while collecting data. Inter-observer errors were avoided by the author, by taking all measurements herself.

The findings of the study indicate positive correlation between head length and head breadth with stature. However it must be kept in mind that the goal of precise prediction of stature from the above mentioned head dimensions is unachievable.[1]

The study done by K. Krishnan and R. Kumar successfully estimated stature from cephalo facial measurements in Koli adolescents an endogamous population of North India. In adolescents, the stature is correlated with age but is complicated by the differences in rates of growth among individuals. The continuing physical growth of the long bones which contribute considerably to stature and progressive growth of the head also has some effect on the stature estimation in adolescents. Thus drawing the inference that stature is usually a straight forward parameter to demonstrate in adults.[1]

Pratik R Varu et al. carried out a study on 100 male cases and 100 female cases ageing more than 20 yrs randomly selected from cadavers brought for post mortem examination. This study has found positive and statistically significant correlation of head length and head breadth with stature for population around Rajkot region of Gujarat. Moreover, it is found that regression formula derived from head length predicts stature more accurately than from head breadth. The present study has similar findings, i.e, head length has more correlation than head breadth with stature.[3]

Different geographical locations will have different regression equations, SEE, correlation coefficients as stature is influenced by number of factors like race, regional and environmental factors, etc.[8]

CONCLUSION

From the present study, it is concluded that Head length and Head breadth are correlated with Stature. Regression equations can be used to estimate Stature in forensic cases from Head length and Head breadth, with better correlation with Head length. Head length and Head breadth can predict the stature when cephalo facial remains are brought for forensic examination. It is further concluded that regression equations are population specific and will not give reliable results if applied to

other populations. However it must be kept in mind that the goal of precise prediction of stature from the above mentioned head dimensions is unachievable.[1]

LIMITATIONS

Due to changes in diet, socioeconomic status, diet, the present regression formulae may need readjustment over time.

The present study clearly has limitations in gender distribution.

Larger sample size will give more reliable regression equations.

RECOMMENDATIONS

Similar kind of study should be repeated with larger sample size with better gender distribution.

More than one observer for measuring the variables, can lead to inter observer error and that can be calculated to see if that is significant or not.

Conflict of Interest: *Nil*

Source of Funding: *Nil*

Acknowledgement: *Nil*

REFERENCES

1. ***Krishan K.*** *Estimation of stature from cephalo-facial anthropometry in north Indian population. Forensic Science International. 2008 Oct;181(1–3):52.e1-52.e6. doi : 10.1016/j.forsciint.2008.08.001.*
2. ***Krishan K, Kanchan T, Menezes RG, Ghosh A.*** *Forensic anthropology casework essential methodological considerations in stature estimation. Journal of Forensic Nursing. 2012 Mar;8(1):45–50. doi: 10.1111/j.1939-3938.2011.01122.x.*
3. ***VaruPR, Manvar PJ, Mangal HM, Kyada HC, Vadgama DK, Bhuva SD.*** *Determination of stature from hand dimensions. JMR 2015;1(3):104-107.*
4. ***González-Colmenares G, Medina CS, Báez LC.*** *Estimation of stature by cephalometric facial dimensions in skeletonized bodies: study from a sample modern Colombians skeletal remains. Forensic Science International. 2016 Jan;258:101.e1-101.e6. doi :http://dx.doi.org/doi:10.1016/j.forsciint.2015.10.016.*
5. ***KI P, Vr V. Somatometric*** *Estimation of Stature Using Head Length and Height Measurements in Male and Female Youths from a Rural Population in Mangalore. International Journal of Health Sciences. 2017;(8):7.*
6. ***Prasad AK, Hiwarkar MP, Kumar A, Taywade OK.*** *Stature Estimation from Head Length and Breadth by Regression Analysis in Madhya Pradesh Population. 2019;8:3. doi: 10.7860/IJARS/2019/41606:24917.*
7. ***Prasad IM.*** *Estimation of Stature from Head Length and Head Breadth by Regression Analysis in South India Population. IJFMP. 2020 Jul 1;13(3):427–32. doi :http://dx.doi.org/10.21088/ijfmp.0974.3383.13320.10.*
8. ***Wankhede KP, Anjankar VP,*** *et al. estimation of stature from head length & head breadth in Central Indian population: an anthropometric study. IJAR. 2015 Mar 31;3(1):954–7. doi : http://dx.doi.org/10.16965/ijar.2015.125*
9. ***K. Krishnan, R. Kumar,*** *Determination of stature from cephalofacial dimensions in a north Indian population, Leg. Med. 9(2007):128-133.*

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ORIGINAL ARTICLE

Epidemiology of Snake Bite in A Medical College in Karnataka

Chandrashekhar B. Bhuyyar[1], Tyagaraju M.R[2], Dayanand Gannur[3], Uday Kumar[4], Shrikant. B.[5], V. M Allagi[6]

ABSTRACT

INTRODUCTION

Snake bites are a cause of considerable morbidity and mortality worldwide. Out of 68 cases, the maximum was between the age group of 20 - 30 years (26%). 47 of 68 (69%) victims were male, and 31% of victims were females. More than half of the victims are farmers. 39 of 68 (>57%) victims belonged to a lower class of socioeconomic status. 24% were illiterates, and 76% were literates. Maximum victims, 91%, were from a rural region. Maximum victims, 68% had snake bites in the fields, followed by 19% snake bites at home. 56% of snake bites occurred in the rainy season and 26% in the winter season.

KEYWORDS |Snakebite; Victims; Farmers.

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INTRODUCTION

Snakebite is a major public health problem all over the world, especially in tropical and sub-tropical countries. Snake venom is the oldest known poison to mankind. A total of 45,900 national snakebite deaths in 2005 constituted about 5% of all injury deaths and nearly 0.5% of all deaths in India.[1]

Considerable morbidity and mortality worldwide are caused by Snake bites. The highest burden of snake bites exists in South Asia, Southeast Asia, and sub-Saharan Africa. Globally, at least 421,000 envenomations cause 20,000 deaths per year as a result of snakebites. There may be as high as 1,841,000 envenomations and 94,000 deaths. Based on the fact that envenomation occurs in one fourth of snakebites, between 1.2 million and 5.5 million snakebites could occur annually.[2]

WHO recognized that snakebite does not have the epidemic potential of infectious and vector borne parasitic diseases, but it should be emphasized that the yearly mortality

caused by snakebite is much greater than that attributed to several presently recognized neglected tropical diseases, including dengue hemorrhagic fever, cholera, leishmaniasis, schistosomiasis, Japanese encephalitis, and Chagas' disease.[3]

More than 60 species of venomous snakes are found in India some of which are abundant and can cause severe envenomation. The most deadly snakes commonly associated with human mortality in India are cobra (Naja Naja), krait (Bungarus Caeruleus), Russell's viper (Daboia Russelii) and saw-scaled viper (Echis Carinatus).[4]

OBJECTIVES

This study was conducted with the following objectives:

1. To know the Socio-demographic profile of snakebite cases admitted and treated in BLDE University's Shri. B. M. Patil Medical College, Hospital and RC, Vijayapur.
2. To know morbidity and mortality due to snakebites and the effectiveness of Hospital management.

MATERIALS AND METHODS

This is a prospective study done for a year from 1st January 2014 to 31st December 2014. The subjects for the study comprised all 68 patients with snakebite admitted to Shri B.M. Patil Medical College, Hospital and R C.

Source of data

The data was collected from following:

1. Proforma, which was designed to collect information regarding the incidence.
2. History elicited from snakebite victims and their attendees.
3. In-patient medico-legal case records of snakebite victims.

Inclusion criteria:

1. The study includes cases of snakebite of both sex groups of all ages with a history of snakebite admitted to Shri B.M. Patil Medical College, Hospital and Research center.

Exclusion criteria

Cases of the unknown bite were excluded from the study.

RESULTS

Table 1: Age wise distribution of cases

AGE in years	N	%
0 TO 10	4	5.9
10 TO 20	7	10.3
20 TO 30	18	26.5
30 TO 40	15	22.0
40 TO 50	14	20.6
50 TO 60	6	8.8
> 60	4	5.9
TOTAL	68	100

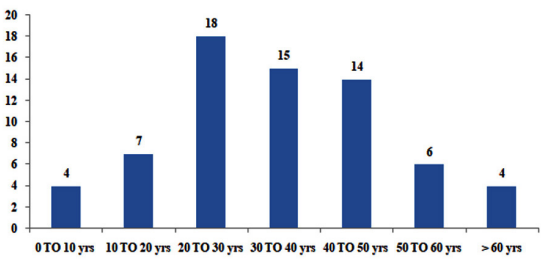

Chart 1: Age

Table 2: Sex-wise distribution of cases

Gender	N	%
Male	47	69.1
Female	21	30.9
Total	68	100

Table 3: Occupation-wise distribution of cases

Occupation	N	%
Agriculture	35	51.5
Daily Labour	8	11.8
Housewife	11	16.2
Nil	3	4.4
Others	3	4.4
Students	8	11.8
Total	68	100

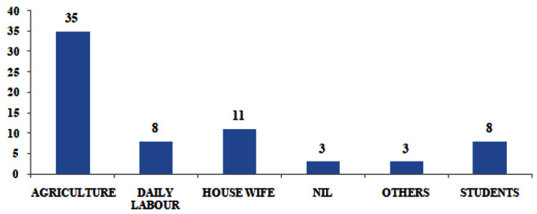

Chart 2: Occupation

Table 4: Distribution of cases as per Socioeconomic status according to modified B G Prasad classification

Socio-economic status	N	%
Upper Class	3	4.4
Upper Middle	4	5.9
Middle Class	9	13.2
Lower Middle	13	19.1
Lower Class	39	57.3
Total	68	100

Table 5: Education-wise distribution of cases

Education	N	%
Illiterate	16	23.5
Primary	11	16.1
Upper primary	16	23.5
Lower secondary	12	17.6
Higher secondary	7	10.2
Post-secondary	4	5.9
NA	2	2.9
Total	68	100

Table 6: Education wise distribution of cases

Region	N	%
Urban	6	8.8
Rural	62	91.2
Total	68	100

Table 7: Distribution of cases v/s time of the incident

Time of Bite	N	%
0 to 06 Hrs	9	13.2
06 to 12 Hrs	15	22.0
12 to 18 Hrs	19	27.9
18 to 24 Hrs	25	36.7
Total	68	100

Table 8: Distribution of cases based on Place of occurrence of the incident

Place	N	%
Fields	46	67.6
House	13	19.1
Road	6	8.8
Cattle shelter	3	4.4
Total	68	100

Table 9: Distribution of cases based on month wise

Month	N	%
Jan	5	7.4
Feb	2	2.9
Mar	4	5.9
Apr	2	2.9
May	4	5.9
Jun	7	10.2
Jul	6	8.8
Aug	15	22.0
Sep	10	14.7
Oct	6	8.8
Nov	2	2.9
Dec	5	7.3
Total	68	100

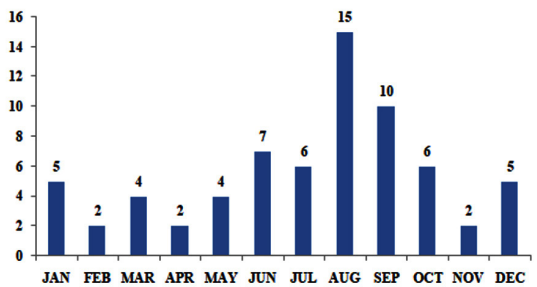

Chart 3: Month-Wise

DISCUSSION

Out of 68 cases, the maximum was between the age group of 20-30 years (26%), followed by the age group of 30-40 years (22%) and the age group of 40-50 years (20%), 47 of 68 (69%) victims belonged to the age group of 20-50 years. Bite victims belonging to extremes of

age groups (0-10 years and >60 years) were a minimum of only 10%.

The same kind of observations was made in studies conducted by Ganneru B & Sasidhar RB[5] in Andrapradesh and Nuchhi U C et al.[6] in Gulbarga. The probable reason for the predominance of the 20-50 yrs age group is they constitute the most active and major working force among these individuals.

47 of 68 (69%) victims were male, and 31% of victims were females.

The same kind of observations was made in studies conducted by Kulkarni ML & Anees S[7] in Karnataka and Shetty AK & Jirli SP.[10]

This observation is in contrast with the findings recorded in the study conducted by Monterio NP et al.[8] in Manipal, where female predominance was recorded with male to female ratio of 1:1.5.

The probable reason for the predominance of males is increased agricultural activity among these individuals.

More than half of the victims are farmers. Among three others, two were in the stationery business, one was a panchayat bill collector, and among 3 of Nil, 2 were kids of 3 years old, and one was a 70-year-old lady.

The observations made in the study are in accordance with the studies conducted by Lal P et al.[9] in JIPMER Hospital, Pondicherry, Nuchhi U C et al.[6] in Gulbarga and Shetty AK & Jirli SP[10] at Belgaum.

The predominance of agriculture workers can be attributed to the increased frequency of human confrontation with snakes in agricultural fields owing to the snakes' habits, habitat and prey preferences.

39 of 68 (>57%) victims belonged to the lower class of socioeconomic status.

In this study, two victims were below the age group of schooling, hence among the rest 66 cases, 24% were illiterates, and 76% were literates having different levels of education. The majority, 41%, had primary education, followed by 29% had secondary education, and 6% were graduates.

The above observation depicts that victims with non technical (unskilled) knowledge are more involved in agricultural work, hence more exposed to snakebites. The low literacy level also leads to a lack of knowledge regarding precautions to be taken to avoid snakebites.

In our study, the maximum number of victims 91%, belonged to a rural region. This finding is similar to the observations in the studies made by Kulkarni ML & Anees S[7] in Karnataka, Nuchhi U C et al.[6] in Gulbarga and Shetty AK & Jirli SP[10] in Belgaum, and Mohapatra et al.[1] in India.

In this study, Maximum snakebites, 65% were between 12 noon to 12 midnight, of which 37% of snakebites occurred between 18.00 hrs to 24.00 hrs, followed by 28% between 12.00 hrs to 18.00 hrs.

In this study, the maximum number of victims 68%, had snakebites in the fields, followed by 19% snakebites at home. The same kind of finding was seen in the study conducted by Kulkarni ML & Anees S[7] in Karnataka.

In this study, a maximum snakebites 56% occurred from June to September (monsoon season), followed by 26% from October to January (winter season).

The same kind of observations was made in the study conducted by Lal P et al.[9] in JIPMER Hospital, Pondicherry, Bawaskar HS[11] in Mahad region of Maharashtra, Shetty AK & Jirli SP[10] in Belgaum and Mohapatra B et al.[1] in India.

Whitaker R[12], in his study conducted in Kerala, observed that the month of May had the highest incidence of snakebite. However, in our study, the highest incidence of snakebite was in the month of 22nd August %.

CONCLUSION

The observations found in this study shows that the farmers of rural background are the maximum victims of snake bites that too in the rainy season. So the farmers should be advised to use shoes and gloves while working in the field. They should even be advised to carry a torch while working in the field. The government should educate the people about the preventive measures immediately necessary for hospital admission to save the

valuable lives of the people.

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REFERENCES

1. ***Mohapatra B, Warrell DA, Suraweera W, Bhatia P, Dhingra N, Jotkar RM.*** *Snakebite Mortality in India: A Nationally Representative Mortality Survey. PLosNegi Trop Dis. 2011; 5(4): e1018.*
2. ***Kasturiratne A, Wickremasinghe AR, de Silva N, Gunawardena NK, Pathmeswaran A.*** *Estimating the global burden of snakebite: A literature analysis and modeling based on regional estimates of envenoming and deaths. PLoS Med.2008; 5(11): e218.*
3. *World Health Report 2004. Changing history. http://www.who.int/whr/ 2004 /en.*
4. ***Whittaker R.*** *Common Indian snakes: A field guide. New Delhi: McMillan India Limited; 2001.*
5. ***Ganneru B, Sashidhar RB.*** *Epidemiological profile of snakebite cases from Andhra Pradesh using immunoanalytical approach. Indian J Med Res 125, 2007 May:661-8. Available from:http://www.icmr.nic.in/ijmr/2007/may/ 0508.pdf.*
6. ***Nuchhi UC, Shah RK, Reddy KSN.*** *A study of snake bite poisoning in Gulbarga region (a five year study). Indian Journal of Forensic Medicine & Toxicology Year: 2009, 3(2).*
7. ***Kulkarni ML, Anees S.*** *Snake venom poisoning: experience with 633 cases. Indian Pediatr. 1994 Oct;31(10):1239-43.*
8. ***Monteiro NP, Kanchan T, Bhagavath P, Pradeep Kumar G.*** *Epidemiology of Cobra bite in Manipal, Southern India. J Indian Acad Forensic Med. 2010;32(3):224-27.*
9. ***Lal P, Dutta S, Rotti SB, Danabalan M, Kumar A.*** *Epidemiological profile of snakebite cases admitted in JIPMER Hospital. Indian Journal of Community Medicine. 2001; 26(1): 36-38.*
10. ***Shetty AK, Jirli SP.*** *Incidence of Snake Bites in Belgaum. J Indian Acad Forensic Med.2010;32(3):139-41.*
11. ***Bawaskar HS.*** *Profile of snakebite envenoming in Western Maharashtra, India. Trans R Soc Trop Med Hyg. 2002 Jan-Feb;96(1):79-84.*
12. ***Whitaker R, Whitaker S.*** *Analysis of Snakebite Data from Pap pinisseriVishchikilsaSociety, Kannur, Kerala (India). Calicut Medical Journal 2005;4(2):e2.Available from: http://www.calicutmedicaljournal.org/2006/4/2/e2.*

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ORIGINAL ARTICLE

A Study on Profile of Poisoning Cases in a Tertiary Care Hospital at Karaikal

J Venkatesaprasanna[1], Prasanna Parthasarathy[2], Thumma Amar[3], Vijayakumar Nair G[4]

ABSTRACT

INTRODUCTION

Background: Acute poisoning is one of the major causes of morbidity and mortality worldwide, with 90% of the burden of fatal poisoning cases are from developing countries. Pattern of poisoning in any region depends on variety of factors such as availability of poisons, socio-economic status of population, religious beliefs and cultural influences. The data regarding poisoning cases in south India is scarce. Hence, the present study was carried out.

Materials and methods: This was a hospital based, descriptive, cross-sectional study conducted for a period of one year, from January 2021 to December 2021.

Results: Out of 152 cases, majority were males (63.16%) and from rural area (83.55%). The most common age group involved was between 21 to 30 years (41.45%). Suicidal poisoning was common (57.74%) followed by Accidental poisoning (34.21%), while none of them were of homicidal in nature. Organophosphorus compounds, Household products, and Rodenticides were the most commonly used poisons.

Conclusion: The present study concludes that acute poisoning is a distressing public health problem. It affects the larger number of male population. The commonest poisoning agent was Organophosphorus compound. The occurrence was high among married males and in the age group of 21 – 30 years. The incidence of acute poisoning, morbidity and mortality related to the poisoning can be diminished by developing and implementation of appropriate preventive strategies. words:

keywords |Epidemiologic Studies; Acute Poisoning; Organophosphorous Compounds; House hold Products.

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INTRODUCTION

Acute poisoning is one of the major causes of morbidity and mortality worldwide, with 90% of the burden of fatal poisoning cases are from developing countries.[1] Approximately 258,000 fatal cases of pesticide self poisoning are reported globally each year, most from

Asian countries, and the figure is greatly exceeded by the number of poisoned patients who seek treatment at health facilities.[2] Data regarding the other kinds of poisonings are limited and are quite variable depending on the geographical area, socio-economic factors and cultural diversity.[3] The low to middle economy nations carry disproportionately larger share (84%) of poisoning cases reported globally.[4] The mortality percentage due to acute poisonings in the developed countries is 2%, while in a developing country like India, it is alarming and as high as 30% with approximately fifty thousand Indians dying annually.[5]

Pattern of poisoning in any region depends on variety of factors such as availability of poisons, socio-economic status of population, religious beliefs and cultural influences.[6] The aetiology of poisoning may be either intentional (suicidal or homicidal) or unintentional (accidental).[7]

With the rapid advancement in the development of newer chemicals and drugs, the problem is getting worse. Information available is limited, including hospitalized patients because of poor regulations and limited health care services in our country.

Several studies done in India have shown organophosphates (OPs) as the most common agents of poisoning.[2,6] Some of the recent studies have found change in the trends of poisoning in certain parts of India with an increasing incidence of poisoning with aluminum phosphate.[8]

The data regarding poisoning cases in south India is scarce. Hence, the present study was carried out with the objectives toknow the pattern of poisoning cases and to study the socio-demographic profile of victims of poisoning in a rural tertiary care hospital in Karaikal.

MATERIALS AND METHODS

This was a hospital based, descriptive, cross sectional study conducted at Vinayaka Mission's Medical College and Hospital, Karaikal, which is a tertiary care teaching hospital in rural part of Pondicherry state. This study was carried out for a period of one year, from January 2021 to December 2021. All the poisoning cases admitted during the study period to the emergency ward, intensive care unit, and medicine wards were included in the study. In the present study, cases of food poisoning and adverse drug reaction were excluded.

The interviewing technique was employed as a tool for data collection. A pre-designed structured proforma was usedto record the necessary information. Informed consent was obtained from the study participants. The diagnosis of poisoning was based on a history given by the patients or relatives and clinical examination. The required laboratory tests were also performed to confirm the diagnosis of poisoning whenever possible.

The data including demographic profile of patients, time of exposure to poison, time interval between poisoning and hospitalization, duration of hospital stay, nature and chemical type of poison, clinical manifestations of patients, treatments delivered to patients, outcome and circumstances of poisoning was collected. The poisons were classified into various groups based on their usage and/or their chemical classification.

Data was entered and analysed by using 'Epicollect'[5] software. Descriptive statistics was used to summarize baseline characteristics of the study participants. The analyzed data was presented in the form of text, tables, and charts.

Ethical clearance was obtained from the institutional ethics committee before commencement of this study.

RESULTS

A total of 152 admitted cases of acute poisoning were enrolled in this study based on inclusion and exclusion criteria. In the current study, 96 (63.16%) patients were males and 56 (36.84%) were females. Most of the patients of acute poisoning were from rural area, i.e., 83.55%, and majority of them were farmers and fishermen, i.e., 55.26%. The most common age group involved was between 21 to 30 years, i.e., 41.45%. Majority of them were married,

Table 1: Socio-demographic profile of victims of poisoning

Variables	Number of cases	Percentage (%)
Gender		
Male	96	63.16
Female	56	36.84
Age group		
<20	15	9.87
21-30	63	41.45
31-40	41	26.97
>40	33	21.71
Domicile		
Rural	127	83.55
Urban	25	16.45
Socioeconomic class		
Class I	5	3.29
Class II	6	3.95
Class III	27	17.76
Class IV	66	43.42
Class V	48	31.58
Marital status		
Married	128	84.21
Unmarried	23	15.13
Divorced	1	0.66
Occupation		
Student	31	20.39
Farmer	52	34.21
Fisherman	32	21.05
Homemaker	29	19.08
Laborer	6	3.95
Self business	1	0.66
Government servant	1	0.66

i.e., 84.21% and were belonged to low socio-economic class, i.e., Class IV and V, 114 (75%) (Table 1).

Suicidal poisoning was common, i.e., 57.74% followed by Accidental poisoning 34.21%, while none of them were of homicidal in nature. Organophosphorus compounds, Household products, and Rodenticides were the most commonly used poisons, i.e., 80.26%. (Fig. 1)

Table 2: Time interval between poisoningand hospitalization, Outcome and Manner of poisoning

Variables	Number of cases	Percentage (%)
Time interval between poisoningand hospitalization (hours)		
<1	73	48.03
1-3	61	40.13
3-6	12	7.89
6-12	4	2.63
>12	2	1.32
Outcome		
Death	16	10.53
Survived	136	89.47
Manner of poisoning		
Accidental	54	35.53
Suicidal	98	64.47
Homicidal	0	0

As shown in Table 2, in the present study, majority of the cases, i.e., 88.13% reached the hospital within 3 hours of exposure, of which

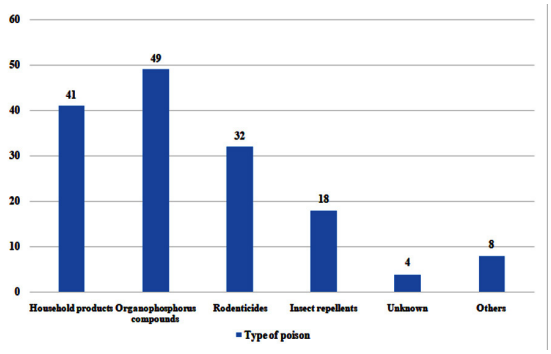

Fig. 1: Type of poison

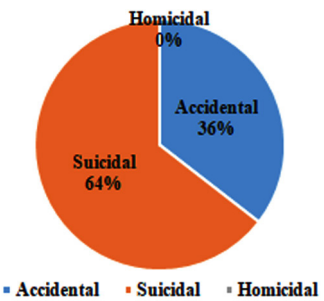

Fig. 2: Manner of poisoning

>54% reached within 1 hour of exposure. Mortality rate was noticed in the presentstudy as 10.53%.

DISCUSSION

In the present study, men out numbered women that was similar to findings of the study conducted by Vedpathak et al.[9] Male: female ratio observed in the study was 1.71, which was similar to a study conducted by Prayag et al.[10], Churi et al.[11], Maharani and N. Vijayakumari.[12] This might be due to the fact that men are more exposed to various levels of stress, and engaged in dangerous occupational and environmental conditions. Among the cases studied, most of the victims of acute poisoning were from rural area. The current study shows that the most of cases belonged to the age group of 21-30 years. The availability of data of acute poisoning in adults is scarce in our region. We observed that poisoning was most common in productive age group (21-30 years) that imparts a huge socioeconomic burden on the society. Acute poisoning was commonly seen among male farmers followed by fishermen and students. Majority of the patients belonged to low socio-economic class. This might be attributed to financial crises at domestic level. Similar findings were reported by Somasundaram et al.[13] Majority of the poisoning cases were suicidal (57.75%), which is in accordance with the findings of other studies.[11,14] All cases of poisoning in children were accidental in nature. The similar findings were reported by Fan AY et al.[15] The possible reason for the accidental consumption of poisons in children could be increased outdoor activity, putting objects into mouth by curiosity and consumption of unknown liquids carelessly kept in uncapped bottles.

Organophosphorous compounds were the most commonly preferred poison followed by household products and rodenticides. The same was in accordance with the other studies done in South India by Kora et al.[13] Vedpathak et al.[9] Prayag et al.[11] Ease of availability, low cost, deficient regulation on sales of organophosphorous compounds and major occupation in this region being agriculture may be responsible for preference of these compounds. However, a study conducted in New Delhi showed that drugs and insecticides were the most commonly preferred agents. This difference within the country may be due to difference in pattern, use, and availability of poison. In addition, difference in urbanization and literacy can also be responsible. Ours is an agriculture based society and owing to easy availability of organophosphorous compounds, these are the most commonly used substances in poisoning.

Most of the patients were admitted within 3 hours of consumption of poison. Mortality rate was noticed in the present study as 11.26%. This rate was comparable to the study by Vedpathak et al.[9] and Patil et al.[16] This mortality rate was less than the study conducted by Somasundaram et al.,[13] i.e., 15% but higher than that reported by Padmanabha et al.[17] As maximum number of cases reached the hospital within 3 hours of toxic exposure which enabled early initiation of treatment. This could be a reason for low mortality rate.

LIMITATIONS

Limitations of the present study may be smaller sample size and shorter duration of the study. Also, the diagnosis of the poisoning was made from patient's history and clinical examination, while they were not confirmed with laboratory testing in majority of the cases. Further studies with larger sample size, longer studyduration along with confirmatory laboratory investigations will give better picture of the situation.

CONCLUSION

The present study concludes that acute poisoning is adistressing public health problem. It affects the larger number of male population. The commonest poisoning agent was Organophosphorus compound. The occurrence was high among married males and in the age group of 21 – 30 years. The incidence of acute poisoning, morbidity and mortality related to the poisoning can be diminished by developing and implementation of appropriate preventive strategies. The healthcare establishments should take necessary actions to create awareness about

the dangers of poisons. Establishing a 'poison control center' in the region will aid in prevention of poisoning events. Healthcare authorities must prioritize the acquisition of antidotes of the common poisons used in the area, so that timely and effective management is possible to save valuable lives.

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REFERENCES

1. ***Batra AK, Keoliya AN, Jadhav GU.*** *Poisoning: An unnatural cause of morbidity and mortality in rural India. J Assoc Physicians India 2003 October;51:955-959.*
2. ***Gunnell D, Eddleston M, Phillips MR, Konradsen F.*** *The global distribution of fatal pesticide self-poisoning: Systematic review. BMC Public Health. 2007;7:357.*
3. ***Dash SK, Aluri SR, Mohanty MK et al.*** *Sociodemographic profile of poisoning cases. Journal of Indian Academy of Forensic Medicine 2005; 27(3): 133-8.*
4. *World health organization. International Programme on Chemical Safety, Poisoning Prevention and Management. 2020.*
5. ***Pillai VV.*** *Modern Medical Toxicology. 4th ed. New Delhi: Jaypee Brothers Medical Publishers. 2013:5*
6. ***Ramesha KN, Rao KBH, Kumar GS.*** *Pattern and outcome of acute poisoning cases in a tertiary care hospital in Karnataka, India. Indian Journal of Critical Care Medicine.2009 Sep;13(3):152-5.*
7. ***Nadeem MN, Maqdoom M, Akif ME.*** *A Prospective Observational Study on Pattern of Poisoning Cases Reported to Emergency Department of a Teaching Hospital in South India. Biomed Pharmacol J. 2020 Dec 31;13(4):1863-9.*
8. ***Murari A, Sharma GK.*** *A comparative study of poisoning cases autopsied in LHMC, New Delhi and JIPMER, Pondicherry. J Forensic Med Toxicol. 2008;19(1):18-20.*
9. ***Vedpathak VL, Pise HN, Kharade P.*** *Clinico-epidemiological profile of acute poisoning cases admitted in a rural tertiary care hospital of Maharashtra. Int J Med Sci Public Health 2017;6(7):1150-1154.*
10. ***Prayag A, Ashtagi GS, Mallapur MD.*** *Pattern of poisoning cases at a tertiary health-care center, Belagavi. Int J Med Sci Public Health. 2016;5(8):1698-701.*
11. ***Churi S, Ramesh M, Bhakta K, Chris J.*** *Prospective assessment of patterns, severity and clinical outcome of Indian poisoning incidents. Chem Pharm Bull (Tokyo). 2012;60(7):859-64.*
12. ***B. Maharani and N. Vijayakumari.,*** *Profile of poisoning cases in a Tertiary care Hospital, Tamil Nadu, India. J App Pharm Sci. 2013; 3 (01): 091-094.*
13. ***Somasundaram KV, Patil A, Shukla S.*** *Epidemiological profile of OP poisoning cases treated at Pravara hospital, Loni, India. Indian PrevSoc Med. 2009;40(3):184-8.*
14. ***Peshin SS, Srivastava A, Halder N, Gupta YK.*** *Pesticide poisoning trend analysis of 13 years: A retrospective study based on telephone calls at the National Poisons Information Centre, All India Institute of Medical Sciences, New Delhi. J Forensic Leg Med. 2014;22:57-61.*
15. ***Fan AY, Che AH, Pan B, Yang C, Coulter CV, Shieffelbien L, et al.*** *Investigating Childhood and Adolescence Poisoning Exposures in New Zealand Reported to the National Poisons Centre during 2000-2009. Asia Pac J Med Toxicol 2013;2(2):52-7.*
16. ***Patil A, Peddawad R, Varma VS, Gandhi H.*** *Profile of acute poisoning cases treated in a tertiary care hospital: A study in Navi Mumbai. Asia Pac J Med Toxicol. 2014;3(1):36-40.*
17. ***Padmanabha TS, Kashinath G, Kulkarni GP.*** *Study of profile of organophosphorus cases in a tertiary care hospital, North Karnataka, Bidar, India. Int J Pharm Bio Sci. 2014;5(1):332-9.*

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ORIGINAL ARTICLE

Stature Estimation from Forearm Length: An Anthropometric Study on Medical Students of South Indian Origin

Jayanth S.H[1], Geetha K.B[2], Vidusha Vijay[3], Manju Prakash[4]

ABSTRACT

INTRODUCTION

With the increasing frequency of mass disasters, identification of mutilated remains becomes quite challenging. With commingling identification becomes further difficult. During such investigations there is a need to estimate the stature to narrow down the identity of the dead. Estimation of stature is more accurate and reliable using long bones than any other part of the body. Despite a need for such a study, there is lack of systematic studies to identify fragmented and dismembered human remains.

Aim: The aim of present study is to analyse anthropometric relationship between the forearm length and body height in both sexes specifically for population of South India.

Materials and Methods: The study was conducted in the Department of Forensic Medicine & Toxicology, Dr. Chandramma Dayananda Sagar Institute of Medical Education and Research, Ramanagara District, Karnataka in the year 2022. The material consisted of 180 young and healthy students (90 males and 90 females) in the age group of 18-24 years after taking informed consent to participate in the study. Subjects of south Indian origin were selected based on their mother tongue. The data obtained were computed and analysed using Statistical Package for Social Sciences (SPSS, version 26.0) computer software.

Results: In the present study, mean stature and forearm length were significantly higher in males than females. Statistically significant correlation was observed between stature and forearm length. Correlation coefficient was higher among males than females. Linear regression models derived for reconstruction of stature in males y = 2.5345 (forearm length) + 101.64 and in females is y = 3.4513 (forearm length) + 73.879.

Conclusion: Study concludes that stature can be estimated from forearm length with a reasonable accuracy among South Indians. Sex specific linear regression formulae were derived for estimating stature from forearm length.

keywords | Forensic Science; Stature; forearm length; Identification; Anthropometry.

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INTRODUCTION

Identification of the dead and in certain circumstances of the living is of paramount importance in forensic practice. Primary characteristics of identification are age, sex and stature. With the increasing frequency of mass disasters, identification of mutilated remains becomes quite challenging. With commingling identification becomes further difficult. During such investigations there is a need to estimate the stature to narrow down the identity of the dead. Stature estimation from skeletal remains and body parts is based on the principle that height of an individual has a definite and linear relationship with various body parts and long bones of an individual.[1]

Estimation of stature is more accurate and reliable using long bones than any other part of the body. Despite a need for such a study, there is lack of systematic studies to identify fragmented and dismembered human remains. The present study was carried out to analyse anthropometric relationship between the forearm length and body height in both sexes specifically for population of South India.

OBJECTIVES OF THE STUDY

1. To find co-relation between Forearm Length & Stature of Individual (male & female).
2. To obtain regression formula to determine stature from forearm length.

MATERIAL AND METHODS

The study was conducted in the Department of Forensic Medicine & Toxicology, Dr. Chandramma Dayananda Sagar Institute of Medical Education and Research, Ramanagara District, Karnataka in the year 2022. The material consisted of 180 young and healthy students (90 males and 90 females) in the age group of 18-24 years after taking informed consent to participate in the study. Subjects of south Indian origin were selected based on their mother tongue.

Informed consent was taken from each of the participants. Approval was taken from Institutional Ethical Committee. Measurements are taken at fixed time to avoid diurnal variations. The measurements were taken three times to avoid error. The subjects were measured for

- ***Stature (S):*** It is obtained as a distance between floor and the highest point on the head when subject is standing in standard standing position, using anthropometric rod.
- ***Forearm length (FL):*** It is measured from head of radius to tip of styloid process of radius using standard measuring tape.

Inclusion criteria

1. Medical Students who are healthy in the age group of 18-24 years with normal physical development studying in Dr. Chandramma Dayananda Sagar Institute of Medical Education and Research, Ramanagara District, Karnataka.
2. Subjects of south Indian origin using mother tongue (Tamil, Telugu, Malayalam, and Kannada etc.) as a criteria for origin.

Exclusion criteria

Students with history of skeletal deformity, physical disability and those who are taking hormonal treatment.

Statistical analysis

The data obtained were computed and analysed using Statistical Package for Social Sciences (SPSS, version 26.0) computer software. Correlation coefficient was calculated and the correlation between the stature and forearm length was drawn. Regression formulae were derived for stature estimation from forearm length in males and females. P-value of less than 0.05 was considered as significant.

RESULTS

In males, stature ranged from 155.5 cm to 186.5 cm and forearm length ranged from 23 cm to 31 cm. (Table 1).

Table 1: Stature and Forearm length in males

Parameter	Minimum	Maximum	Mean	SD
Right Forearm length (cm)	23	31	26.93	2.01
Stature (cm)	155.5	186.5	169.91	6.89

In females, stature ranged from 141cm to 171 cm and forearm length ranged from 21 cm to 27.5 cm (Table No. 2).

Table 2: Stature and Forearm length in females

Parameter	Minimum	Maximum	Mean	SD
Right Forearm length (cm)	21	27.5	24.53	1.21
Stature (cm)	141	171	158.53	6.48

Mean stature was significantly larger in males (169.9 cm) than in females (158.5 cm). Mean forearm length in males was 26.93 cm and it was 24.53 cm in females.

Descriptive statistics of stature and forearm lengths are shown in Chart No 1 and 2 and in Table No. 3 and 4. Statistically significant correlation was observed between stature and forearm lengths (Table 3).

Table 3: Correlation coefficient between stature and forearm length

Sex	Pearson Correlation coefficient (r)	Standard Error of Correlation coefficient
Males	0.74	0.0715
Females	0.64	0.0818

Pearson correlation (r) for stature and forearm length was higher among males (0.74) than females (0.64).

Linear regression models derived for reconstruction of stature in males and females are shown in Table No. 4.

Table 4: Linear regression equation and Standard Error of Estimate

Sex	Coefficient of determination (R^2)	Linear regression equation stature y- stature, x – forearm length	Standard Error of Estimate (SEE)
Males	0.55	y = 2.53 x + 101.64	4.68
Females	0.41	y = 3.45 x + 73.88	5.00

The equation in males is y = 2.53 x + 101.64 and in females is y = 3.45 x + 73.88. Standard Error of Estimate was 4.68 in males and 5.00 in females.

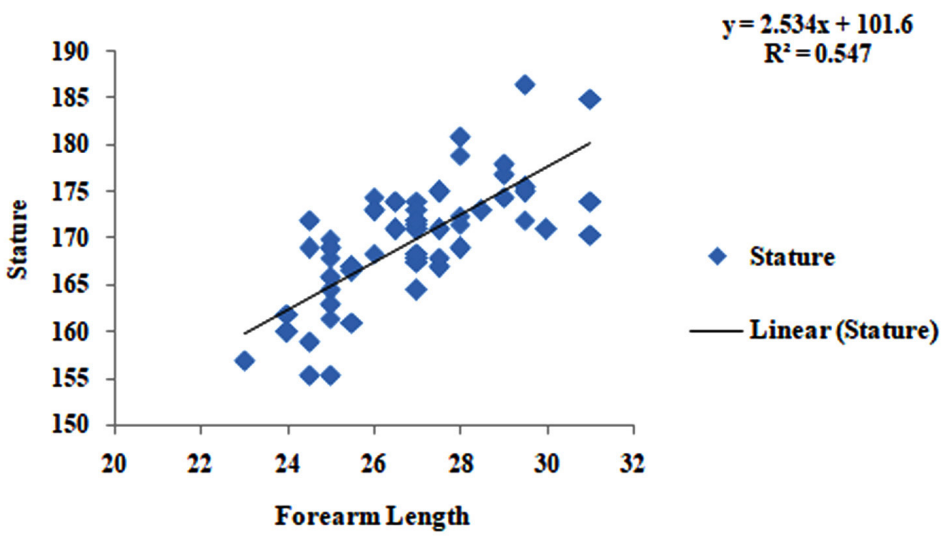

Chart 1: Correlation between stature and forearm length among Males

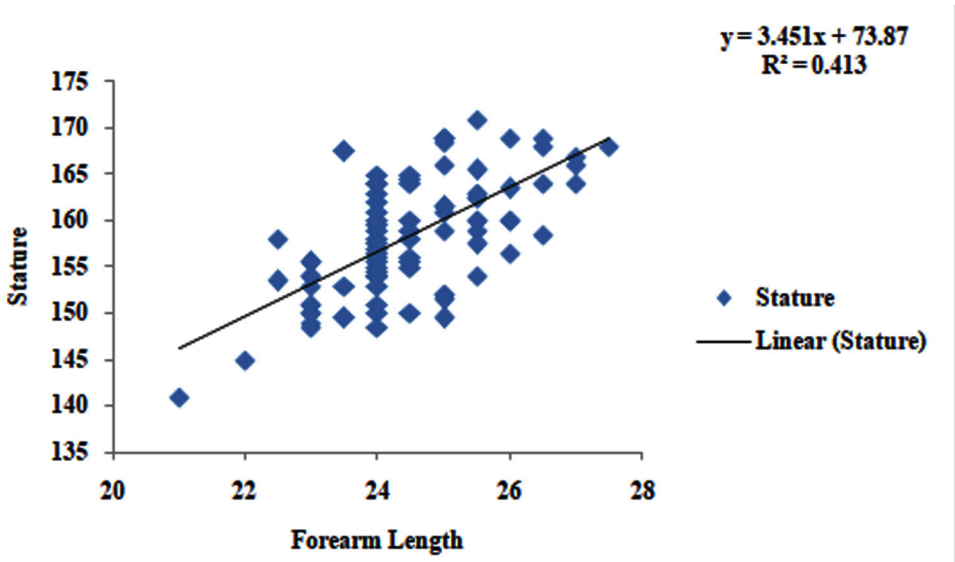

Chart 2: Correlation between stature and forearm length among Females

DISCUSSION

Dismembered remains and body parts are frequently encountered in rural India especially in forests and water bodies. Fulfilling the objectives of forensic autopsy is highly challenging in such cases. After determining sex and age of the remains, estimating stature is vital in identification. Proportion of lengths of different parts of the body to one another and to the stature varies considerably in different individuals. Skeletal growth and development in human beings are influenced by genetics and nutrition. Stature and length of long bones differ in Indians of different ethnicity. Regression equation derived for a particular population in India cannot be generalised and applied to all population of different ethnicity. Studies where stature can be estimated from forearm lengths in South Indian population are few. Hence the present study was conducted to correlate forearm length with stature in both sexes specifically for population of South India.

Amongst the study sample, mean stature was significantly larger in males (169.9 cm) than in females (158.5 cm). Mean forearm length in males was 26.93 cm and it was 24.53 cm in females. Statistically significant correlation was observed between stature and forearm lengths (Table 3). Pearson correlation (r) for stature and forearm length was higher among males (0.74) than females (0.64).

Uzun O et al. in their study observed highest correlation between stature and both forearm lengths after upper extremity length. (r=0.753 for Right, r=0.734 for Left).[2]

The results in a study on Thai children showed that the correlation coefficients between stature and forearm (ulna and radius) length are high and significant in both sexes (r = 0.988 - 0.992, $p < 0.01$). In Thai school age children, forearm lengths (radial length) highly correlated with stature (standard error of estimation range from ±2.7464 cm to ±3.1190 cm).[3] Standard error of estimation estimated in the present study is 4.68 and 5.00 for males and females respectively.

Linear regression models derived in the present study for reconstruction of stature in males and females are shown in Table 4. The equation in males is y = 2.5345x + 101.64 and in females is y = 3.4513x + 73.879. In a similar study done on North Indian population, linear regression equation calculated was males: S= 126.28 + 1.815 (Forearm length); females: S= 160.37 + 0.020 (Forearm length)[4]

An anthropometric study was conducted by Ebrahimi B et al. on students of Hamadan University of Medical Sciences, Iran and they

found a strong positive correlation between forearm length and stature, and a moderate positive correlation between the stature and hand length. (Stature=66.268+4.033×forearm length, SEE= 0.230 and R2= 0.661) (Stature= 122.327+2.725×hand length, SEE= 320 and R2= 0.314).[5]

Potdar AB et al. in their study on 200 medical students in Kolhapur found that there was a positive co-relation between forearm length and stature (r=0.83). Regression equation was derived to estimate stature from forearm length male subjects it was Y=2.66X+100.87 and for females it was Y=3.28X+78.53. There was positive correlation between forearm length and stature in both male (r=0.69) and female (r=0.64).[6]

Panjakash S et al. established definite correlation between stature and forearm length in North Karnataka population and regression equation was formulated as; Stature of males in cm = 2.887 x RFL + 95.82. Stature of females in cm = 2.632 x LFL + 95.08.[7]

Balachandran M and Vasvani V in their study on Kerala subjects concluded that there was a moderate correlation between right forearm length and height and this correlation is statistically significant. They derived regression equation for both males and females.

Height (Male) = 90.24+2.19* Right forearm length

Height (Female) = 77.32+3.19* Right forearm length[8]

Present study has come out with regression equations for South Indian population for both sexes.

Stature y = 2.53 (forearm length) + 101.64 for Males.

y = 3.45 (forearm length) + 73.88 for Females.

CONCLUSION

The present study shows significant and positive correlation between stature and forearm lengths in males and females. Correlation coefficient was higher among males than females. Linear regression equations derived would help in estimation of stature from forearm length with a reasonable accuracy in South Indian Population.

Conflict of Interest: *Nil*

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REFERENCES

1. ***Krishan K, Kanchan T, Asha N.*** *Estimation of stature from index and ring finger length in a North Indian adolescent population. Journal of Forensic and Legal Medicine; 2012, 19: 285-290.*
2. ***Uzun O et al.*** *Stature Estimation-A Turkish Population Sample. Journal of Clinical and Diagnostic Research. 2019 Jan, Vol-13(1): AC09-AC15. DOI: 10.7860/JCDR/2019/38372.12475*
3. ***Kannika Song-in et al.*** *Estimation of Stature from Forearm Length in Thai Children. SDU Res 2013;6 (1): 131-139.*
4. ***Singh B et al.*** *Estimation of stature from forearm length in North Indians. International Journal of Basic and Applied Medical Sciences 2013; 3 (1): 201-204.*
5. ***Ebrahimi Babak et al.*** *The stature estimation from students' forearm and hand length in Iran. J Contemp Med Sci 2020; 6(5): 213–217.*
6. ***Potdar AB et al.*** *A Study of Estimation of Stature from Forearm Length. Indian Journal of Forensic Medicine & Toxicology. April-June 2019; 13(2):219-221. DOI: 10.5958/0973-9130.2019.00118.X*
7. ***Panjakash S et al.*** *Stature estimation from forearm lengths in North Karnataka population; India. Indian Journal of Clinical Anatomy and Physiology, January-March, 2019;6(1):32-37. DOI: 10.18231/2394-2126.2019.0008.*
8. ***Balachandran M, Vasvani V.*** *Estimation of Stature from the Length of Forearm in a Population in Nedungolam Town in Kerala. Op Acc J Bio Sci & Res 7(1)-2021. DOI: 10.46718/JBGSR.2021.07.000176.*

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ORIGINAL ARTICLE

Incidental Findings of Silent Liver Diseases in Autopsy: A Study at Tertiary Care Hospital

Niveditha. S[1], Radha R. K[2], Prathima. S[3]

ABSTRACT

INTRODUCTION

Autopsy survey of 80 cases of liver specimens over a period of 2 years done in Vydehi Institute of Medical Science and Research Center, Department of Pathology, Bangalore. Quite rightly liver is, called as "The custodian of milieu interior" Autopsy study is useful to monitor the cause of death and to plan medical strategy. The term "alcoholic liver disease" encompasses a spectrum of pathologic conditions ranging from isolated steatosis to established cirrhosis. Within this spectrum, varying degrees of inflammation, hepatocellular ballooning degeneration, hepatocyte necrosis, cholestasis, and fibrosis may be encountered. This article reviews the characteristic histologic features of the many forms of alcoholic liver disease.

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KEYWORDS | Alcoholic steatohepatitis; ASH; Non alcoholic steatohepatitis; NASH; Cirrhosis; Benign solitary cyst; BSC

INTRODUCTION

Liver is vulnerable to a wide variety of metabolic, toxic, microbial and circulatory insults. In some instances, the disease is primary while in others the hepatic involvement is secondary to cardiac de-compensation, alcoholism or extra hepatic infections. They either go undiagnosed or are found incidentally during general health check-ups, investigations for other diseases, surgery or at autopsy. Quite rightly liver is, called as "The custodian of milieu interior" Autopsy study is useful to monitor the cause of death and to plan medical strategy.[1]

Abnormal findings in liver autopsy can be fatty change, hepar lobatum, glycogen storage disease, acute phosphorus poisoning, hemosiderosis, syphilis, actinomycosis, infarcts, cloudy swelling, tuberculosis, acute

passive hyperemia, chronic passive hyperemia, amyloidosis, abscess, hydatid cyst, malignancy, cirrhosis and acute yellow atrophy.[3]

These diseases can be seen as "silent liver disease" in the histological findings during autopsy. Alcohol abuse generally leads to three pathologically distinct liver diseases; these are fatty liver, hepatitis and alcoholic cirrhosis. Any one or all the three can occur at the same time, in the same patient.[4]

The underlying causes of chronic liver diseases vary in different geographic areas and are based on various factors such as socioeconomic status, life style, diet, local or regional infections and other endemic diseases.[5]

MATERIAL AND METHODS

Eighty specimens of liver of the deceased, irrespective of age and sex, received over a period of 2 years, in the Department of Pathology, Vydehi institute of medical science and research centre, Bangalore, were examined grossly as well as microscopically. Postmortem examination being done in our institution are usually, cases of road/railway accidents, drowning, hanging and poisoning. Liver specimens were mostly received as a part of examination of multiple viscera. In each case, important information regarding age, sex, clinical findings, food habit, alcoholic usage, suspected cause of death and post mortem findings were obtained from post mortem papers. Gross examination of the liver specimen was done with regards to the weight, surface, capsule, color, consistency, etc. Formalin fixed liver tissues stained with Hematoxylin and Eosin (H & E) were examined under the microscope. The findings of the examination were recorded and analysed. Autolytic changes were seen in the specimens as they are brought by the police & reach pathology department/ histopathology laboratory quite late.

RESULTS

During the study, 80 cases were evaluated, out of which 68(85%) were males and 12(15%) were females.

Table 1: Histopathological findings

Histopathology	No. of cases	Percentage
Fatty change	36	45%
Chronic venous congestion	25	31.2%%
Normal	7	8.7%
Cirrhosis	4	5%
Autolysed	4	5%
Hepatic steatosis	3	3.7%
Benign solitary cyst	1	1.2%
Total	80	100%

Out of 80 specimens, 36 (45%) showed fatty change (Fig. 1), followed by Chronic venous congestion 25 (31.2%) cases, normal 7(8.7%) cases, cirrhosis 4(5%) cases (Fig. 2), autolysed 4(5%) cases, Hepatic steatosis 3(3.7%) case (Fig. 3) and 1 (1.2%) with Benign solitary cyst (Fig. 4).

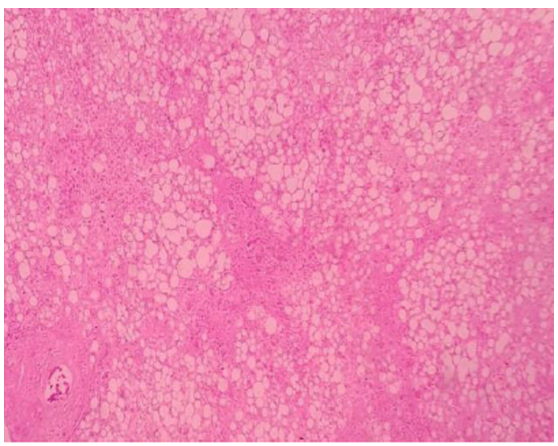

Fig. 1: Section showing small and large fat droplets in fatty liver H & E X40

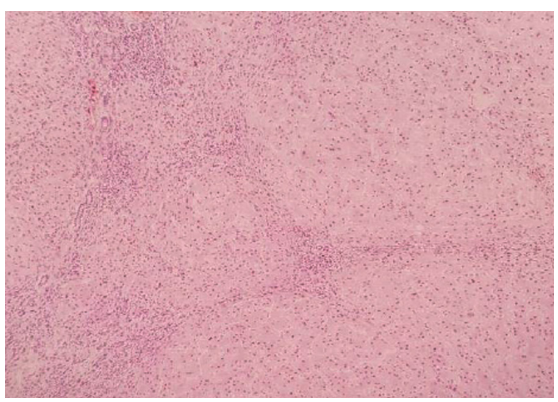

Fig. 2: Section showing regeneration parenchymal nodule surrounded by bands of fibrous tissue in cirrhosis H & E X100

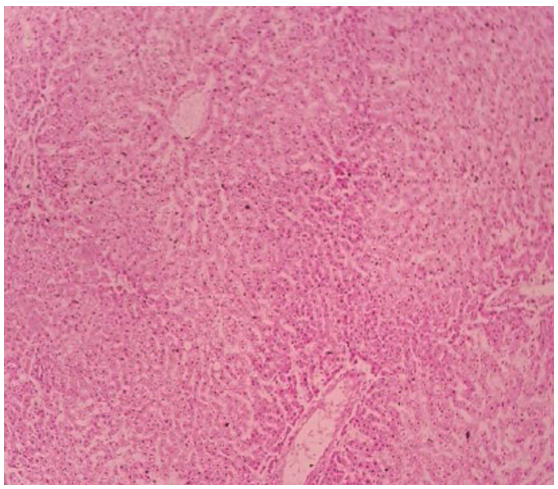

Fig. 3: Section showing Mallory-Denk bodies H & E

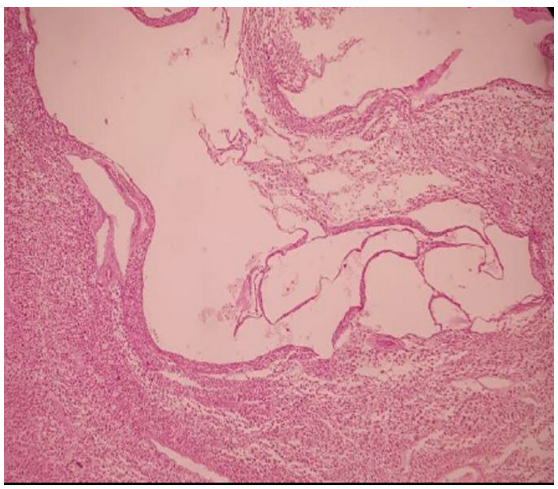

Fig. 4: Section showing cyst lined by flat epithelium H & E X40

Table 2: Age and sex wise incidence of all the cases.

Age group (years)	Male (%)	Female (%)	Total (%)
<20	6(8.8)	2(16.6)	8(10)
20-30	17(25)	3(25)	20(25)
31-40	25(36.7)	4(33)	29(36.2)
41-50	7 (10.3)	1(8.3)	8(10)
51-60	8(11.7)	1(8.3)	9(11.2)
61-70	2(2.9)	0(0)	2(2.5)
71-80	3(4.4)	1(8.3)	4(5)
Total	68(100)	12(100)	80(100)

Table 3: Sex wise distribution of all the cases.

Histopathology	Male (%)	Female (%)	Total (%)
Fatty change	28 (45.9)	8(42.1)	36 (45)
Chronic venous congestion	18(29.5)	7(36.8)	25(31.2)
Normal	4(6.5)	3(15.7)	7(8.7)
Cirrhosis	4(6.5)	0(0)	4(5)
Autolysed	3(4.9)	1(5.2)	4(5)
Hepatic steatosis	3(4.9)	0(0)	3(3.7)
Solitary benign cyst	1(1.6)	0(0)	1(1.2)
Total	61(100)	19(100)	80(100)

DISCUSSION

In the present study, maximum number of cases were seen in age group 31-40 (36.2%) years which was similar to studies conducted by Prashant R et al. and Behers A et al. i.e. 30.1% and 23.4% respectively.[2,3]

Liver diseases predominated in males in the presen tstudy (85%), comparable with the findings of, Singal P et al. (82.8%) and Sotoudehamanesh R et al. (86.7%).[1,5] This may be attributed to the fact that men are more prone to alcohol consumption.

Present study showed that fatty change (45%) was the most common silent liver disease which was similar to studies by Singal et al. (34%) and Prasant R et al. (30.1%).[1,2] This is because a large percentage of people in this region take alcohol which is major causative factor for developing fatty change. Regular intake of alcohol between 40-80 gm increases the liver weight and frequency of fatty changes in liver.

The understanding of hepatic steatosis has progressed considerably in recent years. Several studies have challenged previous assertions that macrovesicular steatosis is completely benign. They indicate that fatty liver of either alcoholic or non alcoholic etiologies can coincide with or lead to necro inflammation and fibrosis. Surprisingly, experimental studies have implicated steatosis itself as a direct cause of more advanced pathology. The mere presence of oxidisable fat within the liver is enough to trigger lipid peroxidation.

Nevertheless, many patients with steatosis never progress to necroinflammation or fibrosis. These observations led to the "two hit hypothesis". In addition to steatosis (the first hit), development of steatohepatitis requires the presence of some other factors (second hit).[6]

Second most common finding of chronic venous congestion was seen in 25(31.2%) cases, which was also the second most common cause (27%) in a study by Singal P et al.[1] This could be due to the fact that CVC liver is the terminal end stage of death in most of the liver autopsies. Also referred to as acute hepatic ischemic necrosis, ischemic hepatitis, shock liver, congestive hepatopathy.

Cirrhosis is the end stage of many chronic liver diseases. This term refers to diffuse hepatic fibrosis with replacement of normal lobular architecture by parenchymal nodules separated by fibrous tissue.

Architectural changes are histologically best appreciated on a reticulin stain.[6] In our study, cirrhosis was seen in 5% which was comparable to the study by Prashant R. et al.[2] showing 2.44% cases having cirrhosis whereas Behera A et al showing 9.37%.[3]

In our study, 3 out of 4 cases (75%) had history of alcohol intake; of these all were males. 3 out of 4 cases (75%) showed micronodularity while remaining 1 (25%) showed mixed nodularity. Similar results were seen in a study by Majethia NK et al. who studied the pattern of liver cirrhosis in 118 autopsy patients.[7]

History of alcohol was seen in 83.25% of cases of which 95% were males. Among alcoholics, 48.4% showed micronodularity. Alcoholism contributes to an increase in chronic liver disease especially cirrhosis which is completely preventable by abstinence from alcohol.

In the present study, steatohepatitis was seen in 3(3.7%) cases. Kour B et al. reported 11(9.2%) of cases having hepatitis, while in a study of Singal et al. hepatitis was found in 9% cases. Steatohepatitis occurs in chronic alcoholics (alcoholic steatohepatitis or ASH) and also in patients who do not consume alcohol (non alcoholic steatohepatitis or NASH).

One of the case showed Benign solitary cyst 1.2% with the history of jaundice in a 26 year old male usually an incidental finding. Zhang XF et al observed solitary benign cyst in only 0.9%, which was lower compared to our study. The study also included 7(8.7%) normal liver specimens and 4(5%) autolyzed specimen.

In summary, asymptomatic fatty liver be the most common silent liver disease among the general population of this region followed by cirrhosis of liver, hepatitis and chronic venous congestion.

Autopsy isa magnificent learning tool in the hands of pathologists to study the histopathological spectrumof diseases which help to study the insitu process as well as rare incidental findings.

CONCLUSION

Silent liver diseases are very common amongst apparently healthy individuals. In this study asymptomatic fatty liver was the most common silent liver disease followed by chronic venous congestion.

Maximum cases were in the age group of 31-40 years with a Male : Female ratio of 6:1. If not detected early, some of these conditions may lead to serious outcomes.

Histopathology of fatty change which has progressed to cirrhosis of varying etiological factors can be studied in post-partum cases and helps undergraduates and postgraduates to understand the etiopathogenesis, gross and microscopic features of cirrhosis.

The study was conducted only on specimens collected from the mortuary and may not reflect the actual pattern of liver diseases. The use of autopsy findings in conjunction with other scientific methods and investigative techniques remains as valuable today as it was centuries ago, both in daily practice and for scientific endeavor.

KEYPOINTS

1. Liver is vulnerable to a wide variety of metabolic, toxic, microbial and circulatory insults.
2. Quite rightly liver is, called as "The

custodian of milieu interior" Autopsy study is useful to monitor the cause of death and to plan medical strategy.

3. Indicate that fatty liver of either alcoholic or non alcoholic etiologies can coincide with or lead to necroinflammation and fibrosis.
4. Cirrhosis is the end stage of many chronic liver diseases.
5. The use of autopsy findings in conjunction with other scientific methods and investigative techniques remains as valuable today as it was centuries ago, both in daily practice and for scientific endeavor.

Conflict of Interest:
Nil
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REFERENCES

1. ***Singal P et al :***
Incidental Findings in Autopsy Examination of liver: A study of 70 cases. Ann. Int. Med. Den. Res. 2017;3(3):PT30-PT32.
2. ***Prashant R et al :***
Incidental findings in autopsy examination of liver: a study at tertiary care hospital. Int J Community Med Public Health 2016;3:697-9.
3. ***Behera A et at:***
Liver autopsy study-incidental pathological findings. Trop J Path Micro2017;3(4):390-395.
4. ***Kour B et al.***
Incidental findings in Autopsy Examination of Liver-A One Year Retrospective Study. Int J Health Sci Res. 2019;9(8):68-70.
5. ***Sotoudehamanesh R, Sotoudeh M, Asgari A, Abedi-Ardakani B, Tavangar SM, Khakinejad A et al.***
Silent Liver Diseases in Autopsies from Forensic Medicine of Tehran. Archives of Iranian Medicine 2006 Oct; 9(4):324-28.
6. ***Desmet V, Rosai J. Liver:***
Rosai and Akerman's Surgical Pathology. Vol 1. St louis, USa: Elsevier Mosby; 2004:925-940.
7. ***Majethia NK, Patil MV, Kalgutkar AD.***
A Histo-PathologicalStudy of Liver in 118 Cases of Cirrhosis. J Liver. 2016; 5:193.
8. ***Theise Neil D.***
Liver and Gallbladder. Robbins and Cotran pathologic Basis of Disease; Vol.2. South Asia Edition. Elsevier India; 2014:837-841.
9. ***Majethia NK, Patil MV, Kalgutkar AD.***
A Histo-PathologicalStudy of Liver in 118 Cases of Cirrhosis. J Liver. 2016; 5:193.
10. ***Thamil SR, Selvam V, Subramanium PM.***
Common Silent Liver Disease In and Around of Salem Population: An Autopsy Study Journal of Clinical and Diagnostic Research. 2012; 6(2):20710.
11. ***Devi Ph. M, Myrthong B G, Meera Th., Nabachandra H.***
Pathological Findings of Liver in Autopsy Cases A Study at Imphal.J Indian Acad Forensic Med2013; 35:206-10.

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ORIGINAL ARTICLE

A Comprehensive Retrospective Evaluation of Autopsy Findings and Histopathological Changes in Cases of Fatal Electrocution in Western Ghats of Karnataka, India.

Pratima R Bhat[1], Prasanna S Jirli[2], Ravindra S Honnungar[3], Somashekhar Pujar[4], Vishal V Koulapur[5], Manoranjan B[6]

ABSTRACT

Background: Aim of this study is to give an account on autopsy findings and histopathological changes in fatal electrocution cases. Secondary aim was to know the epidemiological profile, cause of death and its relation to survival period in fatal electrical injuries.

Study design: A retrospective study was undertaken of all fatal electrocution cases autopsied in mortuary of Dr. Prabhakar Kore Charitable Hospital of Belagavi, Karnataka, India between January 2011 to December 2021. Data was collected from autopsy reports, police information and hospital records. It was further analyzed and expressed in percentage.

Results: Cases represented 8.2% of all autopsy cases. Only 27% cases were due to low voltage electric current. Burn injury was seen in 81% of total cases. 43% cases showed both entry and exit mark. When skin of this area was sent for histopathological examination there was mononuclear infiltrate and subepidermal separation seen. There were interstitial hemorrhages on right atrium of heart and hemorrhagic foci were seen on kidneys and lungs too. Petechial hemorrhages were seen on heart, lungs, brain.

Conclusions: Histopathological findings can be used as evidence in determining cause of death. Deaths due to electrocution demands more closer awareness.

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keywords |Electrocution; Voltage; Burns; electric mark; autopsy; cause of death

INTRODUCTION

Death due to passage of electric current is defined as electrocution. There are numerous research and studies carried out all over the world on deaths due to electrical injuries. Most common causes of electrical deaths include careless behavior while using electrical equipments, improper maintenance of equipments and unawareness among public regarding safety techniques.[1]

Fatality also depends on person's characteristics, environmental factors, type

of electric current, source of electric current. These deaths are mostly accidental in nature, suicides and homicides from electrocution are very rare and If we rectify these common causes deaths are preventable and prevention is always better than cure.[2]

In today's world for smooth functioning of our day to day activities electricity plays very important role. We should not forget that human body is good conductor of electricity and hence when our body comes in contact with unprotected electrical source there are pretty high chances that electricity will flow through our tissues and may lead to fatal outcome.[2]

Year by year there have been constant rise in electric injuries and previously no such detailed study has been carried out on electrocution related deaths in this area which prompted to take up this study to evaluate various epidemiological aspects, pattern of injuries, cause of death, histopathological changes, survival period and to compare it with observations of other authors.

METHODS

This study is cross sectional retrospective investigation of fatal electrocution cases autopsied in mortuary of Dr. Prabhakar Kore Charitable Hospital of Belagavi, Karnataka, India between January 2011 to December 2021. This is a tertiary care hospital attached to Jawaharlal Nehru Medical College. Deaths due to lightening were excluded as current cannot be measured.

Detailed analysis was carried out on basis of hospital records and post mortem reports. Ethical approval was obtained from Institutional Ethics Committee of Jawaharlal Nehru Medical College, Belagavi to conduct the study.

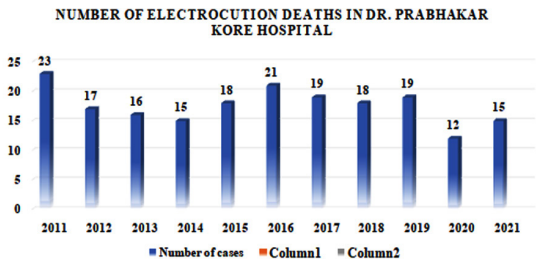
A diagnosis of electrocution fatality was made on basis of post mortem findings of electrocution, information furnished by police, hospital records and exclusion of other causes of death.

Data was analyzed with respect to age and sex of victim, season of year, time of day, place of occurrence, body region involved, voltage, type of electric mark, percentage of burns, cause of death, post mortem changes, histopathological changes, survival period.

The statistical analysis was done and data was analyzed and expressed in form of percentage in figures, tables and charts.

OBSERVATION AND RESULTS

In present study among autopsies which were carried out between 2011 to 2021 a total of 193 cases were of electrocution due to electric current out of total 2354 autopsies (8.2%) (Graph 1).



Graph 1: Total number of electrocution cases over 11 years

Out of these only 12(6%) were female while 181(94%) were male. There ages were ranging from 5 to 60 years. Most of the deaths due to electrocution were between age of 20-40 years (60%), there were 37 cases (19%) below 20 years. (Table 1).

Table 1: Cases as per age and sex

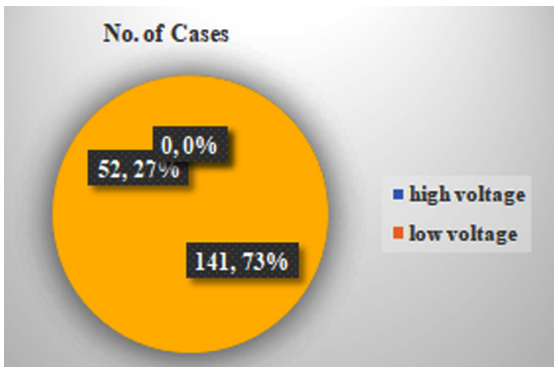
Age group (years)	Male	Female	Total
< 10	7	3	10
11- 20	25	2	27
21- 30	57	3	60
31- 40	58	1	59
41- 50	24	3	27
51- 60	10	0	10
Total	181	12	193

All (100%) cases were accidental in nature (Table 7). The rainy season comprised of 54% followed by summer 30%. Most deaths occurred between 12 noon to 6 pm (62%). 67% of total cases occurred in work place/ non domestic environment (Table 2).

Table 2: Seasonal and diurnal variation along with place of occurence

-	No. of cases	%
Season		
October – January (Winter)	35	18.9
February – may (Summer)	56	29.7
June – September (Monsoon)	102	54
Time		
6 am – 12 noon	53	27
12 noon - 6 pm	120	62.16
6 pm - 12 am	15	8.1
12am – 6 am	5	2.7
Place		
Domestic	63	32.4
Non domestic	130	67.56

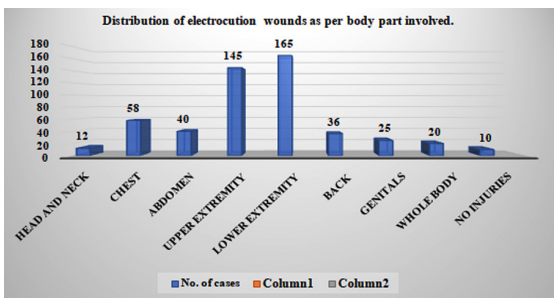
About 73% of cases were due to high voltage electric current (Pie 1).



Pie 1: Cases as per voltage of current

Burns were recorded in 81% of cases. Only entry mark was seen in 22% of cases. Both entry and exit mark were present in 43% of cases. No changes were seen in skin in 27% of cases. (Table 3)

Table 3: Distribution of cases as per body part involved



Lower extremity was involved in 85% of cases followed by upper extremity and chest (Table 3).

Table 3: Types of electrical injuries

Type of electrical injuries	No. of cases	Percentage
Only entry mark	42	22
Only exit mark	15	8
Both entry and exit mark	83	43
No mark	52	27
Burns	156	81
Other injuries (mechanical)	37	19

The survival period was less than 12 hours in 43% of cases whereas it was more than 7 days in 29% of cases. The cause of death was septicemia in 35% of cases followed by cardiac complications like arrythmias and ventricular fibrillation and burns shock. (Table 4)

Table 4: Survival period and Cause of Death

Survival period	No. of cases	Percentage
0-12 hours	83	43.2
12- 24 hours	11	5.4
1-3 days	16	8.1
3-7 days	26	13.5
>7 days	57	29.7
Total	193	100
Cause of death	**No. of cases**	**Percentage**
Septicemia	68	35.13
Burns shock	31	16.2
Ventricular fibrillation	21	10.8
Toxemia	5	2.7
Multiorgan failure	5	2.7
Hemorrhagic shock	16	8.1
Cardiac complications (arrythmias, Myocardial infarction)	47	24.3

Internal organs showed congestion in 64% of cases followed by edema in 51% of cases. Petechial hemorrhages were present over heart, lung, brain in 27% of cases. There was presence of fuild in abdominal and pleural cavity in 35% of cases. (Table 5)

Table 5: Manner of death

Manner of death	No. of cases	%
Accidental	193	100
Suicidal	0	–
Homicidal	0	–

Only 30% (58 cases) were sent for histopathological examination. Out of total samples which were sent for histopathological examination 89% were positive for mononuclear infiltrate and 72% subepidermal separation. Involvement of heart was seen in 74% of cases whereas lung involvement was seen in 66% of cases whereas brain was involved in 91% of cases. (Table 6)

Table 6: Autopsy findings of cases based on signs of electric current flow through body.

Signs of electric current flow	No. of cases	Percentage
Petechial hemorrhages	52	27
Edema	98	51
Congestion	124	64
Subdural, subarachnoid hemorrhages	19	10
Subcapsular hemorrhage	10	5
Fluid in pleura and abdominal cavity	68	35

Table 7: Histopathological changes in electrocution (58 cases were sent for histopathology)

Organ/Tissue	Histological finding	Frequency	Percentage
Skin	Mononuclear infiltrate	52	89
	Subepidermal separation	42	72
Heart	Rupture of pericardial vessels	43	74
	Interstitial hemorrhages on right atrium	19	33
Kidney	Congestion	36	62
	Acute tubular necrosis	34	59
	Hemorrhagic foci	41	71
Lung	Congestion of alveolar walls	35	60
	Interstitial edema	38	66
	Hemorrhage into alveolus	27	47
Spleen	Congestion	47	81
Brain	Edema	35	60
	Congestion	53	91
Liver	Edema	29	50

DISCUSSION

The widespread use of electricity in every phase of life is responsible for increase in both fatal and non fatal injuries.

In our study death of male attributed to around 94% of total cases with most common age group as 20-40 years. This is mainly due to association of men in repair of electrical appliances and other electrical work as compared to women and more occupational exposure in age of 20-40 years. A study by sachingiri in Nagpur, Radha kabbur in Banglore, B. Mukheerjee in Loni showed similar findings.[3-5]

In present study rainy season attracted maximum fatalities (54%), this may be attributed to humid and warm environment and less resistance of wet skin to electric current in rainy season. Similar findings were seen in study by Shaikh Moinuddin in Telangana, Beemshetty Rajesh study in Vishakhapattanam, Kusa Kumar study in Coimbatore, B. Mukheerjee in Loni showed similar findings.[5-8]

Domestic place of incident includes residential areas and non domestic places include electric poles, industries, factories. In our study place of incident was non domestic in 67% of cases, findings were similar in B. Mukheerjee in Loni, kumar study in lucknow, contrast findings were seen in Rautjiet al study in delhi.[5,6,9]

Lower extremity was most commonly involved in our study whereas upper extremity was most commonly involved in Mukheerjee in Loni, kumar study in lucknow and Rautaji et al. study in South Delhi.[5,6,9]

International Electrotechnical Commission defines high voltage as more than 1000 volts of alternating current and above 1500 volts of direct current and low voltage as upto 1000 volts of alternating current and upto 1500 volts of direct current. High voltage current was responsible for 73% of cases in our study whereas in shaikh Moinuddin study at Telangana high voltage current was responsible in 56% of cases. Incontrast to this low voltage was responsible for 61% of cases in study by AkcanRamazan in Ankara.[7,10]

In our study presence of entry and exit wound was seen in 43% of cases whereas in Mukherjee study at Loni only 17% cases showed entry and exit mark and in Mohd. Khan study at Aligarh showed only 29% cases with both entry and exit mark.[5,11]

Present study showed that survival period was less than 12 hours in 43% of cases similar findings were seen in Pathak study at Jaipur, Reddy study at Puducherry.[12,13]

All cases in our study were accidental in nature, similar findings were seen in Rautaji et al. study of South Delhi, kumar study in lucknow, Ankan Study at Ankara, shaha study at Coimbatore.[6,9,10,14]

Commonest cause of death in present study was septicemia followed by cardiac complications like arrythmias, ventricular fibrillations, myocardial infarction and burns shock. Whereas septicemia was cause of death in only 25% cases in shaikh Moinuddin study of Telangana.[7] Electrocution associated burns was responsible for death in 7% cases in study by beemshetty at Telangana[8] in contrast to our study where burns shock was responsible for death in 17% cases.

In present study Internal organs were edematous (51%) and congested (64%) in maximum cases. Similar findings were seen in beemsetty study at Telangana and Pate study at Thane, saha Study at Coimbatore.[8,14,15]

Out of total cases which were sent for histopathological examination 89% showed skin involvement (mononuclear infiltrate, subepidermal separation) whereas in a study by shaikh Moinuddin all 100% cases showed skin involvement and 93% cases showed skin involvement in a study by kabbur at el study at Bangalore, present study findings were in contrast to study by Sachin Giri at Nagpur where 67% cases showed skin involvement.[7,3,4]

CONCLUSIONS

The overall findings of our present study are in accordance with other similar studies carried out in different parts of India.

Majority of electrocution fatalities are occupational and accidental in nature. Therefore deaths due to electrocution demands more closer awareness and are preventable. Hence safety campaigns should be implemented to minimize fatalities due to electrocution. Damaged electrical appliances should be repaired at earliest at home or workplace and electrical transmission lines should be routinely upgraded.

Most of cases of present study were due to contact with high tension electric cable. People who are working in electrical department should first be given proper training before doing any electrical repairs.

In our study on 40% cases showed entry and exit wounds. Hence proper crime scene investigation and detailed history with accurate autopsy should be undertaken as it becomes difficult for autopsy surgeon to diagnose electrocution as cause of death, suspected cases should be confirmed by histopathology and electron microscopy.

Our study showed diurnal and seasonal variation. Maximum cases were reported in rainy season, precautionary measures should be undertaken like not walking in waterlogged

or flooded areas as electrical lines may be snapped due to wind and water.

STRENGTHS AND LIMITATIONS

The strength of this study is that we have addressed and stressed on parameters like histopathological changes in skin and other organs, autopsy findings of cases based on signs of electric current flow through body, cause of death, survival period which are often missed in majority of similar studies. No such study considering all these parameters was conducted so far in state of Karnataka.

Limitation of the study is that even after conducting 11 year study sample size was less due to low incidence of deaths due to electrocution. As study is retrospective so we had to rely on data collected by others and not all cases with skin changes were sent for histopathological examination as diagnosis of death due to electrocution is based on electric contact wound marks and light microscopic changes in skin and other organs.

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REFERENCES

1. ***Reddy, K.S.N. (2017)***
The Essentials of Forensic Medicine and Toxicology. 34th Edition, pages 308-312.
2. *Science Direct topics. Electrocution An overview https://www.sciencedirect.com/topics/medicine-and-dentistry/electrocution Assessed 2021 3 November 2021.*
3. ***Giri, Waghmode.***
Study of different facets of electrocution deaths : A 5 year study . Egyptian Journal of forensic sciences. 2019;9:1-6.
4. ***Kabbur, Siddalingappa.***
A retrospective study of Histopathological changes in Tertiary hoapital. Indian Journal of Forensic Medicine and Toxicology 2017;10: 134-138.
5. ***Mukherjee B, Farooqui JM and Farooqui AAJ.***
Retrospective study of fatal electrocution in a rural region of western Maharashtra, India. Journal of Forensic Legal Medicine 2015; 32:1–3.
6. ***Kumar S, Verma AK and Singh US.***
Electrocution-related mortality in northern India – a 5-year retrospective study. Egyptian Journal Forensic Sciences2014;4:1–6.
7. ***Shaik, Jhansi.***
Study of electrical injuries in fatal cases in tertiary care hospital. Indian Journal of Forensic Medicine and Toxicology 2021;15:3461-3466.
8. ***Beemsetty, Pedada.***
Electrocution related mortality in Vishakhapattanam-15 year retrospective study. Journal on Evidence based Medicine and research 2018;5:2585-2588.
9. ***Rautji R, Rudra A, Behera C, Dogra TD.***
Electrocution deaths in south Delhi: a retrospective study. Medicine Science and Law 2019;59 ,4 : 240-246.
10. ***Akcan R, Karacao_glu E, Keten A, et al.***
Electrical fatalities in Ankara over 11 years. Turkish Journalof medical Science2012;42:533–538.
11. ***Khan, Aziz.***
Deaths due to electrocution-A retrospective study. Medicolegal update. 2019;9:273-275.
12. ***Pathak, Disania.***
Pattern and Seasonal Variation in deaths due to electrocution: A retrospective study. International Journal of Medical ScienceAnd Public Health. 2015; 4:19-22.
13. ***Reddy A, Sengottuvel P, Balaraman R.***
Strategic analysis of electrocution fatalities in a rural south India observed in a year.International Journal of Medical Science And Public Health 2014;6:9-12.
14. ***Shaha KK, Joe EA.***
Electrocution-related mortality: a retrospective review of 118 deaths in Coimbatore, India, between January 2002 and December 2006. Medicine Science Law 2010;50:72-74.
15. ***Pate, Kulkarni.***
Electrocution related mortality: 11 year retrospective study. British journal of medical research 2018; 3: 818-821.

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ORIGINAL ARTICLE

Histopathological Spectrum of Appendicectomy Specimens with Emphasis on Unusual Findings

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ABSTRACT

Introduction: The present study was carried out to assess the value of routine histopathological examination of appendectomy specimens An attempt is made to review the histopathological spectrum of appendectomy over a period of 2 years 3 months.

Aims and Objectives: To study the spectrum of histopathological lesions in appendectomy specimens and special emphasis is made to highlight the unusual lesions observed in surgically resected appendicectomies and appendix in medicolegal autopsies.

Material and Methods: The study was carried out on appendectomy specimens received in the department of pathology Mahadevappa Rampure Medical College during a period of 2 years 3 months from Jan 2019 to March 2021. Clinical data collected from records of corresponding appendectomy specimens were processed. Sections studied for various histopathological patterns with an emphasis on unusual findings.

Results: A total of 500 specimens were analysed among which 298 were males and 202 were females with M:F 1.4:1. The histopathological examination showed Acute appendicitis (57.4%), Acute ulcerative appendicitis (0.8%), Recurrent/Eosinophilic appendicitis (03%), Acute necrotising appendicitis (1.6%), Acute appendicitis with periappendicitis (1.4%), Acute suppurative appendicitis (2.4%), Gangrenous appendicitis (0.8%), Healed appendicitis (2.2%), Chronic appendicitis (25.2%) and Chronic sclerosing appendicitis (1.0%). The unusual fingings were observed in 22 cases (4.4%) which include Tubercular appendicitis (1.0%), Foreign body granuloma (0.8%), Xanthogranulomatous appendicitis (0.2%), Enterobiusvermicularis (0.8%), Round worm (0.2%), Retention mucocele (0.4%), Carcinoid tumor (0.4%), Mucinous adenocarcinoma (0.4%) and Metastatic adenocarcinoma (0.2%).

Conclusion: Though the present study revealed usual findings of appendicitis and variants in most of the cases, the observation of unusual findings like granulomas, parasites and neoplasms warrant a careful study of all appendectomy specimens received in pathology department with emphasis on relevant clinical and laboratory findings thus modulating the management and follow up.

keywords |Appendectomy; Unusual lesions; Histopathology; Appendicitis.

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INTRODUCTION

Appendicitis is the most common abdominal emergency and appendicectomy is routinely performed surgery all over the world to manage appendicitis.[1] Incidence of appendicitis is increasing in India and other developing countries, mainly in urban cities due to increased acceptance towards western diet.[2] Appendicitis occurs commonly in children and young adults with a lifetime risk of 7%.[3] In spite of all of advances in technology and imaging modalities, clinical diagnosis of acute appendicitis is accurate in only 60-80% of cases.[4] Therefore, histopathological examination still remains the gold standard method of choice for confirmation of appendicitis.

Appendicitis can be obstructive/non-obstructive type. In acute appendicitis, luminal obstruction is the main factor and some of the common obstructive lesions are faecolith, lymphoid hyperplasia and foreign bodies. However some unusual factors such as parasitic infestations like enterobiasis, ascariasis, bacterial infections like tuberculosis or a tumor such as carcinoid, primary/secondary adenocarcinoma, lymphoma and gastrointestinal stromal tumor may cause obstruction.[5]

Hence an attempt is made to determine the various histopathological lesions of appendicectomy specimens to find out unusual factors for appendicitis and compare with other studies.

AIMS AND OBJECTIVES

1. To study the spectrum of histopathological lesions in appendectomy specimens surgically removed and in medicolegal autopsies.
2. To analyse the various lesions according to age, sex and clinical presentation.
3. Special emphasis is made to highlight the unusual lesions.

MATERIALS AND METHODS

A study was carried out on all appendectomy specimen received in the department of Pathology at Mahadevappa Rampure Medical College and Basweshwar teaching and general hospital. A total of 500 appendicectomy specimens were received in the histopathology section during a period of 2 years 3 months from Jan 2019 to March 2021. All emergency appendectomies and interval appendectomies done for cases of clinically suspected appendicitis and incidental appendectomies done for other surgeries and medicolegal autopsies were included. The appendix resected along with other organs like hysterectomy and colectomy were also included. Relevant clinical data was retrieved. Gross findings were noted. Specimens fixed in 10% formalin, routine tissue processing and paraffin embedding was done and 5 micrometre thickness sections obtained and stained with H & E were studied. The gross and microscopic findings were analysed and various histopathological diagnoses of the appendicectomy specimens were done and for every case, clinical findings were correlated with histopathological diagnosis.

RESULTS

Table 1: Age & sex distribution.

Age (years)	Males	Females	Total	Percentage (%)
0-9	23	20	43	8.6
10-19	80	60	140	28.0
20-29	122	64	186	37.0
30-39	50	39	89	17.8
40-49	10	10	20	4.0
50-59	09	05	14	2.8
60-69	04	04	08	1.6
Total	298	202	500	100.0

M:F ratio =1.4:1

Majority of the lesions were acute appendicitis (287 cases) which were transmural and few suppurative. Also noted were 15 cases of eosinophilic appendicitis which were not associated with any parasites. About 126 cases were diagnosed as chronic appendicitis.

In the present study the common parasites noted were enterobius vermicularis. However a single case of adult round worm was observed in the lumen of an appendix of a child who

Table 2: Spectrum of usual histopathological lesions.

Sl. No	Usual Histopathological findings	No.	Percentage (%)
1	Acute Appendicitis	287	57.4
2	Acute Ulcerative Appendicitis	04	0.8
3	Recurrent/Eosinophilic Appendicitis	15	3.0
4	Acute Necrotising Appendicitis	08	1.6
5	Acute Appendicitis With Periappendicitis	07	1.4
6	Acute Suppurative Appendicitis	12	2.4
7	Gangrenous Appendicitis	04	0.8
8	Healed appendicitis	11	2.2
9	Chronic Appendicitis	126	25.2
10	Chronic Sclerosing Appendicitis	04	0.8
-	Total	478	95.6

came with acute abdomen. There were 8 cases of granulomas among which 5 were having tuberculosis and 4 were foreign body type. Five cases of the neoplasms were observed which included two each of carcinoid, adenocarcinoma anda single case of metastatic depoist.

Table 3: Spectrum of Unusual histopathological findings.

Sl. No	Unusual histopathological findings	No.	Percentage (%)
1	Tubercular appendicitis	05	1.0
2	Foreign Body Granuloma	04	0.8
3	Xanthogranulomatous appendicitis	01	0.2
4	Parasites	–	1.0
	i) EnterobiusVermicularis	04	–
	ii) Round worm	01	–
5	Retention Mucocele	02	0.4
6	Carcinoid	02	0.4
7	Adenocarcinoma	02	0.4
8	Metastatic adenocarcinoma	01	0.2
	Total	22	4.4

Table 4: Comparative analysis of histopathology spectrum.

Histopathological findings	Divya R et al. (2016) N=308	Myageri A et al.(2019) N=472	Hasan A et al. (2020) N=700	Present study N=500
Inflammatory lesions (Usual finding)	300 (97.4%)	428 (90.6%)	634 (90.5%)	478 (95.6%)
Unusual findings	8 (2.5%)	44 (9.3%)	66 (9.4%)	22 (4.4%)

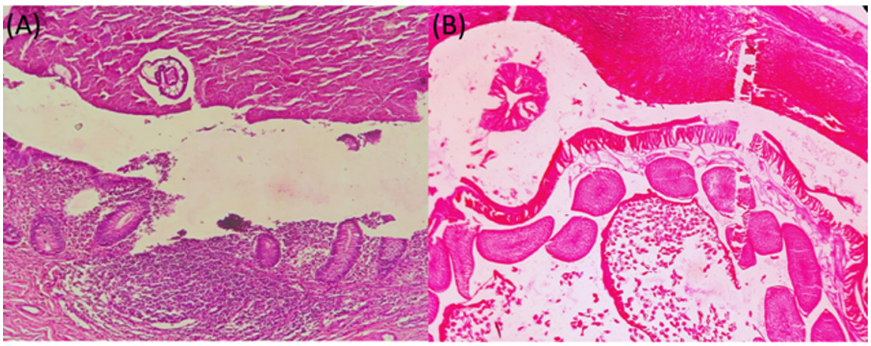

Fig. 1: (A) Enterobius Vermicularis:H & E shows EnterobiusVermicularis in the lumen of the appendix(10X). (B) Round Worm: H & E shows round worm in the lumen of the appendix(10X)

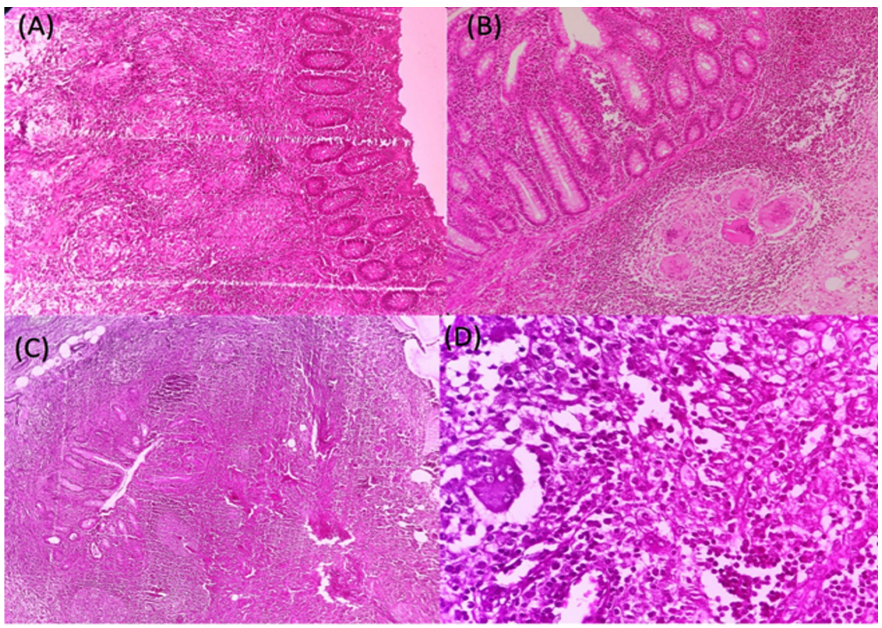

Fig. 2: (A) Tubercular Appendicitis: H & E Shows Appendicular Wall With Features Of Tubercular Granuloma (10X). (B) Foreign Body Granuloma: H & E shows granuloma consist of multinucleated foreign body type of giant cells (10x). (C) Xanthogranulomatous Appendicitis: H & E shows infiltrate composed of foam cells, scattered multinucleated histiocytes (4X), (D) H & E shows sheets of foamy histiocytes (40X)

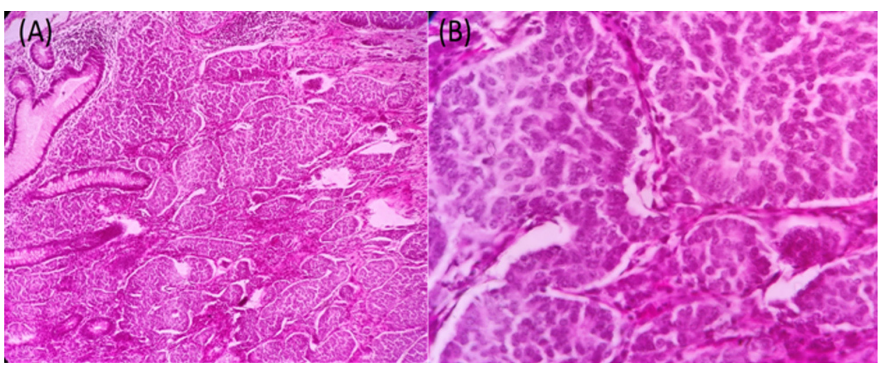

Fig. 3: Carcinoid Tumour: (A) H & E showing carcinoid tumor with monotonous cells arranged in insular pattern (10X). (B) Individual tumorcells showing salt and pepper chromatin (H & E, 40X)

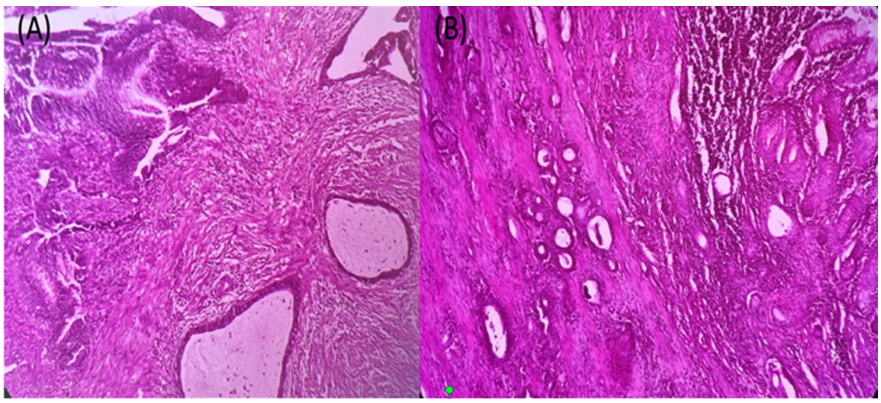

Fig. 4: (A) Mucinous Adenocarcinoma: (A) H & E Shows appendiceal mucosa is lined by neoplastic glands infiltrating muscularis (H & E 10x). (B) Metastatic Adenocarcinoma: H & E shows neoplastic glands infiltrating muscularis (H & E 10x)

DISCUSSION

Appendicitis is one of the most common cause of acute abdominal pain and it remains a clinical emergency despite diagnostic and therapeutic advancement in medical field. In the western world, acute appendicitis accounts for about 40% of all surgical emergencies. Due to adoption of western diet and lifestyle, recent studies showed a rise in the incidence of appendicitis in African countries. Incidence of appendicitis varies considerably by country, race, age, sex, geographic region, socio-economic status, dietary habits and hygiene.[2]

The vermiform appendix is considered by most to be a vestigial organ and its clinical importance lies in its propensity for inflammation which results in the clinical syndrome known as acute appendicitis. Acute appendicitis was recognized as a clinical entity first by Reginald Fitz. Soon afterwards, Charles Mc Burney described the clinical manifestation of acute appendicitis including the point of maximum tenderness in right iliac fossa, that's how it bears his name.[5]

Acute appendicitis is defined as an inflammation of the inner lining of the appendix which then spreads to other parts of the organ. Luminal obstructions such as fecolith, fibrosis, or stricture can lead to appendiceal gangrene and perforation. Lymphoid hyperplasia also narrow the lumen leading to luminal obstruction. Once the obstruction occurs, there will be continous mucus secretion and inflammatory exudation leading to increased intraluminal pressure resulting in obstruction of lymphatic drainage.[3]

Around 15-30% of cases diagnosed as acute appendicitis, it has been observed that there is discrepancy between the histopathological and clinical diagnosis. The histopathological study of appendix has the advantage that it confirms the diagnosis of acute appendicitis and it also reveals other important pathological findings that may not be obvious on gross examination intraoperatively but may affect pateint's clinical management.[6]

In present study, emergency appendicectomy were the most common cases followed by interval appendicectomy. Maximum number of patients (37%) who underwent appendicectomy belonged to the age group of 20-29years (Table 1), which correlated with the study done by Marudanayagam et al. which also showed that most of the appendicectomies (64.58%) were done in the second decade of life.[1] Number of appendicectomies performed were more in males (59.6%) as compared to females (40.4%) with male to female ratio 1.4:1, which were consistent with findings by Zulfikar et al., who studied 323 cases of appendicectomies retrospectively, in which 196(60.7%) were males and 127(39.3%) were females.[7]

Among 500 appendicectomy specimens, 496 (99.2%) were non-neoplastic lesions and only 04 (0.8%) cases were neoplastic lesions. In a retrospective study done by Blair et al. it

was reported that 80% of appendicectomy cases were non neoplastic lesions and 4% were neoplastic andremaining cases showed normal histology of appendix.

In present study, majority of patients presented with right iliac fossa pain followed by generalized abdominal pain. Edino et al. in their study also reported that abdominal pain was the most common presenting symptom in such patients.[9] Most common unusual gross finding in present study was inflamed appendix followed by presence of faecolith in appendice allumen, which correlated with the study by Majidet al who studied 250 appendicectomy cases and found that mucosal congestion was the most common finding in 218 (87.2%) cases.[10]

In the present study, acute appendicitis accounted for the most common histopathological lesion for which appendicectomy was done and was seen in 57.4% (Table 2) of patients. Similar findings were observed in study done by Divya R et al. accounting for 58.7 %11. Chronic appendicitis constituted the second most common lesion, seen in 25.2% cases. Edino et al. in their study reported 17% cases of chronic appendicitis.[9]

In present study, clinically suspected appendicitis were histologically correlated in 478 (95.6%) cases (Table 2). This findings were concordant with those of Divya R et al.[11] (97.4%), Hasan A et al.[12] (90.5%) and Myageri A et al.[13] (90.6%) (Table 4). These include spectrum of inflammatory lesions of appendix, of which majorty includes acute appendicitis (57.4%) and chronic appendicitis (25.2%). Other lesions include acute ulcerative appendicitis, acute suppurative, necrotizing with periappendicitis, gangrenous and chronic sclerosing appendicitis (Table 2). Next common lesion was Healing appendicitis accounting for 2.2 % of cases. The study done by Aravindan K. P. et al. found incidence of healing appendicitis was 6.25%.[14]

Present study included 15 cases (03%) of eosinophilic appendicitis. Eosinophilic appendicitis is characterized by lack of neutrophils, there is eosinophilic infiltration in muscle layer with oedema supporting muscle fibres.[15] It may be associated with helminth infection e.g. Schistosomiasis, strongyloides or enterobius. In many studies, they have revealed that Type I hypersensitivity may also trigger the condition.[16] In the present study all 15 cases were not associated with any parasites, fecolith, foreign body and no associated hypersensitivity.

Unusual findings were found in 22 (4.4%) of cases in present study (Table 3). Divya R et al. found such unusual histological features in 2.5% of cases. In study done by Hasan A et al., unexpected histological features were found in 9.4 % and 9.3% in Myageri A et al.[13] (Table 4)

The presence of Enterobius vermicularis in appendix usually produces symptoms resembling acute appendicitis. In present study, we reported 04 cases (0.8%) of enterobius vermicularis presenting with features of acute appendicitis and it was an incidental finding in histopathological examination. The Worldwide, reported incidence of enterobius infection in patients with symptoms of appendicitis ranges from 0.2% to 41.817 (Fig. 1A). One of the case noted in the appendix removed for medicolegal case.

Ascariasis is one of the most common helminthic diseases which is caused by Ascarislumbricoides and 99% of the worms are located are the jejunum and the proximal ileum. It is rarely found in the appendix, making the diagnosis of appendicitis debatable.[18] In present study, we reported one case of round worm accounting for 0.2% of cases. (Fig 1B)

In present study, 05 cases of tubercular inflammation was observed as an incidental histopathologicaldiagnosis. Its occurrence can either be primary or secondary, the former being very rare with a reported incidence of 0.1-0.6%.[17] The presence of caseation necrosis, granulomas and Langhans giant cells was indicative of primary tubercular inflammation of the appendix with no other foci elsewhere in the body. (Fig 2A)

Foreign body granulomas were found in 04 cases in present study. This granulomatous reaction could be due to appendicitis itself or fecalmatter (Fig 2B). Incidental observation noted in an autopsy case.

Xanthogranulomatous appendicitis is a rare form of chronic inflammation characterized by presence of high number of foamy histiocytes admixed with lymphocytes, plasma cells, abundant hemosiderin macrophages with touton type of giant cell and luminal obliteration with spared lymphoid follicles. In present study, we reported one case of this entity (0.2%). The study conducted by Myageri A et al.[13] have also reported four cases of xanthogranulomatous appendicitis.[13] (Fig. 2C). Mucocele is morphologic description of appendix where it appears dilated due to accumulation of mucin and in present study we found in 0.4% cases.

Other incidental findings diagnosed were two cases of carcinoid which accounted for 0.4%. H of et al. in their study diagnosed carcinoid in 0.47% cases.[19] Carcinoid tumors are the most common appendicealtumors, characteristically small, firm, well circumscribed yellow brown lesions on gross examination.[20] Carcinoid tumor of appendix is found in 0.3%-2.27% of patients undergoing appendicectomy.[21] Clinical presentation of these tumors mimic appendicitis because they lead to luminal obstruction and produce increased levels of serotonin, histamine and kinin which are all potent mediators of inflammation.[22] (Fig. 3)

Adenocarcinomas of the appendix are rare entities, representing <0.5% of all gastrointestinal malignancies and 4-6% of appendix neoplasm.[23] Incidental diagnosis of Mucinous adenocarcinoma was noted in 02 cases which accounted for 0.4% (Fig. 4A) which correlated with the study by Marudanayagam et al. who reported mucinous adenocarcinoma in 0.39% of cases.[1]

In present study, there was a single case of metastatic adenocarcinoma (Fig. 4B) which is very rare and primary site of malignancy was not possible to detect as patient lost for follow-up. Pattanashetti Met al also reported one case of metastatic adenocarcinoma.[24]

The incidence of appendicitis is peak in second and third decades of life. An accurate macroscopic assessment is not possible to make intraoperatively. Hence routine histopathological examination of appendix is

CONCLUSION

recommended not only to confirm the clinical diagnosis of acute appendicitis but also to rule out incidental findings leading to better clinical outcome. A combination of clinical features, laboratory parameters should be combined with ultrasonography to diagnose appendicitis. The observation of unusal findings warrant a careful study of all appendectomy specimens thus modulating the management. This study is highly beneficial for both pathologist and forensic pathologist who will be performing the autopsies regularly.

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REFERENCES

1. ***Marudanayagam R, Williams GT, Rees BI;*** *Review of the pathological results of 2660 appendectomy specimens Gastro., 2006;41(8):745-749.*
2. ***Oguntola AS, Adeoti ML, Oyemolade TA.*** *Appendicitis: Trends in incidence, age, sex and seasonal variations in South-western Nigeria. Ann Afr Med 2010;9:213-217.*
3. ***Turner JR.*** *The Gastrointestinal tract, In: Kumar, Abbas, Fausto(eds). Robins and Cotran Pathologic basis of disease.8th edn. Saunders: Philadelphia;2010. pp870-871.*
4. ***Fergusson JAE, Hitos K, Simpson E.*** *Utility of white cell count and ultrasound in the diagnosis of acute appendicitis. ANZ J Surg 2002;72:781-785.*
5. ***O'Connell PR.*** *The vermiform appendix. In: Russell RC, Williams NS, Bulstrode CJ. editors. Bailey and Love's Short Practice of Surgery. 26th ed. London: Arnold Hodder; 2010.p.1203-1218.*
6. ***Duzgun AP, Moran M, Uzun S, Ozmen MM, Ozer VM, Seckin S et al.*** *Unusual findings in appendectomy specimens: Evaluation of 2458 cases and review of the literature. Indian J Surg 2004;66:221-226.*
7. ***Zulfikar I, Khanzada TW, Sushel C, Samad A;*** *Review of the pathologic diagnoses of appendectomy specimens. Annals of King Edward Medical University, 2009;15(4):168-170.*
8. ***Blair NP, Bugis SP, Turner LJ, Macleod MM;***

Review of pathological diagnosis of 2216 appendectomy specimens. Am J Surg.,1993;165(5):618-620.

9. ***Edino ST, Mohammed AZ, Ochicha O, Anumah M;***
Appendicitis in Kano, Nigeria: A 5year review of pattern, morbidity and mortality. Annals of African Medicine, 2004;3(1):38-41.

10. ***Majid S, Imran AA Khan SA;***
Morphological variations in appendectomy specimens. Pak J Pathol., 2005;16(2):58-60.

11. ***Rabindranath D, Khan AA, Ansari H, Senthil P.***
Unusual incidental findings of routine histopathological examination of appendectomy specimens- a 2-year retrospective analysis with review of the literature. Int J of Allied Med Sci and Clin Res 2016; 4(1):90-98.

12. ***Abdulkarim Hasan1*, Khalid Mohamed Nafie2, Osama Sharafeldin Abbadi;***
The Utility of Routine Histopathological Examination of the Appendectomy Specimens; Annals of Pathology and Laboratory Medicine, Vol. 7, Issue 7, July, 2020.

13. ***Aneel Myageri1, Aditya Divakar Agnihotri2, Lokesh Durjan Singh Chauhan;***
Clinicopathologic Study of Appendix Specimens-A Two Year Retrospective Study at a Tertiary Care Center; National Journal of Laboratory Medicine. 2019 Apr, Vol-8(2): PO05-PO10.

14. ***Aravindan K. P., Deepthy Vijayaraghavan, Marie Therese Manipadam:***
Acute eosinophilic appendicitis and the significance of eosinophil-Edema lesion: indian journal of pathology an dmicrobiology-53(2), april-june 2010.

15. ***KP Aravindan, Deepthy Vijayaraghavan, Marie Therese Manipadam.***
Significance of eosinophil-edema lesion. Indian J Pathol Microbiol 2010;53:258-261.

16. ***Aravindan KP.***
Eosinophils in acute appendicitis: Possible significance. Indian J PatholMicrobiol 1997;40:491-498.

17. ***Rai SP, Shukla A, Kashyap M, Dahiya RK.***
Isolated tuberculosis of the appendix. Indian J Tuberc 2004;51:239-240.

18. ***Wani I, Maqbool M, Amin A, Shah F, Keema A, Singh J, et al.***
Appendicealascariasis in children. Ann Saudi Med 2010; 30:63-66.

19. ***In't Hof KH, Van Der Wal HC, Kazemier G., Lange JF;***
Carcinoid tumor of the appendix. Analyses of 1485 consecutive emergency appendicectomies J GastrointestSurg 2008;12(8):1436-1438.

20. ***Matthyssens LE, Ziol M, Barrat C, Champault GG:***
Routine Surgical Pathology in General Surgery.Br J Surg 2006;93:362-368.

21. ***Sieren LM, Collins JN, Weireter LJ, Britt RC, Reed SF, Novosel TJ, Britt LD.***
The incidence of benign and malignant neoplasia presenting as acute appendicitis. Am Surg 2010;76:808-811.

22. ***Cortina R, McCormick J, Kolm P, Perry RR.***
Management and prognosis of adenocarcinoma of the appendix.Dis Colon Rectum 1995;38:848.

23. ***Connor SJ, Hanna GB, Frizelle FA.***
Appendicealtumors: retrospective clinicopathologic analysis of appendicealtumors from 7,970 appendectomies. Dis Colon Rectum. 1998;41:75–80.

24. ***Mallikarjun Pattanashetti1, MM Priyadarshini2, BN Gayathri3;***
Histopathological Study of Appendicectomy Specimens; National Journal of Laboratory Medicine. 2021 Jan, Vol-10(1): PO30-PO33.

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ORIGINAL ARTICLE

Dental Age Estimation using Demirjian's Methods: A Comparative study

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ABSTRACT

Introduction

Context: There are various methods have been developed for dental age estimation, of these; Demirjian's seven teeth method is most tested and accepted method worldwide. It is based on the tooth development rather than tooth eruption, because developmental process is strictly controlled by genes and less influenced by dietary insufficiency, endocrinal disturbances and environmental insults.

Aims: The purpose of this study is to evaluate the applicability of two Demirjian's methods in a sample of the Varanasi region.

Setting and Design: This is a cross sectional prospective study.

Material and Methods: The evaluation of digital panoramic images of total 432 children and adolescents (237 boys and 195 girls) of age rang 3-16 years from population of the Varanasi region. Seven left mandibular teeth excluding third molar were rated and scored to obtain dental age using Dem73 and Dem76 methods.

Statistical Analysis: Paired t-test was applied to determine the significant difference between estimated dental age and chronological age and correlation was established using Pearson's correlation coefficient.

Results: The Dem73 method overestimated the dental age in boys by 0.23 (±0.80) years and by 0.12 (±0.85) years in the total sample. In the girls' sample, there was no discernible difference in mean age. In boys, girls, and the total sample, Dem76 method overestimated dental ages by 0.85 (±1.14), 0.45 (±1.00), and 0.67 (±1.10) years, respectively. Pearson's correlation revealed high coefficient value between dental and chronological ages.

Conclusions: Dem73 method is more applicable than Dem76 method for age estimation among children and adolescents in the Varanasi region.

keywords |Age estimation; Dental age; chronological age; Tooth Development; Demirji an's method

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Key Massages: Tooth development is the most reliable indicator of a person's actual age than bone age and secondary sexual characters. Demirjian's development method is the most tested and acceptable method for dental age estimation worldwide. Dem73 method was found more applicable for dental age estimation than the Dem76 method in Varanasi region population.

INTRODUCTION

A domain of the forensic sciences i.e., estimation of age is medico legally significant in forensic casework. Assessing chronological age is fundamental for distinguishing proof of criminal cases, survivors of mass catastrophes, and examinations of human remaining parts in archaeological investigations. It is critical to choose whether blamed individual or casualty is beneath or over the age threshold for the criminal law, therefore age assurance for living people is needed to evaluate criminal obligations.[1] Numerous medical and paramedical areas such as diagnosis and treatment planning in orthodontics and pediatric dentistry, pediatric medicine and endocrinology are also concerned with the significance of age determination.[2]

For juveniles and adolescents, age is estimated utilizing formative markers, for example, skeletal development, body weight, and height, sexual turn of events, dental eruption, and maturity. Dental development is the most precise, dependable, and quick indicator of age and is determined by assessing dental advancement stages utilizing radiographs.[3] In humans, dental development starts in the intrauterine period and endures until adulthood. When contrasted with the advancement of different organs, the development of teeth shows the most elevated relationship with the chronological age of juvenescent.[4]

Dental maturation may be evaluated either by the phase of dental eruption or by the calcification and mineralization phase of teeth. The timing and sequence of dental eruption may be influenced by confined conditions such as ankylosis, crowding, extractions, retention of primary teeth, malpositioning, cysts, and dental trauma. Various conditions, both systemic and hereditary, are related to the configuration of postponed tooth eruption. Moreover, it is not feasible to evaluate the specific time of eruption of each tooth for a similar person.[5] The level of calcification is related to various mineralization morphological stages that can be ascertained radio-graphically. The patch of mineralization is substantially more uniform, ongoing, sequenced, and persistent than the tooth eruption, and is less influenced by endocrine illness, dietary insufficiency, and changes in environmental conditions.[6]

The Demirjian's method of dental age estimation is very simple, non-invasive, and does not require highly skilled people to perform, but it is applicable only to the 3–16 year age range, so cases below 3 years and above 16 years cannot be precisely calculated by this method. OPG radiographs of younger children are quite difficult to obtain because they become very nervous and violently shaking their heads could cause injury to them or diminish the quality of the radiographs, making this method more difficult. The Demirjian technique is a broadly applied strategy because of its veracity and feasibility.[7] The utilization of Demirjian's development scale in various populations around the globe has uncovered that a few populations share the comparable pattern of dental maturity achievement as the French-Canadians, while different populations contrast altogether. This pattern was seen in ethnically divergent populations and populations inside an equivalent topographical territory. This features the restricted applicability of such reference information.[8]

The purpose of this study was to evaluate the accuracy and comparison of the Demirjian's seven-teeth method[9] (Dem73) and Demirjian's revised seven-teeth method[10] (Dem76) for assessing age in the Varanasi region population and to examine the practicability of Demirjian's procedure in various age bunches for both sexes.

MATERIALS AND METHODS

In this cross-sectional study, a total of 432 digital panoramic radiographs of children

and adolescents, including 237 boys and 195 girls, from the age range of 3-16 years from the population of Varanasi region, Uttar Pradesh, India were evaluated to calculate dental age (Table 1). The samples, which belong to the inclusion criteria of the study, were collected from the patients who visited the Faculty of Dental Sciences, Institute of Medical Sciences, Banaras Hindu University, Varanasi, for regular dental checkups and treatments. None of the cases have been taken for study purposes only.

Table 1: Age group and sex distribution of studied sample

Age group	Chronological age	Gender		Total (%)
		Male (%)	Female (%)	
3	3.00 - 3.99	7 (1.62)	4 (0.93)	11 (2.55)
4	4.00 – 4.99	10 (2.31)	2 (0.46)	12 (2.78)
5	5.00 – 5.99	14 (3.24)	9 (2.08)	23 (5.32)
6	6.00 – 6.99	20 (4.63)	7 (1.62)	27 (6.25)
7	7.00 – 7.99	13 (3.01)	9 (2.08)	22 (5.09)
8	8.00 – 8.99	19 (4.40)	14 (3.24)	33 (7.64)
9	9.00 – 9.99	25 (5.79)	15 (3.47)	40 (9.26)
10	10.00 – 10.99	28 (6.48)	21 (4.86)	49 (11.34)
11	11.00 – 11.99	22 (5.09)	19 (4.40)	41 (9.49)
12	12.00 – 12.99	22 (5.09)	24 (5.56)	46 (10.65)
13	13.00 -13.99	28 (6.48)	26 (6.02)	54 (12.50)
14	14.00 – 14.99	11 (2.55)	22 (5.09)	33 (7.64)
15	15.00 – 15.99	18 (4.17)	23 (5.32)	41 (9.49)
	Total	237 (54.86)	195 (45.14)	432 (100)

A subject aged 3 to 16 years old of Indian origin, having radiographs with clearly visible teeth with an exact known date of birth and date of radiograph were included in the study. Radiographs that were unclear or had impacted teeth or had any dental anomalies were excluded from the study.

Dental age estimation was done using Dem73 and Dem76 methods. In the Dem73 method, the development of seven left mandibular teeth, from the second molar to the central incisor, were evaluated using digitized panoramic radiographs with the help of DIACOM software. Each tooth was rated individually on an eight-stage scale from A-H and maturity scores were allocated to designated stages for each tooth from the self -weighted score table designed separately for boys and girls. The sum of the scores for each subject was converted into dental age using a standardized age conversion table available in this method for boys and girls separately. In the Dem76 method, the same seven teeth were used, but scores were allocated from the revised self-weighed score table separately for boys and girls based on the calcification stages, and dental age was calculated using the conversion table given in the previous method. Chronological age was calculated in decimals by subtracting the date of birth from the date of a radiograph of each subject.

STATISTICAL ANALYSIS

The degree of inter and intra observer agreement was assessed using Cohen's Kappa statistics before the data was analyzed. For the proposed study, the data was statistically analyzed using IBM SPSS version 24 software. The significant difference between estimated dental age and chronological age for individual

age groups and the combined sample was determined using a paired t-test. Each age category comprises a range of 12 months. For example, age group 3 includes ages from 3.00 to 3.99 years, and so on, and analysis was performed according to the age category and gender wise. Statistical significance was set at $p<0.05$. The correlation between estimated dental age and chronological age for boys, girls, and the total sample was confirmed separately for both the methods using Pearson's correlation (r-value). In this test, the r value close to 1 was considered to represent the strong positive relationship between the compared data.

RESULTS

Among the boys, girls, and the total sample, the mean chronological ages evaluated in the study were 10.16 (±3.28), 11.37 (±3.11), and 10.71 (±3.26) years, respectively. For boys, girls, and the total sample, the mean estimated dental ages using the Dem73 method were 10.39 (±3.42), 11.37 (±3.04), and 10.83 (±3.29) years, respectively. The differences between mean estimated dental ages and mean chronological ages were 0.23 (±0.80), 0.00 (±0.89), and 0.12 (±0.85) years, for boys, girls, and the total sample, respectively. Statistically significant differences were observed in boys (p = 0.000)

Table 2: Paired t-test showing the mean difference between estimated dental age according to Demirjian's seven teeth method and chronological age for boys sample, girls and total sample

Gender	Age group	Mean ± SD			95 % CI	p value
		CA ± SD	EDA ± SD	(EDA – CA) ± SD		
BOYS	3	3.64 ± 0.25	3.43 ± 0.21	-0.21 ± 0.24	-0.44, 0.01	0.057
	4	4.57 ± 0.29	4.46 ± 0.64	-0.11 ± 0.68	-0.59, 0.38	0.631
	5	5.52 ± 0.28	6.03 ± 0.96	0.51 ± 0.88	0.01, 1.02	0.048*
	6	6.38 ± 0.28	7.00 ± 0.35	0.62 ± 0.27	0.49, 0.74	0.000*
	7	7.54 ± 0.32	7.69 ± 0.36	0.15 ± 0.39	-0.09, 0.39	0.196
	8	8.48 ± 0.27	8.34 ± 0.57	-0.14 ± 0.52	-0.39, 0.11	0.259
	9	9.51 ± 0.23	9.43 ± 0.75	-0.08 ± 0.73	-0.39, 0.22	0.570
	10	10.50 ± 0.34	10.59 ± 0.93	0.10 ± 0.94	-0.27, 0.46	0.593
	11	11.53 ± 0.30	11.96 ± 1.15	0.43 ± 0.98	0.00, 0.87	0.051
	12	12.45 ± 0.24	13.01 ± 0.74	0.56 ± 0.75	0.23, 0.89	0.002*
	13	13.43 ± 0.29	13.52 ± 1.12	0.09 ± 1.07	-0.33, 0.50	0.675
	14	14.43 ± 0.24	15.17 ± 0.61	0.74 ± 0.61	0.33, 1.15	0.002*
	15	15.48 ± 0.33	15.56 ± 0.67	0.07 ± 0.73	-0.29, 0.43	0.671
	Total Boys	10.16 ± 3.28	10.39 ± 3.42	0.23 ± 0.80	0.13, 0.33	**0.000***
GIRLS	3	3.50 ± 0.30	3.36 ± 0.28	-0.14 ± 0.30	-0.62, 0.34	0.420
	4	4.53 ± 0.13	5.75 ± 1.70	1.22 ± 1.82	-15.17, 17.61	0.518
	5	5.53 ± 0.23	5.77 ± 0.76	0.24 ± 0.67	-0.27, 0.75	0.312
	6	6.54 ± 0.32	6.87 ± 0.78	0.33 ± 0.86	-0.46, 1.12	0.349
	7	7.56 ± 0.31	7.76 ± 0.33	0.20 ± 0.41	-0.12, 0.51	0.188
	8	8.50 ± 0.32	8.19 ± 0.47	-0.32 ± 0.46	-0.58, -0.05	0.023*
	9	9.51 ± 0.32	9.41 ± 0.58	-0.10 ± 0.56	-0.41, 0.21	0.506
	10	10.65 ± 0.25	10.92 ± 1.04	0.26 ± 1.02	-0.20, 0.73	0.251

11	11.48 ± 0.28	12.18 ± 0.74	0.70 ± 0.74	0.34, 1.05	0.001*
12	12.55 ± 0.35	12.71 ± 1.23	0.16 ± 1.15	-0.33, 0.65	0.509
13	13.56 ± 0.29	13.28 ± 0.81	-0.29 ± 0.86	-0.64, 0.06	0.101
14	14.46 ± 0.34	14.43 ± 0.80	-0.04 ± 0.75	-0.37, 0.30	0.828
15	15.41 ± 0.25	14.67 ± 0.64	-0.74 ± 0.67	-1.03, -0.45	0.000*
Total Girls	11.37 ± 3.11	11.37 ± 3.04	0.00 ± 0.89	-0.13, 0.12	**0.964**
Total Sample	10.71 ± 3.26	10.83 ± 3.29	0.12 ± 0.85	0.04, 0.20	0.003*

Age group 3 means: 3.00 – 3.99 years and so on

CA = chronological age; EDA = estimated dental age; SD = standard deviation; EDA – CA = mean age difference; CI = confidence interval

p* = statistically significant difference ($p < 0.05$)

and the total sample ($p = 0.003$) only. When considering individual age groups, boys of age groups 5, 6, 12, and 14 exhibited significant differences, while girls of age groups 8, 11, and 15 showed significant differences. (Table 2)

In the Dem76 method, boys, girls, and total samples had mean estimated dental ages of 11.01 (±3.8), 11.82 (±3.36), and 11.37 (±3.63) years, respectively. For boys, girls, and the total sample, the difference between mean estimated dental ages and mean chronological ages was 0.85 (±1.14), 0.45 (±1.00), and 0.67 (±1.10) years, respectively. All three groups, boys, girls, and the entire sample, had statistically significant differences ($p<0.05$). Statistically significant differences were found in all individual age groups (except 4, 7, 9 & 10) in boys, while in girls, all individual age groups (except 3, 4, 6, 7, 10 & 15) (Table 3). The Pearson's correlation coefficient revealed a strong positive relationship between estimated dental age and chronological age for boys ($r = 0.972$, $p = 0.000$), girls ($r = 0.958$, $p = 0.000$), girls and the total sample ($r = 0.966$, $p = 0.000$), in the Dem73 method; and for boys ($r = 0.958$, $p = 0.000$), girls and the total sample ($r = 0.955$, $p = 0.000$), in the Dem76 method. The correlation was found to be statistically significant ($p<0.05$) for all the sets of data (Table 4).

Table 3: Paired t-test showing the mean difference between estimated dental age according to revised Demirjian's seven teeth method and chronological age for boys, girls and total sample

Gender	Age group	Mean ± SD			95 % CI	p value
		CA ± SD	EDA ± SD	(EDA – CA) ± SD		
BOYS	3	3.64 ± 0.25	4.19 ± 0.14	0.54 ± 0.26	0.30, 0.79	0.002*
	4	4.57 ± 0.29	5.00 ± 0.62	0.43 ± 0.67	-0.05, 0.91	0.073
	5	5.52 ± 0.28	6.33 ± 0.63	0.81 ± 0.51	0.52, 1.11	0.000*
	6	6.38 ± 0.28	7.19 ± 0.27	0.81 ± 0.23	0.70, 0.92	0.000*
	7	7.54 ± 0.32	7.70 ± 0.27	0.17 ± 0.36	-0.05, 0.38	0.121
	8	8.48 ± 0.27	8.19 ± 0.59	-0.29 ± 0.56	-0.56, -0.02	0.038*
	9	9.51 ± 0.23	9.41 ± 0.98	-0.10 ± 0.97	-0.50, 0.30	0.595
	10	10.50 ± 0.34	10.88 ± 1.34	0.39 ± 1.31	-0.12, 0.90	0.127
	11	11.53 ± 0.30	13.07 ± 1.72	1.54 ± 1.53	0.86, 2.22	0.000*

	12	12.45 ± 0.24	14.67 ± 0.73	2.22 ± 0.72	1.90, 2.54	0.000*
	13	13.43 ± 0.29	15.09 ± 0.90	1.66 ± 0.88	1.32, 2.00	0.000*
	14	14.43 ± 0.24	16.00 ± 0.00	1.57 ± 0.24	1.41, 1.73	0.000*
	15	15.48 ± 0.33	15.97 ± 0.14	0.49 ± 0.33	0.32, 0.65	0.000*
	Total Boys	10.16 ± 3.28	11.01 ± 3.80	0.85 ± 1.14	0.70, 0.99	**0.000***
GIRLS	3	3.50 ± 0.30	3.91 ± 0.36	0.41 ± 0.30	-0.07, 0.89	0.073
	4	4.53 ± 0.13	6.00 ± 1.49	1.47 ± 1.61	-13.01, 15.96	0.420
	5	5.53 ± 0.23	5.98 ± 0.65	0.45 ± 0.54	0.03, 0.87	0.038*
	6	6.54 ± 0.32	6.91 ± 0.62	0.36 ± 0.72	-0.30, 1.03	0.226
	7	7.56 ± 0.31	7.73 ± 0.26	0.17 ± 0.39	-0.13, 0.47	0.226
	8	8.50 ± 0.32	7.98 ± 0.38	-0.53 ± 0.42	-0.77, -0.29	0.000*
	9	9.51 ± 0.32	9.08 ± 0.65	-0.43 ± 0.63	-0.78, -0.08	0.020*
	10	10.65 ± 0.25	10.92 ± 1.35	0.27 ± 1.31	-0.33, 0.86	0.361
	11	11.48 ± 0.28	13.04 ± 0.96	1.55 ± 0.91	1.11, 1.99	0.000*
	12	12.55 ± 0.35	13.49 ± 1.33	0.94 ± 1.27	0.40, 1.47	0.001*
	13	13.56 ± 0.29	14.16 ± 0.71	0.60 ± 0.78	0.28, 0.91	0.001*
	14	14.46 ± 0.34	15.19 ± 0.61	0.72 ± 0.57	0.47, 0.98	0.000*
	15	15.41 ± 0.25	15.39 ± 0.40	-0.03 ± 0.43	-0.21, 0.16	0.766
	Total Girls	11.37 ± 3.11	11.82 ± 3.36	0.45 ± 1.00	0.31, 0.59	**0.000***
Total Sample		10.71 ± 3.26	11.37 ± 3.63	0.67 ± 1.10	0.56, 0.77	**0.000***

Age group 3 means: 3.00 – 3.99 years and so on

CA = chronological age; EDA = estimated dental age; SD = standard deviation; EDA – CA = mean age difference; CI = confidence interval

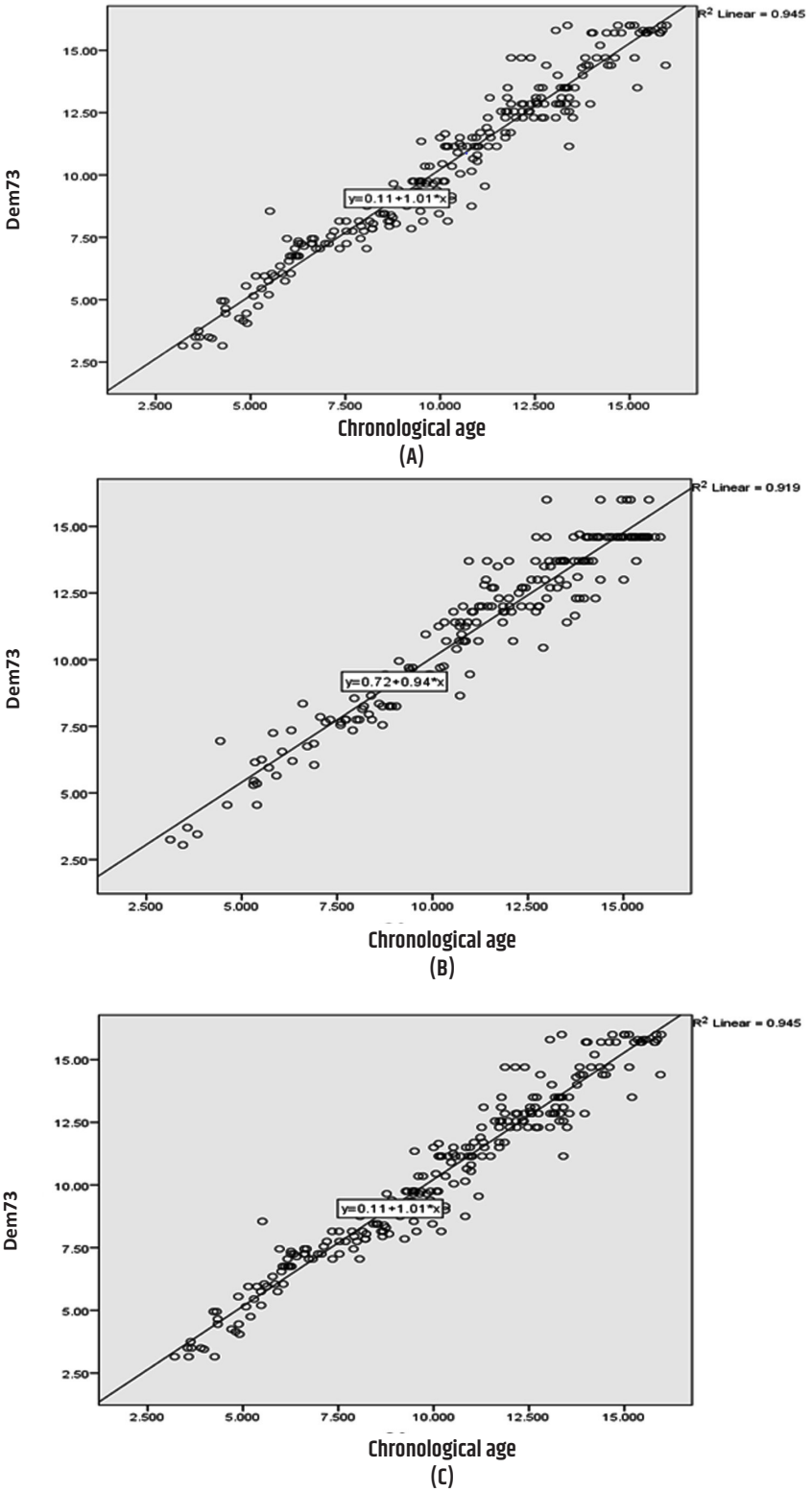
p* = statistically significant difference ($p < 0.05$)

Table 4: Showing the Pearson`s correlation coefficient between estimated dental age and chronological age for the samples.

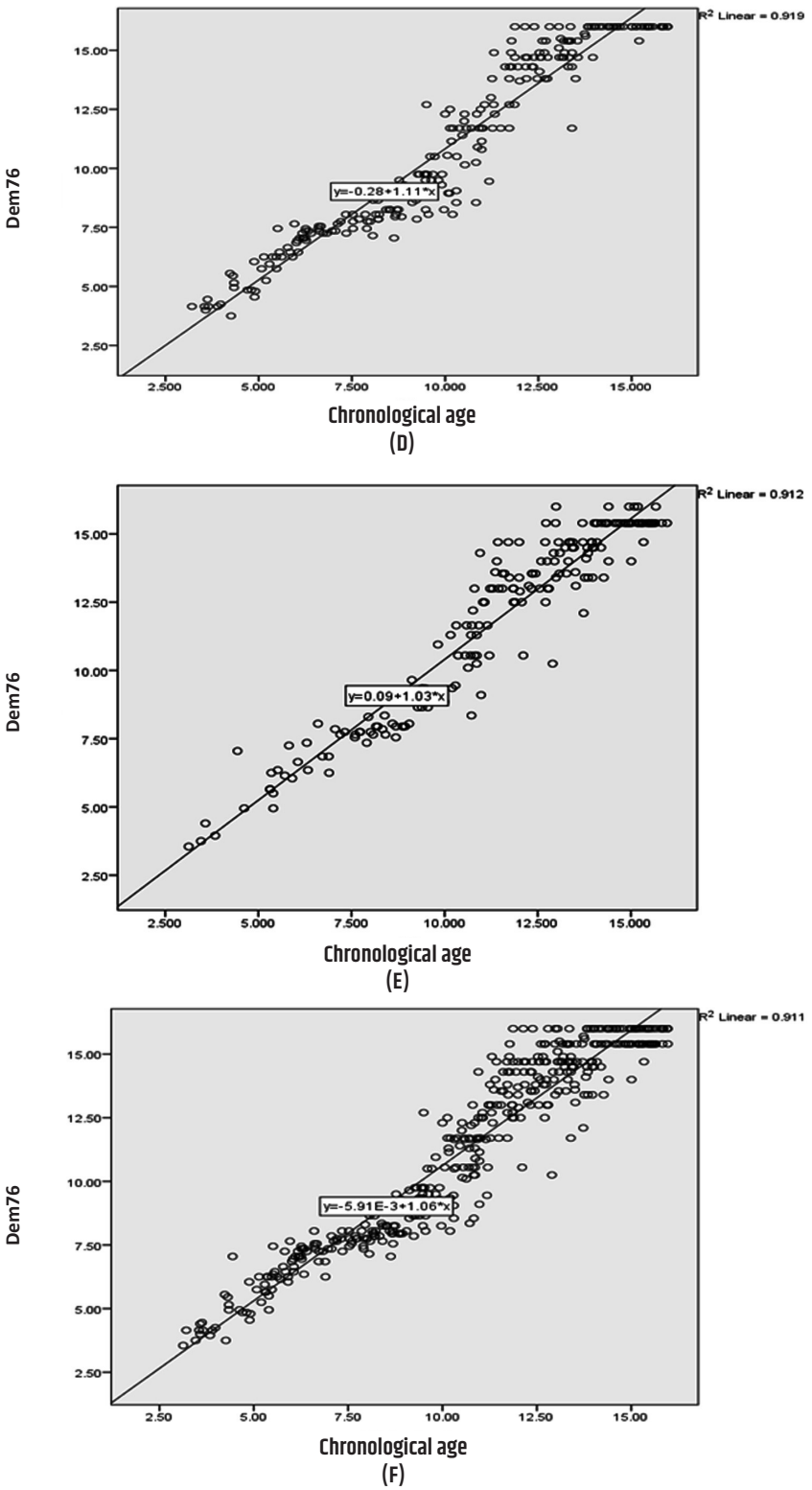
Sample size	Dem73		Dem76	
	Correlation (r)	Significance	Correlation (r)	Significance
Boys (N = 237)	0.972	0.000	0.958	0.000
Girls (N = 195)	0.958	0.000	0.955	0.000
Total (N = 432)	0.966	0.000	0.955	0.000

Significant difference $p<0.05$

Graph 1: Scatter plots showing Pearson's linear correlation between estimated dental ages using Dem73 method and chronological ages for boys (a), girls (b) and total sample (c)



Graph 2: Scatter plots showing Pearson's linear correlation between estimated dental ages using Dem76 method and chronological ages for boys (d), girls (e) and total sample (f)



DISCUSSION

There are various population specific methods of dental age estimation that have been envisaged in different parts of the world, but due to varying differences in different ethnic groups, no universal system of dental age estimation has been developed. That's why each existing method needs to be tested in different ethnic groups.[2] Dental age can be estimated by tooth eruption through tooth count and by the development process through the level of mineralization and calcification. Dental development is a more reliable indicator of age estimation because it is strictly controlled by genes, but tooth eruption and gingival emergence are mostly influenced by space available in the dental arch, extraction of deciduous predecessors, teeth tipping, or teeth impaction. The timing of dental eruption and gingival vary in different ethnic groups and the same ethnic group, making it an unreliable indicator. One more problem associated with dental eruption is that it can only be observed as a single event in time for each tooth. Bone age and secondary sexual characteristics are more influenced by environmental factors as well as dietary habits and diseased conditions.[7]

We examined the dental age estimates obtained using the Dem73 and Dem76 methodologies on the Varanasi region population for boys and girls separately and in a combined sample. While utilizing the Dem73 approach, early dental development was identified in boys, but no difference was found in girls, and when using the Dem76 method, early dental development was detected in both boys and girls when compared to French Canadian children. Individual age groups 5-7 and 10-15 for boys showed early tooth development and the remaining age groups were delayed in tooth development, while individual age groups 4-7 and 10-12 for girls showed early tooth development, and the remaining age groups were delayed in tooth development when compared to the French Canadian population using the Dem73 method. In comparison to the French Canadian population, all individual age groups except 8 and 9 in boys and all individual age groups except 8, 9, and 12 in girls reported early tooth development when using the Dem76 approach.

Only a few studies from various populations have been reported to compare these two age estimating methods simultaneously; of these, only one study was reported from India i.e. Hegde S et al.[11] which agreed with our study, except for the girls' population in the Dem73 approach. They reported higher overestimation in the Dem73 method by 0.75 (SD = ±1.50), 0.64 (SD = ±1.44), and 0.69 (SD = ±1.46) years respectively, for boys, girls, and the total sample, and slightly less overestimation for the Dem76 method by 0.11 (SD = ±0.81), 0.24 (SD = ±0.80) and 0.19 (SD = ±0.80) years respectively, for boys, girls and the total sample as compared to our study. Flood et al.[12] in the South Australian population found that the Dem73 method overestimated ages in boys and girls by 0.61 (SD = ±0.06) and 0.75 (SD = ±0.07) years, respectively, while the Dem76 method overestimated ages by 0.49 (SD = ±0.06) and 0.47 (SD = ±0.06) years in boys and girls, respectively. Another study was conducted on the Western Australian population by Flood et al.[13] also reported over estimation by 0.51 (SD = ±0.12) and 0.63 (SD = ±0.15) years for boys and girls, respectively, using the Dem73 method, and 0.19 (SD = ±0.13) and 0.41 (SD = ±0.14) years for boys and girls, respectively, using the Dem76 method. These two studies are also in agreement with our study, except for the girls' population using the Dem73 approach.

When the Dem73 method, was considered alone, it was found that studies have reported overestimation, underestimation, or high degree of accuracy for dental age as compared to chronological age. Studies conducted on the Indian population are; Koshi and Tondon[14] on 184 south Indian children have reported overestimation by 3.04 years and 2.82 years in boys and girls, respectively. Another study conducted by Prabhakar et al.[15] in the Devangere population of South Indian reported overestimation by 1.20 (SD = ±1.02) years in males and 0.90 (SD = ±0.87) years in females, respectively. Hegde and Sood[16] conducted a study in the Belgaum population of South India on 197 children in age groups 6-13, showed an overestimation by 0.15 years in males and 0.04

years in females, respectively. Studies reported from the rest of the world are; Liversidge et al.[17] reported overestimation by 0.73 (SD = ±0.73) years in males and 0.51 (SD = ±0.79) years in females, respectively. Mani et al.[18] on Malay children reported overestimation by 0.75 years in males and 0.61 years in females, respectively. Studies conducted in the Middle East region by, Al Emran[19] on Saudi Arabian children reported overestimation by 0.3 years in males and 0.4 years in females, Qudeimat et al.[20] on Kuwaitian children reported overestimation by 0.71(SD = ±1.18) in boys and 0.67 (SD = ±1.30) years in girls, Baghdadi Z D[21] on Saudi children reported overestimation by 0.77 (SD = ±0.85) years in males and 0.85 (SD = ±0.79) years in females, Alshiri AM et al.[6] on Western Saudi children reported overestimation by 0.66 (SD = ±1.14) years in males and 0.059 (SD = ±1.26) years in females, Alassiry A et al.[7] on Saudi children reported overestimation by 0.57 (SD = ±1.48) years in males and 0.44 (SD = ±1.66) years in females. The studies were conducted in other parts of the world by, Willems G et al.[22] Tunk ES and Koyuturk AE,[23] Nystrom M et al.[24], Cen J W et al.[25], Leurs IH et al.[26], Bagic I C et al.[27], and Martínez GVM and Ortega-Pertuz AI[28], also reported overestimation of estimated dental age in males and females. All these studies supported our study for the male population only. Hagg and Matson[29], Nykanen et al.[30], Farah C S et al.[31] and Hegde RJ et al.[32] reported a high degree of accuracy and precision for the Dem73 method. Zhai Yui et al.[33], on Northern Chinese population and Hegde RJ et al.[34], on Indian population reported underestimation of dental age in boys and girls, contradicted our study.

The results of our study confirm the necessity of developing population specific scores because differences exist in different population standards within the country and other study groups around the world. Hence, it is imperative to use population specific scores for age estimation in civil and criminal cases for the population being considered.[6] A slight variation was observed when applying the Dem73 method to a Varanasi region in the boys' population, but no variation was observed in the girls' population. Although a mean age difference of 0.5 years is regarded as more correct in forensic studies,[13,35] a difference of one year is also acceptable,[36] and our study utilizing the Dem73 method satisfied both the criteria, while the Dem76 method is within the acceptable range of one year being less accurate than the Dem73 method. These differences may be explained by different factors, such as biological variation in individual children, sampling methods, ethnicity, geographical location, environmental factors, nutrition, socioeconomic status, and the time difference between the two studies.[7]

CONCLUSION

It was concluded that the Dem73 method is more applicable than Demirjian's Dem76 method for age estimation in children and adolescents of Varanasi region.

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REFERENCES

1. ***Akkaya N, Yilanci HÖ, Göksülük D.*** *Applicability of Demirjian's four methods and Willems method for age estimation in a sample of Turkish children. Leg Med (Tokyo). 2015;17(5):355-359.*
2. ***Patel PS, Chaudhary AR, Dudhia BB, Bhatia PV, Soni NC, Jani YV.*** *Accuracy of two dental and one skeletal age estimation methods in 6-16 year old Gujarati children. J Forensic Dent Sci. 2015;7(1):18-27.*
3. ***Celik S, Zeren C, Celikel A, Yengil E, Altan A.*** *Applicability of the Demirjian method for dental assessment of southern Turkish children. J Forensic Leg Med. 2014;25:1-5.*
4. ***Ambarkova V, Galić I, Vodanović M, Biočina-Lukenda D, Brkić H.*** *Dental age estimation using Demirjian and Willems methods: cross sectional study on children from the Former Yugoslav Republic of Macedonia. Forensic Sci Int. 2014;234:187.e1-187.e1877.*
5. ***Bagattoni S, D'Alessandro G, Gatto MR, Piana G.*** *Applicability of Demirjian's method*

for age estimation in a sample of Italian children with Down syndrome: A case-control retrospective study. Forensic Sci Int. 2019;298:336-340.

6. ***Alshihri A M, Kruger E, Tennant M.***
Dental age assessment of 4–16year old Western Saudi children and adolescents using Demirjian's method for forensic dentistry. Egyptian Journal of Forensic Sciences. 2016;6:152-156.

7. ***Alassiry, A, Alshomrani, K, Al Hasi, S, Albasri, A, Alkhathami, SS, Althobaiti, MA.***
Dental age assessment of 3–15-year-old Saudi children and adolescents using Demirjian's method—A radiographic study. Clin Exp Dent Res. 2019; 5: 336– 342.

8. ***Bunyarit SS, Jayaraman J, Naidu MK, Yuen Ying RP, Danaee M, Nambiar P.***
Modified method of dental age estimation of Malay juveniles. Leg Med (Tokyo). 2017;28:45-53.

9. ***Demirjian A, Goldstein H, Tanner JM.***
A new system of dental age assessment. Hum Biol. 1973; 45(2):211-227.

10. ***Demirjian A, Goldstein H.***
New systems for dental maturity based on seven and four teeth. Ann Hum Biol. 1976. Sep;3(5):411–421.

11. ***Hegde S, Patodia A, Dixit U.***
The applicability of the original and revised Demirjian standards to age estimations of 5-15 year old Indian children. J Forensic Odontostomatol. 2018 May 30;36(1):1-13.

12. ***Flood SJ, Franklin D, Turlach BA, McGeachie J.***
A comparison of Demirjian's four dental development methods for forensic age estimation in South Australian sub-adults. J Forensic Leg Med. 2013;20(7):875-883.

13. ***Flood, S.J., Mitchell, W.J., Oxnard, C.E., Turlach, B.A. and McGeachie,***
J. (2011), A Comparison of Demirjian's Four Dental Development Methods for Forensic Age Assessment,†. Journal of Forensic Sciences, 56: 1610-1615.*

14. ***Koshy S, Tandon S.***
Dental age assessment: the applicability of Demirjian's method in south Indian children. Forensic Sci Int. 1998;94(1-2):73-85.

15. ***Prabhakar AR, Panda AK, Raju OS.***
Applicability of Demirjian's method of age assessment in children of Davangere. J Indian Soc Pedod Prev Dent. 2002;20(2):54-62.

16. ***Hegde RJ, Sood PB.***
Dental maturity as an indicator of chronological age: radiographic evaluation of dental age in 6 to 13 years children of Belgaum using Demirjian methods. J Indian Soc Pedod Prev Dent. 2002;20(4):132-138.

17. ***Liversidge HM, Speechly T, Hector MP.***
Dental maturation in British children: are Demirjian's standards applicable?. Int J Paediatr Dent. 1999;9(4):263-269.

18. ***Mani SA, Naing L, John J, Samsudin AR.***
Comparison of two methods of dental age estimation in 7-15 year old Malays. Int J Paediatr. 2008;18:380–388.

19. ***Al-Emran S.***
Dental age assessment of 8.5 to 17 Year-old Saudi children using Demirjian's method. J Contemp Dent Pract. 2008;9(3):64-71.

20. ***Qudeimat MA, Behbehani F.***
Dental age assessment for Kuwaiti children using Demirjian's method. Ann Hum Biol. 2009;36(6):695-704.

21. ***Baghdadi ZD.***
Dental maturity in saudi children using the demirjian method: a comparative study and new prediction models. ISRN Dent. 2013;2013:390314.

22. ***Willems G, Van Olmen A,***
Spiessens B, Carels C. Dental age estimation in Belgian children: Demirjian's technique revisited. J Forensic Sci. 2001;46(4):893-895.

23. ***Tunc ES, Koyuturk AE.***
Dental age assessment using Demirjian's method on northern Turkish children. Forensic Sci Int. 2008;175(1):23-26.

24. ***Nyström M, Ranta R, Kataja M, Silvola H.***
Comparisons of dental maturity between the rural community of Kuhmo in northeastern Finland and the city of Helsinki. Community Dent Oral Epidemiol. 1988;16(4):215-217.

25. ***Chen JW, Guo J, Zhou J, Liu RK, Chen TT, Zou SJ.***
Assessment of dental maturity of western Chinese children using Demirjian's method. Forensic Sci Int. 2010;197(1-3):119.e1-119.e1194.

26. ***Leurs IH, Wattel E, Aartman IH, Etty E, Prahl-Andersen B.***
Dental age in Dutch children. Eur J Orthod. 2005;27(3):309-314.

27. ***Čuković Bagić, I., Sever, N., Brkić, H. i Kern, J. (2008).***
Dental Age Estimation in Children Using Orthopantomograms. Acta stomatologica Croatica, 42 (1), 11-18.

28. ***Martínez GVM, Ortega-Pertuz AI.***
Comparison of Nolla, Demirjian and Moorrees methods for dental age calculation for forensic purposes. Rev Odont Mex. 2017;21(3):155-164.

29. ***Hägg U, Matsson L.***
Dental maturity as an indicator of chronological age: the accuracy and precision of three methods. Eur J Orthod. 1985;7(1):25-34.

30. ***Nykänen R, Espeland L, Kvaal SI, Krogstad O.***
Validity of the Demirjian method for dental age estimation when applied to Norwegian children. Acta Odontol Scand. 1998;56(4):238-244.

31. ***Farah CS, Booth DR, Knott SC.***
Dental maturity of children in Perth, Western Australia, and its application in forensic age estimation. J Clin Forensic Med. 1999;6(1):14-18.

32. ***Hegde RJ, Khare SS, Saraf TA, Trivedi S, Naidu S.***
Evaluation of the accuracy of Demirjian method for estimation of dental age among 6-12 years of children in Navi Mumbai: A radiographic study. J Indian Soc Pedod Prev Dent. 2015 Oct-Dec;33(4):319-323.

33. ***Zhai Y, Park H, Han J, Wang H, Ji F, Tao J.***
Dental age assessment in a northern Chinese population. J Forensic Leg Med. 2016;38:43-49.

34. ***Hegde RJ, Shigli A, Gawali P, Jadhav G, Garje P, Kulkarni T.***
Relationship between chronological age, dental age, and body height using Demirjian method among children aged 4-14 years in Pune - A radiographic study. J Indian Soc Pedod Prev Dent. 2020 Oct-

Dec;38(4):338-342.

35. ***McKenna CJ, James H, Taylor JA, Townsend GC.*** *Tooth development standards for South Australia. Aust Dent J. 2002;47(3):223-227.*

36. ***Chaillet N, Nystrom M, Kataja M,*** *Demirjian A. Dental maturity curves in Finnish children: Demirjian's method revisited and polynomial functions for age estimation. J Forensic Sci 2004;49:1324–1331.*

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ORIGINAL ARTICLE

Histopathological Spectrum of Pulmonary Lesions in Autopsies: A Two Year Retrospective Study

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ABSTRACT

Introduction

Background: The lungs are secondarily involved in almost all forms of terminal events. Study of these lesions will help in devising prophylactic strategies to reduce associated mortality.

Objectives: To find the frequency of various lung lesions in relation to age, sex, and to analyze histopathological spectrum of lung lesions in autopsy cases.

Material and methods: Two years retrospective study based on hospital records from January 2019 - December 2020 carried out in department of pathology. Lungs were fixed in 10% formalin & processed. Paraffin wax embedding was done & sections stained with H & E stain. Gross and microscopic examination of samples were conducted for diagnosis.

Results: A total of 147 cases with lung specimens were received during the period of study. Among these, 47 (32%) cases showed tissue autolysis of lung. The age ranged from 8 months to 80 years. Majority of cases analyzed were from adults, only 8 (5.5%) cases were below 15 years of age. Pathologies were detected in 99 cases and one case had unremarkable histology. Majority of the cases (77%) were males. Microscopic findings seen included congestion and edema (30%), inflammation (acute pneumonia, granulomatous and fungal) (23%), emphysema (20%), changes in interstitium (12%) and pulmonary thromboembolism (12%). Majority of the pulmonary thromboembolism were seen in the age group of 16-30 years.

Conclusion: Congestion and edema followed by pneumonia were the most commonly observed pathological lung lesions in our study. Autopsy study of lung lesions can provide an insight to plan certain preventive strategies to reduce morbidity and mortality due to lung pathology.

keywords | Autopsy; Histopathology; Lung lesions

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INTRODUCTION

The term "autopsy" refers to a self-examination of a deceased person. It is a crucial method for detecting the state of internal organs as well as analyzing sickness

or injury that could explain the reason and manner of death. All three cavities of the body, including the cranium, thorax, and abdomen, must be examined during an autopsy. The most significant aspect of both medicolegal and clinical autopsies in the thorax is the lung examination. Clinical or pathological autopsies are frequently performed by pathologists to ascertain the cause of death and to investigate the body.[1]

Various infectious, occupational, and neoplastic disorders impact the lungs. Gross pathologic examination of autopsy lungs reveals information about the status of the lung, whether it is collapsed or hyperinflated, the presence of scarring, fibrosis, bullae, consolidation, nodules, infarction, secretions, Edema, congestion, granuloma/abscess formation, and the status of the bronchi and pleura, which may provide a clue to the diagnosis.[2]

This study describes the frequency of various lung lesion in relation to age and sex and analyses histopathological spectrum of lung lesions in autopsy cases.

MATERIALS AND METHODS

This is a retrospective study done in the department of pathology in a tertiary care hospital in Bangalore for a period of two years (January 2019 to December 2020). The study was conducted on lung specimens of 147 autopsies where the specimen of lung was sent for pathological examination. Patient information regarding age, sex, brief history of illness and in situ postmortem findings were obtained from the request form.

All specimens were adequately fixed in 10% formalin. Gross examination of lungs included size, weight, color, consistency and presence of any pathological findings were noted and sections from representative areas were taken. After processing and paraffin embedding, sections were cut and stained with Hematoxylin and eosin (H & E) stain according to standard procedure. All the histological sections were examined microscopically, and findings were noted.[1]

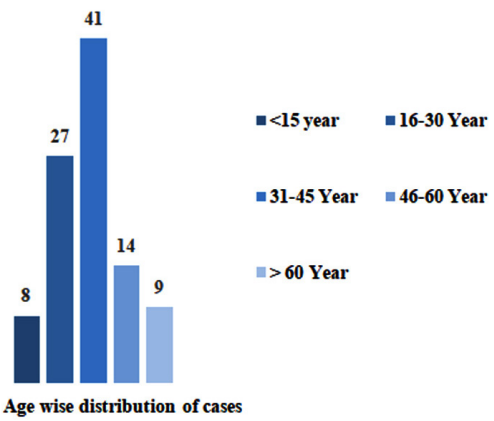
All cases of lung specimens were included in study irrespective of age, sex and cause of death. However, we excluded autolyzed lung specimens from the study.

A Microsoft Excel 2019 software program was used to enter all data and analyse descriptive data.

RESULTS

A total of 147 specimens were received during the period of study along with relevant clinical details and autopsy findings. Among these in 47cases (40%) the tissue was autolyzed and in one specimen the histopathology was unremarkable.

Significant microscopic findings were found in 99 cases. Among the pathological lung specimens 77 were males and 22 females. The age ranged from 8 month to 80 years. Eight specimens belonged to individuals aged below 15 years. Majority of the lung samples (41 specimens) came from autopsies conducted on adults between 31 and 45 years. There were only 9 specimens belonging to people over 60 years age where autopsies were carried out. (Graph 1)



Graph 1: Age wise distribution of cases

Wide varieties of microscopic findings were seen in lungs which included congestion and edema, inflammation (acute pneumonia, granulomatousand fungal), changes in interstitium, emphysema, and pulmonary thromboembolism. There were two cases of lung malignancies one each of primary (Adenocarcinoma of lung) (Fig. 1) and

metastatic disease. (Table 1).

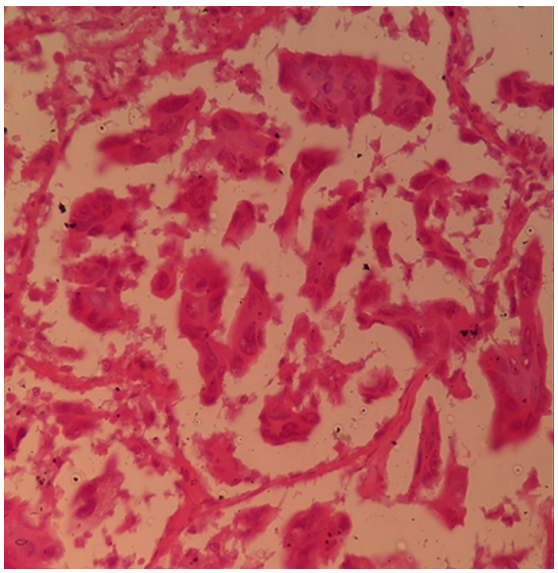


Fig. 1: Adenocarcinoma of lung (H & E 40x)

The most common pathology was congestion and edema, seen in 25 males and 5 females. The second most common pathology was inflammatory change, seen in 19 males and 4 females, of which 21 had finding of acute pneumonia (Fig. 2) and one case each of granulomatous inflammation (Fig. 3) and fungal (Cryptococcus) (Fig. 4).

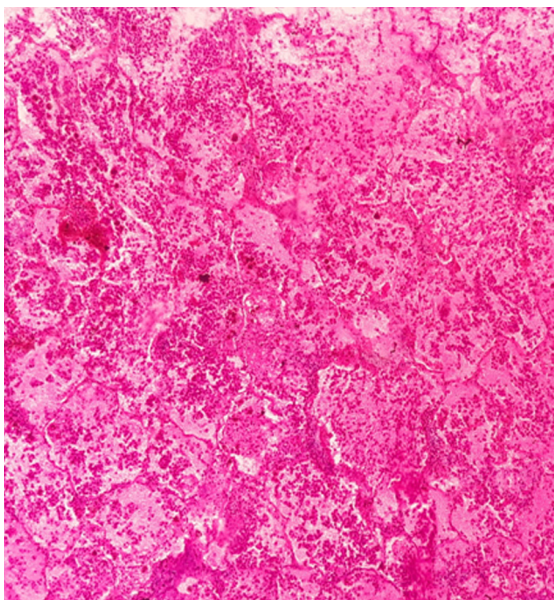


Fig. 2: Lobar pneumonia (H & E 10x)

Table 1: Distribution of cases based on histopathological diagnosis

Lung Lesions/ histopathological diagnosis	Total Cases	Malen (%)	Femalen (%)
Congestion and edema	30	25 (83)	5 (16)
Inflammatory changes	23	19 (82)	4 (17)
Emphysematous changes	20	18 (90)	2 (10)
Lung malignancy	2	0 (0)	2 (100)
Changes in the interstitum	12	8 (66)	4 (33)
Pulmonary thromboembolism	12	7 (58)	5 41)
Total	99	77 (77)	22 (22)

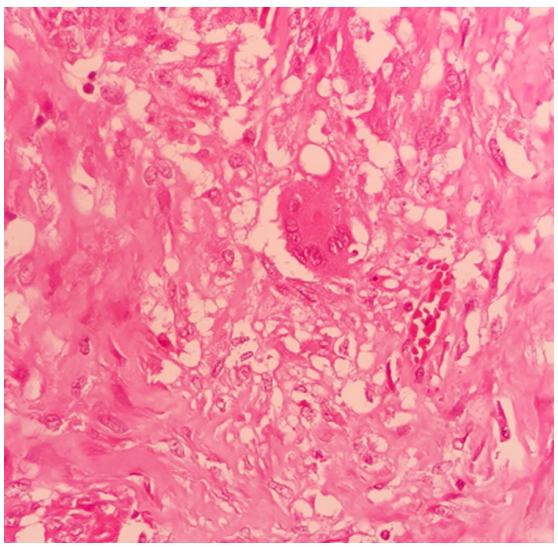


Fig. 3: Granulomatous inflammation (H & E 40x)

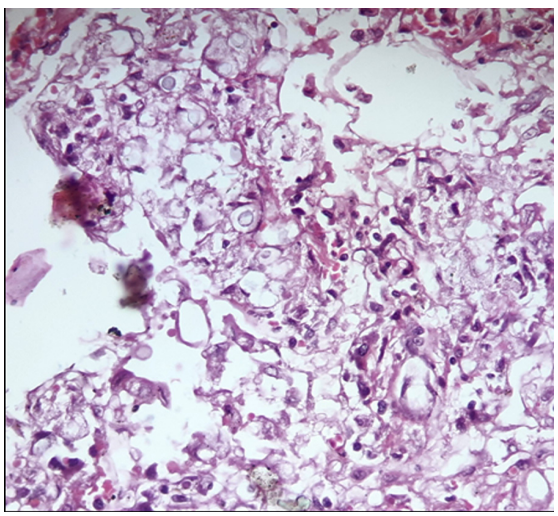


Fig. 4: Cryptococcal infection (H & E 20x)

Among the 20 cases with emphysematous changes, 18 were males, and 2 were females. Twelve specimens had interstitial changes and pulmonary thromboembolism, most of which were males in the age group of 16-30 years.

DISCUSSION

Medico-legal autopsies are a mandatory legal requirement in unnatural deaths and are done to assist the legal and criminal evaluation procedures. Autopsies, when combined with relevant details and histopathological examination, are extremely useful in determining the causes of death.[1]

Many of the findings in our study were comparable with other similar studies done across India. Majority of the specimens in our study were from males and a similar pattern was also observed in studies conducted in different parts of India.[1-3]

Congestion & oedema was the most common histopathological finding similar to the study done by Khare P et al. in which 86 autopsy lung specimens were evaluated over a period of one and half year from a tertiary care hospital. Higher occurrence of congestion & oedema in our study could be due to secondary involvement of lungs in all forms of terminal events with cardiovascular causes.

The second commonest finding in the present study was acute pneumonia accounting to 21 cases (21%) which was comparable to the study done by TS Anisha et al. which is in a similar setting as our study in a close by geographical location with total number of acute pneumonia cases being 15%.[3] However, the study done by Goswami et al. in northwestern part of India had a much higher number of pneumonia specimens (33.8%) recorded over a similar study period.

In our study, emphysema cases were 20% which was comparable to Gowsami et al., whereas studies done by Khare P et al. and TS Anisha et al. the incidence of cases of emphysema were fewer.[1-3] Similar to all other studies majority of emphysematous specimens collected were from males, this could be due to the higher prevalence of smoking seen among men.[4]

In our study, two cases were found to have malignancy (one each of primary and secondary). Patel et al. in his study spanning autopsies from six years also had about 2% specimens with unsuspected neoplasia. In general, unsuspected malignancies are a very uncommon finding with a similar low percentage seen in other studies as well.[2] Ten years retrospective analysis of 474 specimens in a tertiary care center in central India revealed no specimens with malignancy.[6]

Fungal colonies were seen in one specimen in our study, they were variably sized, round to oval encapsulated with thin cell walls suggestive of cryptococcus. A study conducted by Khare P et al. found 1 case of broad non septate hyphae form which was an incidental finding in their study.[1]

Our study had a few limitations, lack of complete and detailed clinical history did hamper the diagnosis and cause of death determination. Along side for the lung specimens that were collected in the time overlapping the COVID-19 first wave, we did not have any test done to confirm the COVID-19 status of the cases, this may or may not have influenced our outcome.

CONCLUSION

In our study, the most common lung lesions contributing directly or indirectly to the cause of death were pulmonary edema and/or congestion. Pneumonia was the second most common pathological lung lesion observed in our study, implying that lung infections are a common cause of death. As a result, we believe that effective implementation of measures to prevent hospital acquired pneumonia may reduce mortality. Autopsies have remained a valuable complementary tool for identifying and understanding respiratory diseases. It also serves as a reassuring and educational tool in determining and establishing the cause of death.

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REFERENCES

1. ***Khare P, Gupta R, Ahuja M, Khare N, Agarwal S, Bansal D.***
   Prevalence of Lung Lesions at Autopsy: A Histopathological Study. J Clin Diagn Res. 2017;11(5):EC13-EC16.
2. ***Goswami PR, Goswami AP, Khandkar AS.***
   Autopsy study of spectrum of lung lesions in Tertiary care hospital. J Family Med Prim Care. 2021;10(3):1251-1253.
3. ***Anisha TS, Shashikala K, Ramya T, Sharmila PS.***
   Patterns of Lung Lesions in Autopsy: A Histopathological Study. Indian J Forensic Med Pathol. 2020;13(1):9-13.
4. ***Rai B, Bramhankar M.***
   Tobacco use among Indian states: Key findings from the latest demographic health survey 2019-2020. TobPrevCessat. 2021 9;7:19.
5. ***Patel S, Rajalakshmi BR, Manjunath GV.***
   Histopathologic Findings in Autopsies with Emphasis on Interesting and Incidental Findings-A Pathologist's Perspective. J Clin Diagn Res. 2016;10(11):EC08-EC12.
6. ***Dhruw D, Chikhlikar K, Nayak K, Thakur N, Singh B, Meshram A.***
   Histopathological Spectrum of Lesions in Lungs on Post-mortem Specimen in a Tertiary Centre of Bastar Region - A Retrospective Study. Journal of Clinical and Diagnostic Research. 2020,14(9): EC05-EC09.

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ORIGINAL ARTICLE

Determination of Gender Divergences of Maxillary Sinuses Measurements in Computed Tomographic Scans of Kerala Population

Vyshnav R[1], Tina Sharma[2], Priyakanksha Mishra[3]

ABSTRACT

Introduction

The challenging forensic procedure of corpse identification is required by law authorities and social norms. It is very crucial to compare the post-mortem and antemortem medical information in cases where the bodies are severely damaged and beyond recognition. However, conventional identification techniques might not have been effective, especially though there have been substantial post-mortem alterations. In unidentifiable skeletons, gender has long been determined from either the skull, pelvic or long bones with an epiphysis and a metaphysis. In the present study, attempt has been made to determine gender divergences from axial and coronalcomputed tomographic scan (CT) of maxillary sinus in Kerala population. A total of 40 individuals including 20 male and 20 female, visiting the Outpatient Department of the Koyilli Hospital, Kannur were included as the study subjects. The dimensions of right and left maxillary sinuses of 40 subjects from plain CT were measured using Radiant DICOM software. Statistical analysis was completed with independent student t-test and general descriptive analysis with SPSS software. Gender determination using height, length, width of the maxillary sinus on both sides showed statistically insignificant results but in case of left volume and left anterior posterior height of maxillary sinus the p-value was found to be significant at 95% of confidence level. So, the present study concludes that left volume of maxillary sinus and left anteroposterior height showed statistically significant results which can be considered in determining and screening corpses on the bases of maxillary sinus computed tomographic records.

KEYWORDS | Forensic Science; Forensic Medicine; Gender determination; Forensic Anthropology; Postmortem Identification; Maxillary Sinus.

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INTRODUCTION

Post Mortem identification is one of the most important and necessary forensic procedure. Post mortem identification can be done by comparing the antemortem records of certain body parts like skull, teeth, bones, maxillary sinus. However, skull, bone or teeth

may get badly tampered due to decomposition and are difficult to be used for identification.[1-3]

In such cases Maxillary sinus plays a vital role in identification as they remain intact even if other parts are decomposed. Maxillary sinus is located in the maxillary bone and are the two air filled spaces which have considerable changes in size between both left and right maxillary sinus.[3-5] Sinus develops rapidly and attain maximum growth by the age of 20. Previous studies indicate that 95 percent of the adults have the frontal sinuses and thus can be considered as a potential part of the skull for the classification.[5-10]

Radiography is one of the standard procedures in identification of individuals. Computer Tomography (CT) is widely used in forensic to identify unknown individuals mainly in cases of fragmented or decomposed body as they provide sequence of cross-sectional images of interior of the body. Studies indicates that Computer Tomography (CT) could be an excellent method for imaging and are used for analyzing maxillary sinus. The anthropometric measurements of maxillary sinus alone can even be used for gender determination if the other body parts are not found or are fragmented, burned or decomposed.[11] Even though some population shows changes in frequencies, it is estimated that more than 90 percentage of individuals have frontal sinus and even the sinus characteristics of twins are different. Therefore, sinus can be of a great potential part for gender determination.[12]

Identification of the characteristics of a corpse such as age, gender etc. are an essential procedure in forensic examination. However, the identification is very difficult in certain cases where the body might have completely mutilated or decomposed due to various reasons. In such cases of forensic examination anthropometric measurements plays a vital role in identification of an individual.[14-16] Maxillary sinus is an important part which can be used for determination of gender by measuring and examining the morphometric measurements of the sinus, therefore sinus plays a major role in forensic examination as they can be used to confirm the gender of an individual even after death along with other methods such as determining gender from pelvis, long bones or by examining dental documents. Here, in this paper, the attempt has been made to determine the gender divergences from the maxillary sinus measurements of CT samples of human skulls by calculating the Medio lateral (ML) and Anterior posterior (AP) measurements of the maxillary sinus. Here, in this paper, the attempt has been made to determine the gender divergences from the maxillary sinus measurements of CT samples of human skulls by calculating the Mediolateral (ML) and Anterior posterior (AP) measurements of the maxillary sinus. So, in the present study, attempt has been made to determine gender from 40 samples of CT scans with Coronal and Axial view.

MATERIALS AND METHODS

The study was conducted in 38 samples which includes 19 Males and 19 female participants. The samples were collected from the population of Kerala, India. CT scan samples of maxillary sinus from coronal, axial as well as sagittal plane was collected from the Hospital and were examined in Radiant DICOM viewer software. Using the software ML and AP measurements of both left and right maxillary sinus of coronal view were taken and AP of both left and right axial view were taken and recorded and documented. The measurements were taken from the first to last particular points in the sinus while keeping the maxillary sinus in the possible widest position. The measurements taken proceeded to statistical analysis in order to determine the gender with help of independent student t-test using SPSS (Statistical package for the social science) software.

The null hypothesis (H_0) and alternative hypothesis (H_1) of the Independent Samples t Test is as follows:

H_0: There is no significant differences in Sizes of ML (Medio Lateral), AP (Anterior Posterior), APH and Volume of Maxillary sinus of male and female computed tomographic scans.

H_1: There is significant differences in Sizes of ML (Medio Lateral), AP (Anterior Posterior), APH and Volume of Maxillary

sinus of male and female computed tomographic scans.

RESULTS AND DISCUSSION

The mean values of the right side maxillary sinus AP (width), ML (depth), and AP (height) in males are 2.3000, 3.5320, and 3.1240, respectively, and in the case of females, it was 2.1984, 3.2621, 3.1574. The volume calculated according to Sahlstr and Johnson formula depicted the volume of the right maxillary sinus for males to be 13.3231 and for females, it turns out to be 11.7353 as shown in Table 1 and Fig. 1.

Table 1: Showing descriptive statistics of the left and right side of maxillary sinus dimensions of the male and female in Kerala population

	Group Statistics				
	Gender	**N**	**Mean**	**Std. Deviation**	**Std. Error Mean**
MLR	Male	20	2.3000	.57099	.12768
	Female	19	2.1984	.57429	.13175
APR	Male	20	3.5320	.46141	.10317
	Female	19	3.2621	.66617	.15283
APRH	Male	20	3.1240	.59464	.13296
	Female	19	3.1574	.61878	.14196
VR	Male	20	13.3231	6.41673	1.43482
	Female	19	11.7353	5.09617	1.16914
MLL	Male	20	2.4685	.53059	.11864
	Female	19	2.3316	.56364	.12931
APL	Male	20	3.6050	.41160	.09204
	Female	19	3.3879	.67307	.15441
APLH	Male	20	3.6410	.37492	.08384
	Female	19	3.1532	.63559	.14582
VL	Male	20	32.9007	10.67908	2.38792
	Female	19	25.8756	11.06580	2.53867

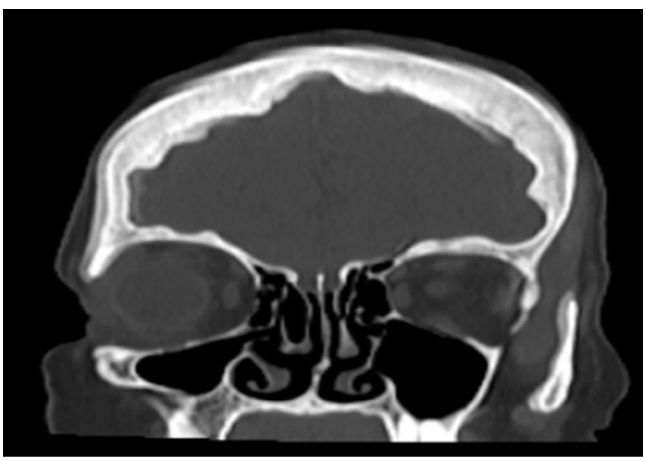

Fig. 1: CT scan image of maxillary sinus axial view

Sex determination using height, length, width, and volume of the maxillary sinus on the right side showed statistically insignificant results with P >.05 as shown in Table 2.

Table 2: Showing Statistical results of Maxillary sinus with left volume

Independent Samples Testa											
-		Levene's Test for Equality of Variances		t-test for Equality of Means							
						Significance		Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
		F	Sig.	t	dt	One-Sided p	Two-Sided p			Lower	Upper
MLR	Equal variances assumed	.574	.453	.554	37	.292	.583	.10158	.18344	-.27010	.47326
	Equal variances not assumed	-	-	.554	36.874	.292	.583	.10158	.18347	-.27020	.47336
APR	Equal variances assumed	3.870	.057	1.477	37	.074	.148	.26989	.18270	-.10028	.64007
	Equal variances not assumed	-	-	1.464	31.874	.077	.153	.26989	.18440	-.10577	.64556
APRH	Equal variances assumed	.129	.722	-.172	37	.432	.865	-.03337	.19430	-.42706	.36032
	Equal variances not assumed	-	-	-.172	36.687	.432	.865	-.03337	.19450	-.42758	.36085
VR	Equal variances assumed	.428	.517	.853	37	.200	.399	1.58787	1.86191	-2.18472	5.36045
	Equal variances not assumed	-	-	.858	35.901	.198	.397	1.58787	1.85084	-2.16617	5.34191
MLL	Equal variances assumed	.275	.603	.781	37	.220	.440	.13692	.17521	-.21809	.49193
	Equal variances not assumed	-	-	.780	36.534	.220	.440	.13692	.17549	-.21881	.49265
APL	Equal variances assumed	5.569	.024	1.222	37	.115	.229	.21711	.17762	-.14278	.57699
	Equal variances not assumed	-	-	1.208	29.531	.118	.237	.21711	.17976	-.15026	.58447
APLH	Equal variances assumed	5.703	.022	2.938	37	.003	.006	.48784	.16607	.15136	.82433
	Equal variances not assumed	-	-	2.900	28.878	.004	.007	.48784	.16820	.14378	.83191
VL	Equal variances assumed	.052	.821	2.018	37	.025	.051	7.02508	3.48199	-.03010	14.08026
	Equal variances not assumed	-	-	2.016	36.714	.026	.051	7.02508	3.48525	-.03856	14.08873

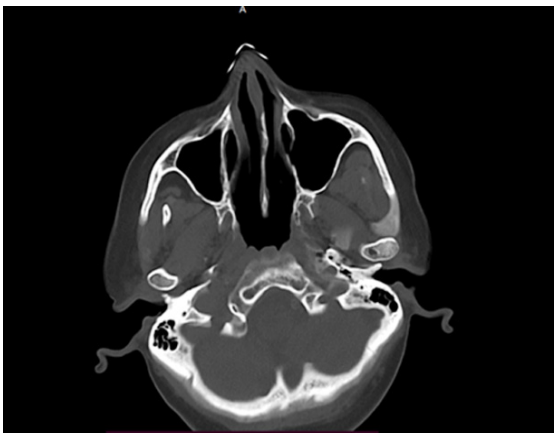

Fig. 2: CT Scan image of sinus of coronal view

The mean values of the left side of maxillary sinus ML (Depth), AP (Width), and AP (Height) in males are 2.4685, 3.6050, and 3.6410, respectively, and in the case of females, it was 2.3316, 3.3879, and 3.1532. The volume calculated according to Sahlstrand-Johnson formula depicted the volume of the left side of the maxillary sinus for males to be 32.9007 and for females, it turns out to be 25.8756 shown in Table 1 and Fig. 1 Sex determination using height, length, and width of maxillary sinus on the left side showed statistically insignificant results with P >0.05 as shown in Table 2. But the left volume and Anteroposterior height showed statistically significant results with P < 0.05. In the present study, the measurements of the maxillary sinus AP (width), ML (depth), and AP (height) and volume was evaluated.

SIGNIFICANT PARAMETERS

An independent sample t test was conducted to compare the gender divergences in APLH parameters of left male and female computed tomographic scans. The levene's test for equality of variance it was observed that the value of significance was lesser than 0.05 that suggests mean of equal variances not assumed. There were significant differences [t (37) =2.9, p=0.004] in scores for Males (M=3.64, SD =0.37) and Female (M=3.15, SD= 0.63). The magnitude of the differences in the means (mean difference=0.48,95% Cl: 0.14 to 0.83) was significant. Hence, H1 was supported. Similarly, In case of volume of left maxillary sinuses of male and female computed tomographic scans. The levene's test for equality of variance it was observed that the value of significance was greater than 0.05 that suggests mean of equal variances assumed. There were significant differences [t (37) = 2.018, p=0.025] in scores for Males (M=32.90, SD =10.67) and Female (M=25.87, SD=11.06). The magnitude of the differences in the means (mean difference = 7.02 , 95% Cl: 0.30 to 14.08) was significant. Hence, H1 was supported.

INSIGNIFICANT PARAMETERS

An independent sample t test was conducted to compare the gender divergences in ML of right maxillary sinuses of male and female computed tomographic scans. The levene's test for equality of variance it was observed that the value of significance was greater than 0.05 that suggests mean of equal variances assumed. There were no significant differences [t (37) =0.554, p=0.292] in scores for Males (M=2.30, SD =0.570) and Female (M=2.19, SD=0.574). The magnitude of the differences in the (mean difference =0.101,95% Cl:0.27 to 0.473) was very small. Hence, H1 was not supported. In case of AP of right maxillary sinuses of male and female computed tomographic scans. The levene's test for equality of variance it was observed that the value of significance was greater than 0.05 that suggests mean of equal variances assumed. There were no significant differences [t (37) =1.47, p=0.074] in scores for Males (M=3.53, SD =0.46) and Female (M=3.26, SD=0.66). The magnitude of the differences in the (mean difference =0.269, 95% Cl:0.10 to 0.64) was very small. Hence, H1 was not supported. In case of APH of right maxillary sinuses of male and female computed tomographic scans. The levene's test for equality of variance it was observed that the value of significance was greater than 0.05 that suggests mean of equal variances assumed. There were no significant differences (t (37) =0.432, p=0.432) in scores for Males (M=3.12, SD =0.59) and Female (M=3.15, SD=0.61). The magnitude of the differences in the (mean difference =0.33, 95% Cl:0.42 to 0.36) was very small. Hence, H1 was not supported. In case of Volumeof right maxillary sinuses of male and female computed tomographic scans. There were no significant differences [t (37) =0.853,

p=0.20] in scores for Males (M=13.32, SD = 6.4) and Female (M=11.73, SD=5.09). The magnitude of the differences in the (mean difference=1.58, 95% Cl:2.1 to 5.3) was very small. Hence, H1 was not supported. Similarly, in case of ML of left maxillary sinuses of male and female computed tomographic scans. The levene's test for equality of variance it was observed that the value of significance was greater than 0.05 that suggests mean of equal variances assumed. There were no significant differences [t (37)=0.781, p=.220] in scores for Males (M=2.46, SD=0.53) and Female (M=2.33, SD=0.56). The magnitude of the differences in the (mean difference=0.136, 95% Cl:0.21 to 0.49) was very small. Hence, H1 was not supported. Similarly, In case of AP of left maxillary sinuses of male and female computed tomographic scans. The levene's test for equality of variance it was observed that the value of significance was greater than 0.05 that suggests mean of equal variances assumed. There were no significant differences [t (37) = 2.9, p=0.115] in scores for Males (M=3.6, SD =0.41) and Female (M=3.30, SD=0.67). The magnitude of the differences in the (mean difference=0.217, 95% Cl:0.15 to 0.58) was very small. Hence, H1 was not supported.

DISCUSSION

Gender determination from maxillary sinus plays a major role in forensic procedures. It has been reported that the size of maxillary sinus of female was found to be smaller than that of male, The accuracy rate of the right and left maxillary sinus measurements together was 69.4% in females and 69.3% in males, with a mean of 69.3%.[11] Another study indicated that the maxillary sinus exhibits anatomic variability between different ethnic groups and genders[2], it is also reported that Volumetric analysis revealed that European crania had larger maxillary sinuses than Zulu crania and male crania had larger maxillary sinuses than females.[1] Another study indicates that the mean area in males was 1.7261 cm^2 with a standard deviation of 0.2364 and in females was 1.3424 cm^2 with a standard deviation of 0.2369. The mean perimeter in males was 5.2885 cm, whereas the mean perimeter in females was 4.3901 cm. Hence, showing males have a larger area and perimeter when compared with females.[10] It is also reported in a study that comparison of X-ray images can be undertaken in an objective way by quantifying the probability of identity even under circumstances where the comparative images were made under different conditions such as rotation.[17-19] In a study of computed tomography measurements of different dimensions of maxillary and frontal sinuses, it is observed that mean value of sinus volume was 15.7±5.3 cm^3 and significantly larger in males than in females (P = 0.004) and there was no significant relation between the volume of maxillary sinus with age or side.[3] It has been reported in a study of Evaluation of foramen magnum in gender determination using helical CT scanning that the reconstructed CT image can provide valuable measurements for the FM and could be used for sexing when other methods are inconclusive.[13,16] In a study of sex determination in Egyptian population using MDCT of maxillary sinuses indicated that Cephalo-caudal and size of the left maxillary sinuses by MDCT may be useful to support gender determination in Egyptians (accuracy rate 70.8% for males). However, further studies on gender determination from the maxillary sinuses are needed.[15] In a study of using maxillary sinus for gender determination using a thin slice multidetector computed tomography assisted morphometric study they observed that the values of male sinuses were significantly higher than female values (P <0.001).[20] In the present study of maxillary sinuses only the left volume of maxillary sinuses showed significant results whereas the right side volume showed insignificant results. The present study therefore validated the left volume parameter to be considered as appropriate measure to gender of an individual.

CONCLUSION

The findings of the present study suggests that the volume of the left maxillary sinuses can help to determine gender. According to the present study, length, width, and height of the maxillary sinus were used for gender determination on both sides, they proved statistically insignificant results, whereas when left maxillary sinus volume was considered,

the p-value was significant at 95% of confidence levels Hence, this study concludes that left maxillary sinus volume and left anterior posterior height revealed statistically significant results which can be considered when determining the gender of corpses using maxillary sinus computed tomography records. It also supports the use of computed tomography as a reliable method for assessing different dimensions of the maxillary sinuses.

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REFERENCES

1. ***Sidhu, R., Chandra, S., Devi, P., Taneja, N., Sah, K., & Kaur, N.*** *Forensic importance of maxillary sinus in gender determination: A morphometric analysis from Western Uttar Pradesh, India. European Journal of General Dentistry.2014: 3(01), 53-56.*
2. ***Fernandes, C. L.*** *Forensic ethnic identification of crania: the role of the maxillary sinus—a new approach. The American journal of forensic medicine and pathology. 2014: 25(4), 302-313.*
3. ***Sahlstrand-Johnson, P., Jannert, M., Strömbeck, A., & Abul-Kasim, K.*** *Computed tomography measurements of different dimensions of maxillary and frontal sinuses. BMC medical imaging. 1992; 11(1), 1-7.*
4. ***Reichs, K. J.*** *Quantified comparison of frontal sinus patterns by means of computed tomography. Forensic science international. 1993: 61(2-3), 141-168.*
5. ***Zhen, S., Ma, X., Lu, B., Ming, S., Lin, K., Zhao, L., Zhou, W.*** *Supercapacitor electrodes based on furan-EDOT copolymers via electropolymerization. International Journal of Electrochemical Science. 9(12), 2014: 7518-7527.*
6. ***Teke, H. Y., Duran, S., Canturk, N., & Canturk, G.*** *Determination of gender by measuring the size of the maxillary sinuses in computerized tomography scans. Surgical and radiologic anatomy. 2007: 29(1), 9-13.*
7. ***Wind, J., & Zonneveld, F. W.*** *Computed Tomography of an AustrMopithecus Skull (Mrs Pies): A New Technique. 1989:7518-7527.*
8. ***Uthman, A. T., Al-Rawi, N. H., & Al-Timimi, J. F.*** *Evaluation of foramen magnum in gender determination using helical CT scanning. Dentomaxillofacial Radiology. 2012: 41(3), 197-202.*
9. ***Ariji, Y., Ariji, E., Yoshiura, K., & Kanda, S.*** *Computed tomographic indices for maxillary sinus size in comparison with the sinus volume. Dentomaxillofacial Radiology. 25(1), 19-24.*
10. ***Sidhu, R., Chandra, S., Devi, P., Taneja, N., Sah, K., & Kaur, N.*** *Forensic importance of maxillary sinus in gender determination: A morphometric analysis from Western Uttar Pradesh, India. European Journal of General Dentistry. 2014: 3(01), 53-56.*
11. ***Teke, H. Y., Duran, S., Canturk, N., & Canturk, G.*** *Determination of gender by measuring the size of the maxillary sinuses in computerized tomography scans. Surgical and radiologic anatomy. 2007:29(1), 9-13.*
12. ***Kanchan, T., & Rastogi, P.*** *Sex determination from hand dimensions of North and South Indians. Journal of forensic sciences. 2009: 54(3), 546-550.*
13. ***Uthman, A. T., Al-Rawi, N. H., Al-Naaimi, A. S., & Al-Timimi, J. F.*** *Evaluation of maxillary sinus dimensions in gender determination using helical CT scanning. Journal of forensic sciences. 2011: 56(2), 403-408.*
14. ***Eshak, G. A., Ahmed, H. M., & Gawad, E. A. A.*** *Gender determination from hand bones length and volume using multidetector computed tomography: a study in Egyptian people. Journal of forensic and legal medicine. 2011: 18(6), 246-252.*
15. ***Amin, M. F., & Hassan, E. I.*** *Sex identification in Egyptian population using Multidetector Computed Tomography of the maxillary sinus. Journal of forensic and legal medicine. 2012: 19(2), 65-69.*
16. ***Giacomini, G., Pavan, A. L. M., Altemani, J. M. C., Duarte, S. B., Fortaleza, C. M. C. B., Miranda, J. R. D. A., & De Pina, D. R.*** *Computed tomography-based volumetric tool for standardized measurement of the maxillary sinus. PloS one. 2018: 13(1), e0190770.*
17. ***Riepert, T., Ulmcke, D., Schweden, F., & Nafe,*** *B. Identification of unknown dead bodies by X-ray image comparison of the skull using the X-ray simulation program Foxsis. Forensic science international. 2001: 117(1-2), 89-98.*
18. ***Quatrehomme, G., Fronty, P., Sapanet, M., Grévin, G., Bailet, P., & Ollier,*** *A. Identification by frontal sinus pattern in forensic anthropology. Forensic science international. 1996: 83(2), 147-153.*
19. ***Pirner, S., Tingelhoff, K., Wagner, I., Westphal, R., Rilk, M., Wahl, F. M., Eichhorn, K. W. (2009).*** *CT-based manual segmentation and evaluation of paranasal sinuses. European archives of oto-rhino-laryngology. 2009: 266(4), 507-518.*
20. ***Ekizoglu, O., Inci, E., Hocaoglu, E., Sayin, I., Kayhan, F. T., & Can, I. O. (2014).*** *The use of maxillary sinus dimensions in gender determination: a thin-slice multidetector computed tomography assisted morphometric study. Journal of Craniofacial Surgery. 2014: 25(3), 957-960.*

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REVIEW ARTICLE

A Rare Case of Traumatic Neuroma of the Median Nerve

Libni D Angel[1], J. Thanka[2]

ABSTRACT

Introduction

Traumatic neuromas are considered as pseudotumors caused due to reactive proliferation of the neural tissue. Due to trauma of the nerve, a process of degeneration at the distal end and regeneration at the proximal endoccurs. Histopathological examination is essential for making a diagnosis of traumatic neuroma along with clinical and radiological correlation.

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KEYWORDS | Neuroma; Pseudotumor; Trauma.

INTRODUCTION

Traumatic neuromas are Pseudotumors also known as amputating neuromas.[1] It can occur in any part of the body.[2] The main symptom of a traumatic neuroma is pain, especially severe neuralgia. It usually presents as a firm, round, slow growing, palpable and painful nodule. After digital amputation, 6% of people will develop a neuroma. Clinically it can mimic soft tissue tumors and diagnosis depends upon histopathological examinations that show a haphazard arrangement of nerve bundles. The present case report, is about a rare manifestation in a 26-year-old male with swelling and pain in the right index finger.

Clinical presentation clinical history and findings

A 26 year old male came to our hospital with complaints of swelling and pain in the right index finger for 2 months. The swelling was initially small in size and gradually increased associated with pain. On external examination, a swelling measuring 2x1 cm which is firm in consistency and tender on palpation. The patient had a prior right wrist injury from an accident that occurred six months back.

Investigation

MRI was done for the patient which showed a focal fusiform swelling measuring 27x9 mm of the median nerve with disorganized fascicles noted at the level of the distal radius. The swelling is proximal to the carpal tunnel and seen continuous with proximal and distal aspects of the median nerve.

Histopathological Findings

Excision of soft tissue with neurorrhaphy and tendon repair was done and sent for histopathological examination. Grossly received three grey black soft tissue bits largest measuring 1.5x1x0.5cm and the smallest measuring 1x0.7 cm. Microscopically, haphazard proliferation of the nerve fascicles enveloped in collagen was noted with areas of fibrosis, hemorrhage, and congested blood vessels.

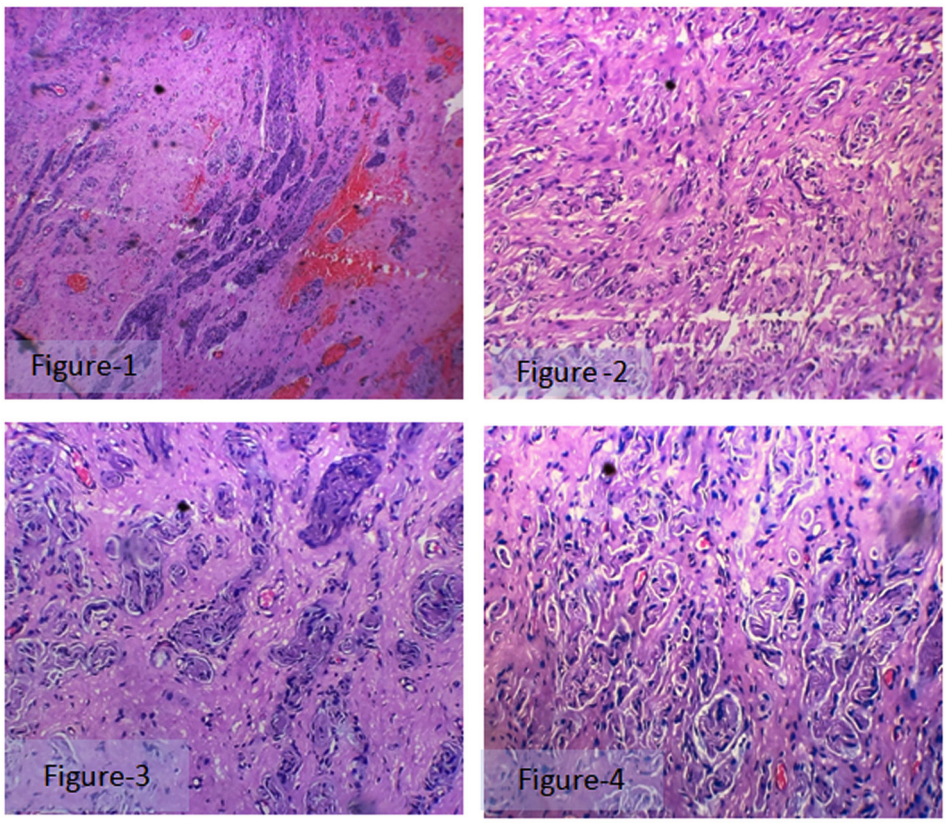

Fig. 1: Microscopic features from soft tissue biopsy shows haphazard proliferation of nerve fascicles enveloped in collagen, H&E magnification 4x, **Fig. 2:** H & E magnification 10x, **Fig. : 3 & 4** H&E magnification 40x.

DISCUSSION

Traumatic neuromas are considered as pseudotumors caused due to reactive proliferation of the neural tissue. The history of trauma is needed for the diagnosis of traumatic neuroma. The pathology is due to damage of the axons leading to primary cause for the development of traumatic neuroma. The pattern of injury described as Wallerian degeneration.[3] Within a day of injury, fragmentation of the distal axons occurs along with separation of the myelin sheaths and breakdown into spherical structures. The Macrophages get activated and participate in the removal of axonal and myelin debris. At the site of transection, the process of regeneration starts with the formation of a growth cone and new branches from the stump of the proximal axon. Following this process, the

Schwann cells control the sprouting axons. Continuous shearing of these sprouting axons removes the misguided branches. Around the regenerating axons, the Schwann cells form new myelin sheaths. A successful repair process is only when the transected ends are closely approximated. A failure of the outgrowing axons to find their distal target can produce a "pseudotumor" termed traumatic neuroma. With progression, the damage tends to out do the repair mechanism, resulting in progressive loss of axons.

For traumatic neuromas, the histopathological differential diagnosis comprises of Neurofibromas, mucosal neuromas, palisading neuromas, and neurovascular Hamartomas. The Neurofibromas can have fibrous connective tissue and non-capsulated lesion similar to that of the traumatic neuroma, the differentiating feature is abundant, and the haphazard arrangement of axons seen in traumatic neuroma but not in neurofibroma which has mast cells and nuclei with wavy in nature.[4] The mucosal neuromas have a very similar appearance to the increased nerve bundles. But there will be no inflammatory cells in a fibrous connective tissue background as that of traumatic neuroma.[5] The palisading neuroma forms nerve bundles with spindle cells showing a palisading arrangement in a circumscribed margin, but there is an absence of fibrous connective tissue and inflammatory cells compared to traumatic neuroma.[6] Neurovascular hamartomas show poorly circumscribed masses that are tightly packed in a loose matrix and are free of inflammation.[7]

CONCLUSION

The diagnosis of Traumatic Neuroma is important for patient management. Proper history, clinical examination and finally histopathology is important to distinguish it from other soft tissue painful tumors.

Traumatic neuromas are rare. In this article, we highlight histopathology and differential diagnosis which is very important and useful for the proper treatment of the patient.

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REFERENCES

1. ***Eguchi T, Ishida R, Ara H, Hamada Y, Kanai I.***
A diffuse traumatic neuroma in the palate: a case report. Journal of medical case reports. 2016 Dec;10(1):1-5.
2. ***Yang JR, Wang CJ, Kao WB, Wang YL.***
Traumatic neuroma of bilateral mental nerve: a case report with literature review.2010 Sep 1;21(3):252-260.
3. ***Foltán R, Klíma K, Špačková J, Šedý J.***
Mechanism of traumatic neuroma development. Medical hypotheses. 2008 Oct 1;71(4):572-576.
4. ***Chander V, Rao RS, Sekhar G, Raja A, Sridevi M.***
Recurrent diffuse neurofibroma of nose associated with neurofibromatosis Type 1: a rare case report with review of literature. Indian journal of dermatology. 2015 Nov;60(6):573.
5. ***Lee MJ, Chung KH, Park JS, Chung H, Jang HC, Kim JW.***
Multiple endocrine neoplasia type 2B: early diagnosis by multiple mucosal neuroma and its DNA analysis. Annals of dermatology. 2010 Nov;22(4):452.
6. ***Koutlas IG, Scheithauer BW.***
Palisaded encapsulated ('solitary circumscribed') neuroma of the oral cavity: A review of 55 cases. Head Neck Pathol. 2010;4:15–26.
7. ***Allon I, Allon DM, Hirshberg A, Shlomi B, Lifschitz-Mercer B, Kaplan I.***
Oral neurovascular hamartoma: a lesion searching for a name. J Oral Pathol Med. 2012;41:348–353.

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CASE REPORT

Homicidal Railway Accident: A Case Report

Siddhant Pankaj Murkey[1], Pankaj Nandkishore Murkey[2]

ABSTRACT

Introduction

Railway transportation has emerged as the major mode with the ongoing modernization of vehicular mechanics. In India, the railway tracks run not only in the outskirts but also in between the suburbs in many places. And with the rising population of the country, most of the trains are over packed with the passengers travelling to their destination. The railway is still the most preferred mode of transportation as compared to flight and road in India. These factors play the role in increasing the chances of accidents in India. It is not quite unusual for us to hear about some sort of railway accident or derailment of a train on a normal day. On average there are 15 deaths every day due to railway accidents since India is the fourth largest country concerning railways transport system. With a huge proportion of the population living without the availability of basic needs of a home, as is commonly seen in form of shanties beside the railway track itself. The railway providing compensation in cases of accident related to it has become a source of easy money, luring many towards the fraudulent use of the rule. The same was seen in the below discussed case report.

KEYWORDS | Railway accident; homicidal death; hemorrhagic shock.

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INTRODUCTION

The most important known role of a forensic pathologist in any type of accident is not only restricted to performing the autopsy. The forensic pathologist's role starts with identifying the individual and ascertaining the cause and pattern of visible injuries. This pattern can help establish the most appropriate reason for the injury and help find the cause of death. Which ultimately helps the investigating authority to rule out the dilemma between the accidental and homicidal theory behind the death.

Deaths in cases of railway accidents occur while the person is either trying to cross the track or crossing the unmanned crossing. While most of the non-fatal injuries occur as a result when passengers of the train hang out of the doors and are hit by certain objects on the side of the track like poles or trees.[11] In cases where history is not clear, difficulty in distinguishing accident from suicide/homicide arises.[12]

Establishing the cause of the incident is the main crux in all types of accident cases under investigation. The information is not only relevant to the investigating authorities but also the others to prepare strategies for

its prevention. The person's relative position concerning the striking surface of the vehicle produces a different type of pattern of injuries.

With a limitation of systematic studies related to respective injury patterns, forensic pathologists are many times asked for the reconstruction of the event after the postmortem. Reconstruction of the event along with the injury pattern noted on the deceased led to an interesting change in the manner of death in this case. The same is the scenario in the case of a railway accident in India. Where the railway covers 6909 stations traversing 63273 km in length.[13]

CASE

The unidentified deceased was brought to the autopsy centre of MGIMS & KHS, Sevagram at around 07:30 PM by the Seloo Road railway police wrapped in cloth with dissected two parts. The body was kept in cold storage. The next morning the body was identified by his clothing and old scar mark over the right side forearm.

As per the history provided by the relatives they were unaware of his whereabouts since 1 day before the discovery of the body. He was last seen by his wife, while he was leaving for lunch with his friends. A complaint was lodged with the nearest police station at night when he didn't return home.

The post-mortem examination was performed after receiving the requisite documents. The findings are as follows:

Crush injury with two dissected halves at the level of the iliac crest, separating the trunk and the lower half of the body with evisceration and exposed bony structures, margins of the wound irregular with deposits of blackish coloured grease, dirt and stone particles was noted. Suggestive of railway track injury.

Split lacerations of varying sizes from 2cmx1cm to 6cmx2cm going deep to the bone were seen over the left side frontal region, left parietal, and left the temporal region with everted irregular margins and no grease or dirt materials. The presence of a punctured wound adjacent to the left tragus with 3 cm diameter, everted edges going deep to the muscles of the neck was noted. As depicted in Fig. 1.

Chop wound of size 11cmx4cm, directed obliquely downwards over the right side of the neck just below the ramus of mandible with head towards the lateral aspect and tail towards the midline, with clean cut margins, depicted in Fig. 2. Underneath muscles were hemorrhagic, with a clean cut margin of the incision of the carotid artery of size 0.5cmx0.2cm. Two clean cut incised wound of size 2cmx1cm was noted over the ala of the nose.

All the above mentioned injuries were ante-mortem in nature. Internal organs were found to be pale. No positive finding indicating the natural cause of death was noted. No noxious smell was perceived on opening the stomach, or intestine. However, viscera were sent for toxicological examination and turned out to be negative for any type of toxin/intoxicant.

DISCUSSION

Railway transportation has emerged as the major mode with the ongoing modernization of vehicular mechanics. With this, there has been an increase in many folds of accidents associated with the railway. India is a developing country railways system is the preferred economic mode for travelling. In the world, Indian railways are the largest network under single management.

In India, the railway tracks run not only in the outskirts but also in between the suburbs in many places. And with the rising population of the country, most of the trains are over packed with the passengers travelling to their destination. These factors play the role in increasing the chances of accidents in India. Thus, railway accidents have an important role in the medical and legal terms that are related to trauma and other related disorders/ disabilities arising from it.[1,2]

Moreover, railway tracks have become the most commonly used place for suicides, where access is easy and the outcome is achieved with less amount of effort, leading to self-destruction.[3]

According to the study conducted by Valsalva et al. victims of the railway, and track accidents

were trespassers in the majority amounting to 83.7%, 7.6% were passengers of the train, and 3.8% were pedestrians and 1.9% were staff of railways. They also found that majority of the cases of railway track accidents were accidental, followed by suicidal ones and were following the study conducted by Mohanty et al.[4]

As per the National Crime Records Bureau (NCRB) of India 27,643 cases were reported of railway accidents. There was a rise seen in the data in 2017 by 1.6%. The deaths reported were 24,545 in 2018 and 3431 were the injury burden from railway accidents.[5] On average there are 15 deaths every day due to railway accidents since India is the fourth largest country concerning railways transport system. The scenario in developed countries is different, due to better infrastructure and law enforcement.[6,7] Mortality and morbidity in such countries due to railway accident is far higher compared to developing countries. In the USA, this causes a burden of around US$ 300 million annually to the government.[8]

According to Section 124-A of the Railways Act, 1989, the railways are not liable to pay any compensation for death or injury to a person in case of suicide/attempted suicide/self-inflicted injury/his criminal act/ act committed under intoxication or insanity. However, apart from the above mentioned acts amount of compensation payable is Rs. 4 Lakhs in case of death and from Rs. 32000 to 4 lakhs depending on the nature of the injury.[9] In 2016 Ministry of railways amended the rules for compensation, where the amount was doubled in case of death i.e. Rs.8 Lakhs. This came into force on 1st January 2017.[10]

These amounts of compensation have lured many towards the fraudulent use of the rule. In the above discussed case, the injuries over the face region were consistent with that of an assault by a hard and heavy object. The injury over the right side of the neck was consistent to have sustained from a blow by a certain sharp and heavy object. All the injuries apart from the transection were non-consistent with the railway accident. The cause of death in this was thus given as Hemorrhagic shock due to the incised carotid artery with multiple injuries over the body as a result of an assault.

After further investigation by the police, the fact came to light. The victim was first assaulted by a wooden stick by his friends on a certain petty matter, He then fell unconscious, and his friends later decide to kill him and throw him on the railway track, so that the death appeared to have occurred from the accident on the track. They also decided to extract the compensation money from his wife, by making her believe about the loan he has taken from them.

CONCLUSION

Claiming compensation in cases of railway track accidents has become a common practice in India. Autopsy thus needs to be meticulous for refuting or accepting such claims. This increases the responsibility of the doctor performing the post-mortem. Hence, one should be vigilant and remain unbiased by the

Fig. 1: Lacerations over Face.

Fig. 2: Chop wound over the right neck.

history provided till the same is proven by the observation.

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REFERENCES

1. ***Rao.M.A,***
Indian Railways. India the land and the people, National Book Trust India.
2. ***Sheikh MI, Shah JV, Patel R.***
Study of death due to Railway accident. J Ind Acad For Med. 2008; 30(3):122-127.
3. ***Park K.***
Park's Text Book of Preventive and Social Medicine, M/s. Banarsidas Bhanot Publishers 1167, Prem Nagar, Jabalpur. 15th Edition. 2011:299.
4. ***Knight B.***
HWO COX Medical Jurisprudence and toxicology, 5 th edition 1987 Revised and rewritten by Prof. Bernard Knight page no. The Lawbook Co(P)Ltd. Sardar Patel Marg, Allahabad. 309-311.

(5) Mohanty MK, Panigrahi MK, Mohanty S, Patnaik KK.
Death due to traumatic railway injury. Med Sci Law. 2007;47:156-160.

6. *National Crime Records Bureau, Ministry of Home Affairs, Government of India (2019). Accidental Deaths and Suicides in India 2018.*
7. ***Evans AW (2003)***
Accidental fatalities in transport. J R Stat Soc Ser A 166(2):253–260.
8. ***Miller TR, Douglass JB, Pindus NM (1994)***
Railroad injury: causes, costs, and comparisons with other transport modes. J Safety Res 25(4):183–195.
9. ***Goldberg BA, Mootha RK, Lindsey RW (1998)***
Train accidents involving pedestrians, motor vehicles, and motorcycles. Am J Orthop 27(4):315–320.
10. *Ministry of Railways of India, The railways' accident and untoward incident (Compensation) Rules, 1990.*
11. ***Apurba Nandy (2010).***
Principles of forensic medicine including toxicology (3rdedn) New Central Book agency, Howrah: 473-474.
12. ***Lerer L.B & matzopolulos R.G (1997)***
fatal railway injuries in cape town south Africa AM.J Forensic Medicine & Pathology 19, 144-147.
13. *Press Information Bureau Government of India Ministry of Railways, 27th Dec 2016.*

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- Twetman S, Axelsson S, Dahlgren H, Holm AK, Källestål C, Lagerlöf F, et al. Caries-preventive effect of fluoride toothpaste: A systematic review. Acta Odontol Scand 2003; 61: 347-55.

Article in supplement or special issue

- Fleischer W, Reimer K. Povidone iodine antisepsis. State of the art. Dermatology 1997; 195 Suppl 2: 3-9.

Corporate (collective) author

- American Academy of Periodontology. Sonic and ultrasonic scalers in periodontics. J Periodontol 2000; 71: 1792-801.

Unpublished article

- Garoushi S, Lassila LV, Tezvergil A, Vallittu PK. Static and fatigue compression test for particulate filler composite resin with fiber-reinforced composite substructure. Dent Mater 2006.

Personal author(s)

- Hosmer D, Lemeshow S. Applied logistic regression, 2nd edn. New York: Wiley-Interscience; 2000.

Chapter in book

- Nauntofte B, Tenovuo J, Lagerlöf F. Secretion and composition of saliva. In: Fejerskov O,

No author Listed

- World Health Organization. Oral health surveys - basic methods, 4th edn. Geneva: World Health Organization; 1997.

Reference from electronic media

- National Statistics Online—Trends in suicide by method in England and Wales, 1979-2001. www.statistics.gov.uk/downloads/theme_health/HSQ20.pdf (accessed Jan 24, 2005): 7-18. Only verified references against the original documents should be cited. Authors are responsible for the accuracy and completeness of their references and for correct text citation. The number of reference should be kept limited to 20 in case of major communications and 10 for short communications.
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