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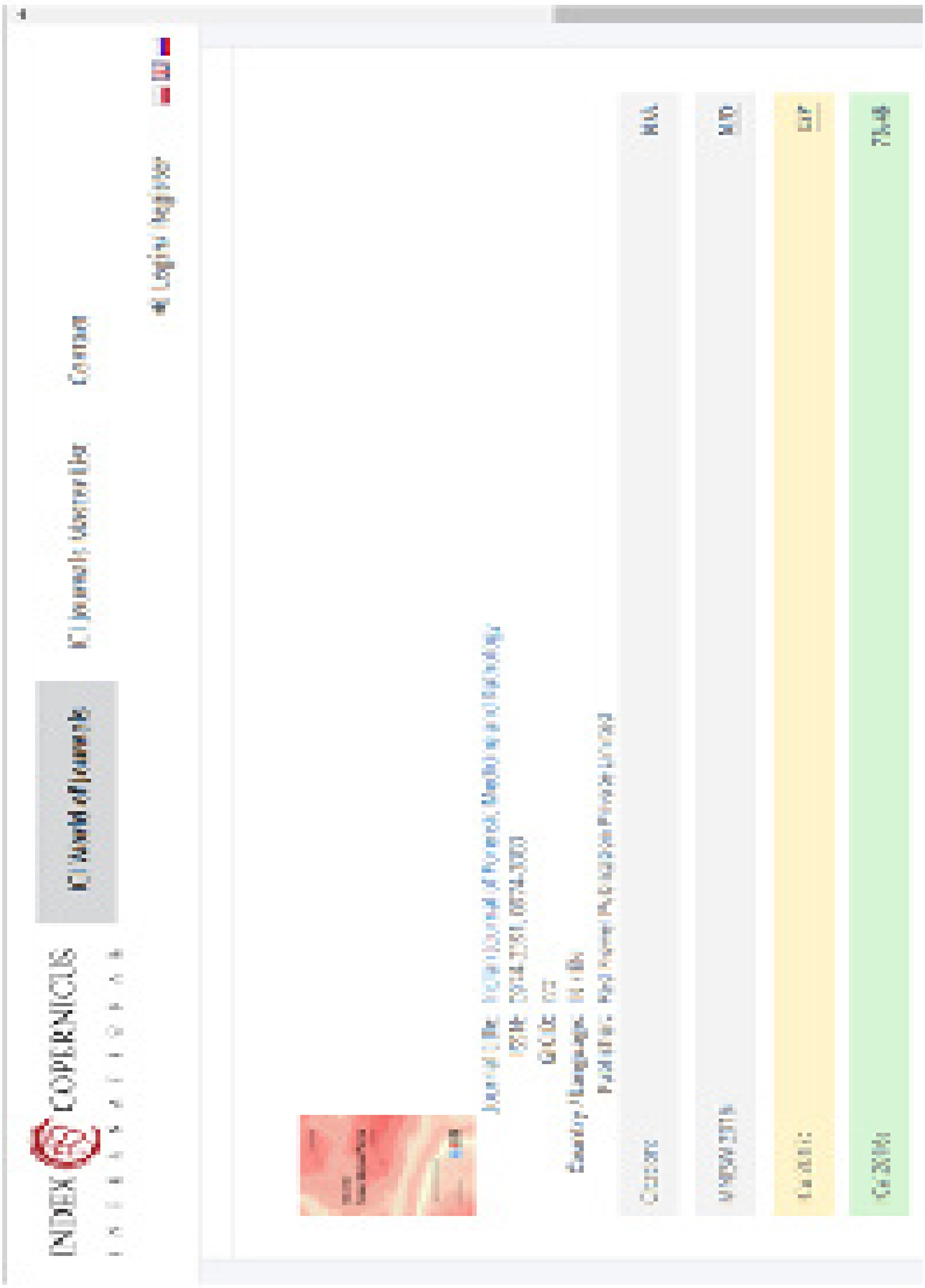
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Original Article

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Occupational Health Hazards of Workers on Construction Sites

Ajay Patil[1], Chandrakant M. Kokatanur[2]

Abstract

Introduction: Occupational health hazards faced by this large and growing number of people depend on the region and its economic standing. *Aim:* To study occupational health status of workers, causes and patterns of occupational injuries. *Materials and methods:* It is a cross-sectional study in total of 100 workers who were examined at different construction sites and hazards were noted. *Results:* It is being observed that most of the construction workers belong to the age group of 20-30 yrs. Male gender dominates construction workers. Distribution of the workers in different categories observed in this study was bricklayers 40% plumber 20%, painters 20%, stone cutters 6%, cleaners 6%, carpenters 4%, heavy machine operator 2%, truck driver 2%. The total injuries abrasions (56) contributed more. Site of injuries is categorized as upper extremities in 41 workers, lower 19 cases. Most of the injuries are afflicted in the evening hours followed by morning and afternoon. Accidents and the injuries occurred predominantly in the overtime'. Use of PPE was only in 4 cases and other 49 cases observed never used the PPE. 9 workers could get an immediate medical attention where 44 others could get first aid. 11 workers lost their daily wages and 42 others escaped from the loss of salary. The loss of daily wages ranged from 1 day to 5 days and the average of it being of daily wage loss per person. *Conclusions:* There is need that the employers address all the potential risk factors at the workplace and educate employees on safe work practices and risk awareness.

Keywords: Occupational Health Hazards; Personal Protective Equipment; Occupational Injuries.

Introduction

The history of civilization shows that men like lived in caves. As civilization developed men discovered 3 basic material wood/ mud & stones to construct the hut and building, wood is good hut has a fear of fire, mud is cheap but is likely to washed away by rain, stone because of its durability is still popularly used, during all types of construction. the users of stone & marble have increase at a rapid rate during the last few years due to various construction plans undertaken by state central government [1]. Occupational health hazards refer to the vulnerable risks to health and safety for those who work outside the home. According to World Health Organization (WHO), around 70 percent of adult men and 60 percent of adult women throughout the world, an estimated additional 40 million adults enter the global workforce each year [2,3]. The specific occupational health hazards faced by this large and growing number of people depend on the region and its economic standing. However, the following are some of the most common occupational health hazards faced by workers worldwide. The occupational health hazards internationally are mostly structural failures and mechanical or electrical accidents. It includes structures vulnerable to adverse weather conditions, moving and/or unprotected parts of machines, or equipment failure. These occupational health hazards exist fairly equally in developed. World Health Organization defined "Occupational health deals with all aspects of health and safety in the workplace and has a strong focus on primary prevention of hazards." Health is basically defined as a state of physical, mental and social well-being and not merely the absence of disease. Occupational health is a multidisciplinary field of healthcare concerned with enabling an individual to undertake

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their occupation, in the many way that causes least harm to their health. Hence our aim is to study occupational health status and patterns of workers, causes of occupational injuries.

Materials and Methods

It is a cross-sectional study done in department of forensic medicine in total of 100 workers who were examined at different construction sites and various hazards were noted like injuries, skin dermatosis, COPD, multiple joint pains, conjunctivitis, URTI, UTI, malnutrition etc. At its 214th session, the governing body of the ILO decided that one of the two technical questions to be included in the agenda of the tenth session of building, civil engineering and public works committee would be the improvement of working conditions and of the working environment in the construction industry".

In the building sector, as in any other activity, occupational safety and health and general working conditions form an aggregate of interdependent and interacting component part, excessive working hours or the accident, premature ageing or proneness to disease, while housing conditions, food, the existence or absence of medical services and other factors such as remuneration, the pace of work, the nature of the employment contract and fear unemployment also exert their effects. These interactions are reinforced by the features characteristic of the construction industries, including- to mention only two-uncertain weather conditions and the large proportion of migrant, temporarily, young and in some countries, women workers, whose situation makes them both of dangerous work or excessive working hours.

Results

Table 1: Workers in different age and genders groups.

Age-Group	Number of workers	Percentage
0-10	0	0
10-20	30	30
20-30	40	40
30-40	20	20
40-50	10	10
Total	100	100
Sex		
Male	89	89
Female	11	11
Total	100	100

It is been observed that most of the construction workers belong to the age group of 20-30 yrs., followed by 10-20 yrs. Least number of workers are observed in age group of 40-50 yrs. Male gender dominates construction workers, in the study 89% cases were males as compared to the 11% of females (Table 1).

Table 2: Distribution of workers according to the type of work

Trade Occupation	Number Of Workers	Percentage
Plumber	20	(20%)
Painter	20	(20%)
Cleaner	6	(6%)
Bricklayer	40	(40%)
stone cutter	6	(6%)
Carpenter	4	(4%)
heavy machine operator	2	(2%)
truck driver	2	(2%)
	100	(100%)

Distribution of the workers in different categories observed more common in this study was bricklayers 40%, plumber 20%, painters 20 (Table 2).

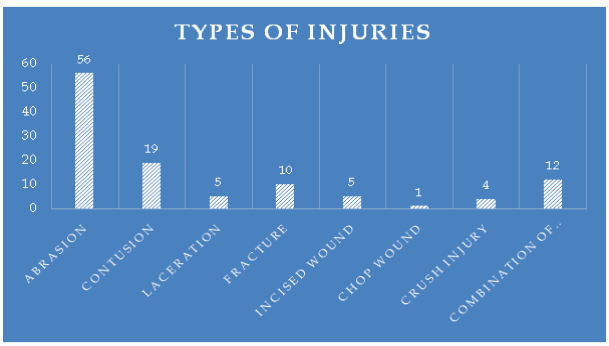

Fig. 1: Distribution of the cases according to the type of injuries

Total injuries contributed to the study were classified as abrasions (56), contusions (19), lacerations (5), fractures (10), incised wounds (5), crush injuries (4) combination of injuries in (12) (Figure 1).

Table 3: Site of injuries distribution.

Siteof injuries	Number of cases	Percentage
Upper extremities	41	41
Lower extremities	19	19
Trunk	1	1
Head, face, neck	4	4
Genitals	0	0

Site of injuries is categorized as upper extremities in 41 workers, lower extremities 19 cases, head, neck, face 4 cases, on trunk and in no case injury was on genitals (Table 3).

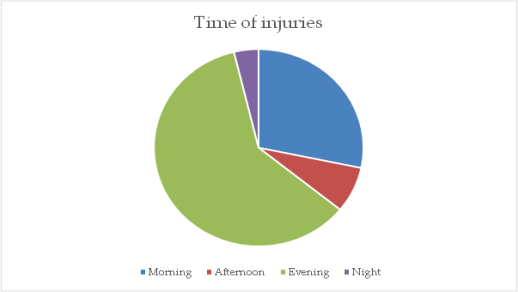

Fig. 2: Time of injuries

Many accidents and the injuries occurred predominantly in the overtime. Use of PPE. was only in 4 cases and other 49 cases observed never used the PPE **(Figure 2).**

Table 4: Availing treatment and loss of wages after the injury

Was treatment after the injury	Number of cases	Percentage
Yes	9	9
No	44	44
Loss of wages		
Yes	11	11
No	42	42

9 workers could get an immediate medical attention whereas 44 others couldn't get the first aid. 11 workers lost their daily wages and 42 others escaped from the loss of salary. The loss of daily wages ranged from 1 day to 5 days and the average of it being 2.27 days of daily wage loss per person (Table 4).

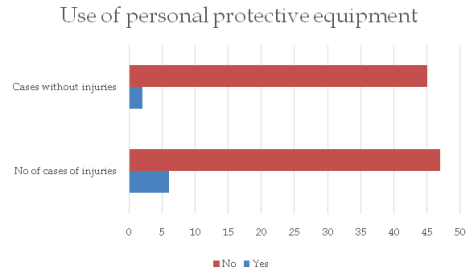

Fig. 3: Use of personal protective equipment

Most of the hazards are with not using protective equipment (Figure 3).

Table 5: Health problems associated in workers

Health problems noted	10-20 yrs	20-30 yrs	30-40 yrs	40-50 yrs	Total number of cases
Skin dermatosis	10	15	15	10	50
Joint pains and body ache	8	15	8	5	36
Hearing impairment	0	1	1	1	3
COPD	0	1	2	3	6
UTI	1	3	5	10	19
Conjunctivits	0	1	1	3	5
URTi	2	3	5	5	15

In the other hazards observed skin dermatitis was the most common in age group 20-40: joint pains in age group 20-30: hearing impairment in late ages: COPD in late ages; UTI in age group of 40-50; conjunction in age group of 40-50; URTI (upper respiratory tract infection) in all age groups and it was minimal in young age group and maximum in elderly (Table 5)..

Study was done in total 100 workers and results as follows

Discussions

The study was done on 100 workers. The construction sites were sampled to represent all registered construction sites in Mumbai. Each member or case in the sample is referred to as subject, respondent or interviewers according to Ogula [4]. In research, sample size is normally directly proportional to the population of interest. The different sample from different construction sites in this study was a representative of the population of workers in each particular construction site. Babbie suggests that in research a response rate of at least 50% is considered adequate for analysis and reporting; a response of 60% is good; a response of 70% is very good; a response of 80% and above is excellent". Mugenda and Mugenda found a response rate of 50% is adequate for analysis and reporting while 100% response rate is excellent [5].

It is been observed that most of the construction workers belong to the age group of 20-30 yrs., followed by 10-20 yrs. Least number of workers are observed in age group of 40-50 yrs. The results on age of participants concurs with a similar study by Khairuzzaman et al.,found workers age ranging being between 25 and 60 years with a majority being in the age group of 30–40 years [6]. A similar study by Guidotti, young workers tend to feel immune to hazards and do not take PPE usage seriously while older workers feel that they are used to certain types of equipments and that they have experience to work safely despite the hazards involved [7]. Acharya done similar study in Nepal also found that majority of the construction workers were in age group 30-40 years and were more likely to use PPE compared to others [8].

Male gender dominates construction workers, in the study 89% cases were males as compared to the 11% of females. Hard work with high occupational risk is always done by men according to ILO[9] and WHO [4]. The results on gender concur with a similar study by Acharya (2014) on Utilization Pattern of Personal Protective Equipment among Industrial Workers of Nepal, majority of the respondents were male (68.4%) [8]. Kimeto in his study on safety provision among tea factory workers reported that male workers in the factories were high (75.0%) compared to their female counterparts (25.0%) [10].

Anatomical distribution of the injuries is categorized as upper extremities in 41 workers, lower extremities 19 cases, head, neck, face 4 cases, on trunk and in no case injury was on genitals. Acharya [8] in a similar study reported almost similar results regarding the prevalence of injuries/ailments among construction site workers. In his study, out of 187 respondents, 60 (32.1%) workers had faced health problems or hazards while working in the industry. Most of the workers suffered from accidents/injuries followed by muscolo-skeletal problems. Studies of Aguwa [11] on workplace personal protective equipments also reported similar results on the type of injuries/ ailments experienced by industrial workers. A similar study in a developing country (Nepal) showed that there were high industrial hazards due to low use of PPE. Improper utilization of PPE in the workplace has lead to various health hazards according to studies of Acharya.

Site of inury distribution at different times of the day in my study shows the pattern as most of the of the injuries are afflicted in the evening hours followed by morning and afternoon and the least cases in the night as the sited where the data was collected were not functioning during those hours. it was also observed that the accidents and the injuries occurred predominantly in the overtime.

Use of PPE was only in 4 cases and other 49 cases observed never used the PPE. Muchemedzi and Charamba [12] noted in his study that accidents result from unsafe conditions, equipment or materials in the work environment. A similar study conducted among cement workers in United Arab Emirates by Ahmed and Smith [13], showed that only 52.9% of the workers knew the hazards other than the dust that were associated with their work. Accidents are caused by unsafe acts or practices (the human element that results from poor attitudes, physical conditions and lack of knowledge or skills to enable one to work safely) as explained by (Muchemedzi et al., [14] in a similar study. According to Frank bird accident ratio study in 1969, 88% of accidents are caused by unsafe acts of persons, 10% are caused by unsafe mechanical or physical conditions and the remaining 2% are unpreventable. Muchemedzi and Charamba [12] established that the majority of accidents (98%) do not just happen, instead; people who perform unsafe acts and create unsafe conditions cause them and therefore accidents are preventable. When accidents are prevented injuries/illness are also gotten ride off. Use of PPE can protect a worker from potential injuries/illness as a result of accidents.

The loss of daily wages ranged from 1 day to 5 days and the average of it being 2.27 days of daily wage loss per person. In the other hazards observed, skin dermatitis was the most common in age group 20-40: joint pains in age group 20-30: hearing impairment in late ages: COPD in late ages; UTI in age group of 40-50; conjunction in age group of 40-50; URTI (upper respiratory tract infection) in all age groups and it was minimal in young age group and maximum in elderly.

Constant awareness of all hazards, injuries and illness associated with constructions should be maintained. All sorts of injuries to workers should as much as possible should be minimized while on duties. Strictly Safety rules to be followed by taking help of personal protective equipments. One should follow the standard permissible limits of working hours. Periodic rest in between the work schedules is needed Periodical medical examination to be conducted scrupulously. Awareness about the safety at work to be increased by interaction with workers, orientation lectures, various posters, slogans to be displayed. Quick attention and First aid boxes to be provided at the construction sites. Workers should be trained for giving first aid to others.

Conclusion

Occupational hazards are preventable so Prevention depends on the understanding that workers' safety is not only the responsibility of the workers, but is the primary responsibility of the employer. The employers needs training of their employees on the appropriate safety procedures and maintain safe working environment so that hazards are less likely to occur.

It is essential for workers to adhere to strict safety

protocol and attend routine safety seminars that stress the importance of following safety guidelines. Potentially hazardous machinery should be routinely inspected to ensure safety measures are in place and working properly. Tools should be properly chosen and suitably verified before use. Workplace should be brightly lit and extreme temperatures avoided, as well as suitable clothing for assignment tasks provided.

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Original Article

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A Retrospective Study of Pattern of External Injuries in Road Traffic Accidents- at HAH Centenary Hospital New Delhi

Shahina[1], Amit Sharma[2]

Abstract

The study was conducted in HAH Centenary Hospital of Hamdard Institute of Medical Science & Research New Delhi, India. It is retrospective study so the cases entered in Medico legal case register during the period January 1st 2014 to 31st December 2014 were considered. Patients with alleged history of road traffic accidents were included in the study. Road Traffic Accidents (RTA) are in increasing trend now a day's throughout the world causing great burden of morbidity and mortality among people. The present study is conducted to know the pattern of injuries, age, sex and time of incidence in patients of RTAs.

Keywords: RTA; Injuries; Vehicle.

Introduction

An accident has been defined as "an unexpected, unplanned occurrence which may involve injury". Motor vehicle accidents rank first in many countries, among all fatal accidents. During 2002 there were almost 1.19 million deaths from road accidents in world. In addition to this there are as many as 50-100 minor injuries and 10 – 20 serious injuries, which require long period of expensive care and treatment [1]. In today's busy life the use of automobiles is increasing day by day, along with this ignoring the traffic rules and poor road condition leads to increased rate of accidents. By the year 2020 the road traffic accidents are expected to take third rank of disease burden [2]. In world Indian ranks as one of the highest rates of traffic accidents, with increase in both casualties as well as death rates due to traffic accidents in the country. 80,000 get killed and 340000 get injured every year due to traffic accidents in India. In India there occurs an accident in every 1 mint and in every 8 mints there is a death caused by road traffic accidents [3].

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Methodology

The study material for this project was taken from the medicolegal register of HAH Centenary Hospital of Hamdard Institute of Medical Science & Research New Delhi, of year 2014. The details of RTA cases were taken from 1st January 2014 to 31st December 2014. The details like age, sex, residence, type and site of injury and time of incidence were taken down. The total 251 cases were studied.

For the purpose of this study, the nature of injuries was taken into consideration, bases on radiological examination and external examination which was required for diagnosis. The injuries over head covers the injuries present over face, scalp and neck. Injuries of upper limb indicates injury present over arm, forearm, hand and shoulder. For lower limb includes injuries over hip joint and foot, Thoraco-abdomen includes injuries over front chest, and abdomen and injuries over spine includes injury over entire back from neck to sacrum.

Observation and Results

A total of 251 road traffic accidents were studied. Different parameter were considered, age, sex, time of incidence and region of the body involving injury.

Table 1: Depicts the sex wise distribution of cases.

	Number of cases	percentage
Male	184	73.3%
Female	67	26.7%
Total	251	100%

Based on the above table 1 the males are more prone for accidents comprising 184 (73.3%) cases out of 251 cases and females comprises 67 cases (26.7%)

Table 2: Depicts the age wise distribution of cases.

Age range in years	Number of cases	percentage
1-10 years	30	11.9
11- 20 years	57	22.7
21-30 years	91	36.2
31-40 years	28	11.1
41-50 years	19	7.6
51-60 years	9	3.6
61-70 years	17	6.8

The most vulnerable group is 21-30 years followed by 11-20 years (Table 2).

Table 3: Depicts the distribution of cases based on time of incidence.

Time of incidence	Number of cases	Percentage
7am-10am	82	32.7
11am-2pm	24	9.6
3pm-6pm	60	23.9
7pm-10pm	56	22.3
11pm- 2am	18	7.2
3am- 6am	11	4.4

The above tables 3 shows that highest no. of accidents occurs between 7am to 10 am followed by 3pm to 6pm.

Table 4: Depicts the distribution of injuries based on region involved

Region	Simple	Grievous
Head	63	84
Upper limbs	97	4
Lower limbs	114	3
Thoraco-abdominal	7	9
spine	3	0

The above table 4 explains that head is more prone for injuries followed by lower limb next comes the upper limb. Considering collectively extremities bear the major burden of injuries (Table 4).

Discussion

The increased rates of accidents coincide with the population explosion. The majority of cases are young people mostly in their reproductive and productive age groups leading to a great loss to the nation as well.

The present study showed the male predominance with 184 cases i.e. 73.3% as compared to 67 i.e. 26.7% female cases among 251 cases. The male to female ratio was 2.7:1. The studies conducted by Siddaraman et al. [4] and Dileep et al. [5] showed that there is male predominance. The reason behind this could be that males have outdoor work more than females so they are more prone to come in contact with traffic so more liable for accidents as well.

This study showed 36.2% of cases were in the age group of 21-30 years followed by 22.7% in the age group of 11-20 years followed by 11.9% cases in age group of 1-10 years. these results clearly indicates that the most ambulatory and most enthusiastic age group is more liable for injuries this age is more prone for rash driving least bothered about the traffic rule. Children are also showing a higher values of accidents which is because in metropolitan cities the traffic load is so high that even the small link roads have high traffic load. Present study and its results are in agreement with the study conducted by RV Kachre et al. [6].

The present study shows that the most number of cases occurred during 7am to 10am (82 cases: 32.7%) followed by 3pm to 6pm (60 cases, 23.9%) followed by 7pm – 10pm (59 cases; 22.3), which corresponds with the office hours, but the study conducted by Bairagi et al. [7] mentioned that majority of accidents (30.26%) occurred between 6 PM – 12 midnight.

This study showed head injuries constitutes 147 cases out of which 63 were simple injuries and 84 were grievous, followed by injuries over lower limbs constituting 117 cases then upper limbs forming 101 cases. The study conducted by siddaramma et al and study done by Bairagi et al.[7] showed that extremities are more prone for injuries which is accordance to our study also if we collective consider the lower and upper limbs.

Conclusion

Road traffic accidents are the major health problem all over the world. It not only leads to property loss but human loss as well, it is becoming

one of the major cases of death all over the world as well as with majority of people left handicapped. The major risk is to developing countries were the understanding of traffic rule is less along with the poor condition of roads to curb this problem there is need for strict enforcement of traffic rules, along with this there should be improvement in health care facilities to handed such conditions favorably.

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A study to Evaluate Knowledge of Handling Medico-Legal Cases among Interns in a Teaching Institution

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Abstract

Background: The rising trend of medico-legal cases reporting to our hospital emphasizes the need to have physicians who are trained in Forensic Medicine to equip them to deal with such situations. In an era of escalating crime, litigation and eroding doctor-patient relationship, ignorance of the law could lead to pitfalls in practice. Hence, the present study was conducted to evaluate the knowledge of our interns on handling routine medico-legal cases in the wards and Casualty. *Material and Methods:* A total of 109 interns posted in various departments of the institute during the period from May 2016 to April 2018 participated in this research. Data was collected in the form of a self-administered questionnaire comprising close-ended multiple choice questions related to the topic of the study. It was then analyzed using SPSS version 11 by descriptive analysis. *Results:* The majority of participants were able to identify a medico-legal case and classify an injury as simple or grievous. However, there was uncertainty regarding giving opinion in a case of drunkenness and custody of forensic samples in poisoning. *Conclusion:* Overall, interns had good knowledge of handling medico-legal cases. The knowledge gaps identified through this study on particular topics have to be revised at regular intervals during internship and residency.

Keywords: Medico-Legal; Forensic Medicine; Interns; Wards; Casualty.

Introduction

A physician has a dual responsibility, the first being a duty of care towards the patient and secondly, a duty to serve the interest of justice [1]. These two roles have to be efficiently combined for a satisfying outcome. In the present context, a doctor, whether in private or government service, not only has to manage sick patients but also face medico-legal challenges in routine practice. The subject of Forensic Medicine which is taught to undergraduate medical students in their second year is, perhaps, the only training they have on how to handle cases of a medico-legal nature. When young medical graduates go on to become interns and then doctors, they come across actual case scenarios and are at a loss as they would have forgotten what they learnt earlier. The rising crime rate and traffic congestion have led to an overall increase in the number of violent assault and vehicular accident cases reporting to the Casualty departments of hospitals in our state. Therefore, the need of the hour is to have forensically equipped doctors who are well-versed with the legal and ethical aspects of their practice [2]. They must be confident about medical examination and report writing, standard operating procedures to be followed and appearing as expert witnesses in courts of law.

The present study is an effort on our part to find out how much interns in our hospital know about handling regular medico-legal cases that they face during their clinical postings. It also provides a means to reflect upon our teaching methodology in order to devise a way of making the curriculum more practical and applicable to real life situations in the wards and Casualty. Further, we plan to take remedial measures in undergraduate and internship training if working knowledge is found to be inadequate.

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Material and Methods

The current research is a cross-sectional study which was conducted on medical interns with a total sample size of 109 (one hundred and nine) participants. All the interns who were posted in various departments of the institute during the period from May 2016 to April 2018 and were willing to participate were included in the study. Those who did not give written consent or failed to show up were excluded from the same. Data collection was done in the form of a structured self-administered questionnaire comprising 10 (ten) closed-ended multiple choice questions related to handling of medico-legal cases in the wards and Casualty. The nature and purpose of the study was explained to them and written consent of all respondents was documented. The questionnaire was validated, pre tested and modified accordingly.

The answer scripts were evaluated wherein each correct response was awarded one mark. There was no negative marking for wrong answers. The total marks secured were calculated out of ten and the percentages worked out for all the questionnaires retrieved. Knowledge was graded on the basis of scores obtained by individual participants as follows:-

GOOD – >70% i.e. total score more than 7 out of 10

FAIR – 50-70% i.e. total score 5 to 7 out of 10

POOR – <50% i.e. total score less than 5 out of 10

Data Analysis

The data collected was entered in SPSS 11:00 and subjected to descriptive analysis.

Ethical Considerations

Approval for the project was received from the Institutional Ethics Committee (IEC) on 21st April 2016.

Results

A total of 109 (one hundred and nine) questionnaires were retrieved from participants in the present study out of which 92.7% were complete in all respects and 7.3% were incomplete in that one or two questions had been left unanswered. The results are tabulated in Tables 1 and 2.

A majority of interns (98.2%) were able to correctly identify a medico-legal case out of the list provided to them while 89% knew that medical duties take precedence over legal obligations in any given situation. Most of the respondents (95.4%) were able to classify injuries medico-legally as simple or grievous. A good number (94.5%) of participants could give an appropriate opinion after being presented with a case scenario on the examination of a rape victim. On the other hand, 82.6% were sure about who should record the Dying Declaration in an ideal situation. Less than half (49.5%) of them knew the correct procedure in the event of death in medico-legal cases in the wards. A handful of interns (9.2%) were aware of what is to be done to the samples collected in Casualty in suspected poisoning. In the issue of consent in emergencies, 86.2% had a good idea of how to proceed in such circumstances. Few participants (34.9%) knew about the retention of medical records as per Directorate General of Health Services (DGHS) guidelines followed in all Central Government hospitals. As regards the

Table 1: Knowledge of handling medico-legal cases (n=109)

Sr.No.	Questions	No. of responses	Correct responses No (%)
1.	Identifying a medico-legal case	109	107 (98.2)
2.	Priority of medical duties over legal obligations	107	97 (89)
3.	Medico-legal classification of an injury as simple or grievous	109	104 (95.4)
4.	Opinion after examination of rape victim	108	103 (94.5)
5.	Recording a Dying Declaration	109	90 (82.6)
6.	Procedure in the event of death in a medico-legal case	107	54 (49.5)
7.	Procedure to be followed in poisoning cases	109	10 (9.2)
8.	Consent in emergencies	109	94 (86.2)
9.	Retention of medical records as per DGHS guidelines	104	38 (34.9)
10.	Examination and report on drunkenness	104	48 (44)

examination and report on drunkenness, only 44% could correctly state that the opinion in such cases is based on clinical examination findings and not on laboratory test results.

Grading of knowledge

It was observed that 65 (59.6%) interns had good knowledge, 40 (36.7%) had fair knowledge and 4 (3.7%) of them were found to have poor knowledge on handling medico legal cases (Figure 1).

Discussion

The internship period is crucial to acquire practical hands-on experience of what medical students have learnt during their five years of training. It marks an important transition from the status of a student to that of a qualified professional. Most of the concepts learnt are applied in actual case scenarios in the wards and Casualty. A good knowledge of how to handle medico-legal problems at this stage would thus enable a future doctor to face such situations confidently and without fear. Medical teachers have a vital role to play in transmitting this knowledge and helping students develop the right skills and attitudes to become good practitioners.

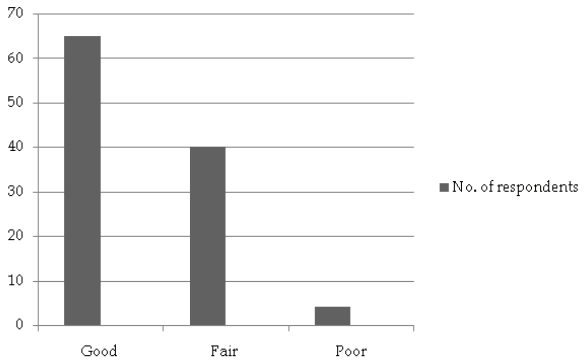

Fig. 1: Grading of knowledge among respondents

Table 2: Analysis of questions with <50% correct responses (n=109)

		Percentage of responses
Q 6. A 20 year old man sustained head injury in a road traffic accident. He was admitted in the Neurosurgery Ward but expired two days later. As the attending doctor, what is your next course of action?		
a)	Issue a Death Certificate	17.4
b)	Hand over dead body to relatives	0.9
c)	**Give an intimation to police**	**49.5**
d)	Make arrangements for a postmortem examination	30.3
No answer		1.9
Q 7. A patient is brought to Casualty with signs and symptoms of organophosphorus poisoning. After performing gastric lavage, what will you do with the sample collected?		
a)	Send it to the Forensic department for analysis	88.1
b)	**Hand it over to police with proper receipts**	**9.2**
c)	Discard the sample	0.9
d)	Store it in the refrigerator	1.8
Q 9. As per DGHS guidelines, records of medico-legal cases should be retained for a minimum period of		
a)	3 years	25.7
b)	5 years	17.4
c)	**10 years**	**34.9**
d)	Indefinitely	17.4
No answer		4.6
Q 10. Opinion in a case of drunkenness is based on		
a)	Alleged history of drinking	0.9
b)	**Clinical examination findings**	**44**
c)	Blood alcohol level	24.8
d)	Breathalyzer test results	25.7
No answer		4.6

Doctors, whether in government service or private practice and irrespective of their geographical location, will inevitably come across cases of a medico-legal nature while performing their day-to-day duties. Hence, the ability to identify such cases assumes importance. It is a matter of common sense to realize that immediate lifesaving measures are prioritized over legal formalities at any point of time. The latter should, however, be completed in due course of time. A Supreme Court judgment of 1989 rules that when a patient is in a miserable state hanging between life and death, it is a duty coupled with human instinct on the part of the medical practitioner to do all that is within power to save life, and this requires neither decision nor code of ethics nor rule of law [3]. Interns are expected to be able to differentiate between simple and grievous injuries. This entails adequate training on report writing during the undergraduate years and a clear understanding of Section 320 of the Indian Penal Code (IPC) [4]. In the current study, 82.6% of respondents knew that the ideal person authorized to record the Dying Declaration is a Magistrate in the presence of a doctor. This is consistent with the findings of an earlier study done by Geetha O on doctors in Kerala in 2009 where 72% responded that it should ideally be done by a Magistrate and 60% replied that it can also be done by a doctor in the presence of witnesses [5]. Our research reveals that only 9.2% of participants were sure about the *chain of custody* of a gastric lavage sample collected in a case of poisoning which differs from a study done by Mardikar PA et al. in Nagpur in 2015 where 95.7% of interns knew about preservation of gastric lavage in poisoning cases [6]. In addition, we found that knowledge regarding retention of medico-legal records was lacking in the majority of respondents which is similar to the findings of Rai JJ et al conducted in Vadodara in 2012 [7].

Our observations clearly indicate that some remedial measures are necessary to elucidate certain 'grey areas' with less than 50% correct responses (Table 2). As medical teachers, we could revise our teaching methodology, lecture style, lecture content and evaluation for a more practical approach to medico-legal education [8]. The inclusion of problem based learning exercises and case scenarios could facilitate better learning among students. A refresher/orientation class at the start of internship may be introduced to enable new interns to recollect what they have already learnt and apply it while doing the rounds in the wards and Casualty. Topics may be selected and taken up for discussion with concerned departments at varying intervals during internship to strengthen weak areas and address specific issues, for example 'Procedure to be followed in the event of death in a medico-legal case', 'Collection and Preservation of samples in poisoning cases', 'Retention of records in medico-legal cases' and 'Examination and reporting in a case of drunkenness'. A 15 days posting in the Department of Forensic Medicine and Toxicology during internship may be made mandatory to enable proper handling of medico-legal cases [9]. Problem-oriented on-the-job training and regular updates on new developments in the field could possibly improve knowledge and perception of these issues [10]. Further, regular Continuing Medical Education (CME) programmes on medical law and ethics could be held from time to time to ensure that interns and doctors are confident about dealing with such situations on a day-to-day basis.

Conclusion

The majority of interns had good knowledge about handling medico-legal cases. However, there is a need to clarify confusion around certain relevant topics as they have a bearing on the future practice of a budding doctor. In this regard, medico-legal education has to be reinforced with changes in undergraduate teaching methodology. Inclusion of more problem based and case based learning for students can help them understand better on how to handle such cases. Additional refresher's courses during internship and residency are also very important for reinforcing their knowledge. Only then will we be able to produce competent graduates who are equipped with the necessary knowledge of the legal and ethical aspects of every case they handle.

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Profile of Blunt Injuries over Chest: An Autopsy Study

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Abstract

Background: Out of three vital organ two (Heart and Lung) are in the thoracic cavity. So injuries to chest cavity are mostly fatal in the form of haemorrhagic shock or neurogenic shock. Blunt or sharp objects may causes these type of injuries. *Aims:* To study the epidemiological aspect of fatal blunt chest injuries. *Material And Method:* In this study 120 cases of chest injuries by blunt objects are studied for their various aspect. *Results:* Most cases are of road traffic accident (RTA). Most of them are young male between 20-40 years of age. Though majority of them died within in 1hrs, on the spot or on the way. Nature of injuries are correlated with the history and incident. Involvement od lung shows multiple rib fractures. Heart, major vessels and diaphragm were also involved in significant number of cases. *Conclusion:* Most of the fatal blunt chest injuries were of road traffic accidents majority of them have lungs and ribs injuries and hemorrhagic shock is the cause of death in almost all cases.

Keywords: RTA; Fracture; Spot Death; Haemorrhagic Shock.

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 thoracic damage occurs without any external visible injuries and diagnosed only during meticulous internal examination [1-4].

Run-over accidents and fall from a height can leads to multiple fractures of ribs on either sides. Hitting by hard and blunt object also cause fracture of the ribs and sometimes the fractured ends may penetrate the lung or heart. Sternum is usually fractured by direct impact especially in RTA [4,5].

Here in this study the epidemiological aspects of blunt chest 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.

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Material and Methods

The materials for the present study were the dead body of blunt chest 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 chest 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 thoracic organ and cause of death.

Observation & Results

120 cases of blunt chest injuries are studied of which majority of the victims (35.8%) are young adult male between 21-40 year of age group. Age-wise the maximum number i.e., 31 (25.8%) of the victims were from 21-30 years of age, followed by 31-40 and 41-50 years of age group

i.e., 25% & 16.6% cases respectively. At the extreme of age cases were few. Sex-wise there is a clear predominance of male over female i.e., 96 (80%) & 24 (20%) cases respectively.

More than half (61.6%) of the victims were died on the spot just after the incidence. Another 28 (23.3%) were died within 6 hours. Only 4 (3.3%) of the victims survived more than 24 hrs.

Among blunt chest injuries 80.8% are caused by road traffic accidents, of which 2/3 (65.8%) by direct impact of the vehicle. Other blunt chest injuries are caused by, fall from height (11.6%) and by blunt weapon (2.5%) in homicidal assault.

Injuries are caused externally front of chest in 51.6% and mostly on left side in 24.1% Back of chest involved in 27.5% cases and both front and back seen in 20.8% cases. Least cases seen on right back (7.5%) Internally lungs injured in all 120 and heart in 64 (53.3%) cases. Only both lungs are involved in 29.1% of cases and Both lungs and heart involved in 20% of cases. Associated Aortic and pulmonary injury seen in 5% of cases and diaphragmatic injury seen in 5.8% of cases.

Amongst heart injuries right ventricle was involved more often (32.8%) than other parts of heart. Left ventricle alone in 15 (23.4%) while whole heart was found lacerated in 4 (6.2%) of the cases. Haemorrhage and shock was the cause of death in most of the cases.

Table 1: Age and Sex wise distribution:

Age	Male		Female		Total	
1-10	7	5.8 %	0	0%	7	5.8%
11-20	10	8.3%	2	1.6%	12	10%
21-30	21	17.5%	10	8.3%	31	25.8%
31-40	22	18.3%	8	6.6%	30	25%
41-50	18	15%	2	1.6%	20	16.6%
51-60	10	8.3%	1	0.8%	11	9.1%
61-70	5	4.1%	1	0.8%	6	5%
Above 70	3	2.5%	0	0%	3	2.5%
Total	96	80%	24	20%	120	100%

Table 2: Manner of injuries

Sr. No.	Manner	No. of cases	No. of Cases (%)
1.	RTA	97	80.8%
	Impact	79	65.8%
	Run over	18	15%
2.	Fall from Height	14	11.6%
3.	Fall of object (Wall or any)	6	5%
4.	Blunt Weapon (Homicidal)	3	2.5%
	Total	120	100%

Discussion

Mordenization 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

Table 3: Survival Period

Sr. No.	Period	No. of cases	No. of Cases (%)
1.	Spot Death	74	61.6%
2.	Less than 1hr	18	15%
3.	1hr to 6hr	10	8.3%
4.	6hrs to 12hrs	6	5%
5	12hrs to 24 hrs	8	6.6%
6	More than 24 hrs	4	3.3%
	Total	120	100%

Table 4: Involved areas (External Examination)

Sr. No.	Type of injury	No. of cases	No. of Cases (%)
1	Front of chest	62	51.6%
	Right	14	11.6%
	Left	29	24.1%
	Both	19	15.8%
2	Back of chest	33	27.5%
	Right	9	7.5%
	Left	18	15%
	Both	6	5%
3	Front & Back	25	20.8%
	Total	120	100%

Table 5: Involved areas (Internal Examination)

Sr. No.	Involved Organ	No. of cases	No. of Cases (%)
1	Right lung	9	7.5%
2	Left lung	12	10%
3	Both lungs	35	29.1%
4	Only Heart	0	0%
5	Heart & left lung	27	22.5%
6	Heart and both Lungs	24	20%
7	Heart , Lungs & Major Vessels (Aorta/ Pulmonary)	6	5%
8	Heart, Lungs and Diaphragm	7	5.8%
	Total	120	100%

Table 6: Involved areas of Heart

Sr. No.	Part	RTA		Other		No. of Cases	
1	Right Ventricle	20	31.5%	1	1.5%	21	32.8%
2	Left Ventricle	13	20.3%	2	3.1%	15	23.4%
3	Both Ventricle	8	12.4%	2	3.1%	10	15.6%
4	Right Atrium	0	0%	0	0%	0	0%
5	Left Atrium	0	0%	0	0%	0	0%
6	Both Atrium	1	1.5%	1	1.5%	2	3%
7	Right Side of Heart	4	6.2%	1	1.5%	5	7.7%
8	Left side of Heart	6	9.3%	1	1.5%	7	10.9%
9	Whole heart	3	4.7%	1	1.5%	4	6.2%
	Total	55	85%	9	15%	64	100%

injury. Some of cases of blunt trauma on chest are also seen in quarrel 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 [1,5].

In RTA direct impact by the vehicle is most common cause of blunt trauma to the chest. [6,7,8,11,12,14]. Injuries to ribs were found fractured in almost all the cases, of which 3rd to 6th ribs were most often involved. This is also consistent with the observations made by the other study [2,8,13,14]. Majority of cases shows fatal lung injuries and other injuries are seen in few of the cases this is also consistent with almost all study. In the cases where heart was involved the right ventricle was most commonly injured. This is consistent with other studies [7,10,14].

Conclusion

- More than 50% of chest 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.
- Fracture of ribs were seen in almost all cases, of which 3rd to 6th ribs were most often involved.
- Lungs were involved in all the cases followed by both lungs and heart, aorta and diaphragm were least involved.
- In the cases where heart was involved; right ventricle followed by left ventricle was most commonly injured.
- More than 75% of the victim died either on spot or within 6hrs. in the way or in casualty.
- Almost all cases haemorrhagic shock was the cause of death.

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Profile of Fatal Head Injury Cases Due to RTA in and Around Bijapur

Ashok Kumar Rajaput[1], Ramesh C. Patil[2], Anand Mugadlimath[3]

Abstract

Introduction: Deaths due to road traffic accident are one of the common forms of unnatural death and its history is old as the invention of the wheel. The head is the most prominent of the exposed parts of human body by virtue of its situation, choice in great majority of situations involving blunt trauma which may be accidental, suicidal or homicidal. *Materials & methods:* The present study was undertaken on fatal head injury cases of road traffic accidents brought by the police to the mortuary of Al-Ameen Medical College and District Hospital, Bijapur for medico-legal autopsy between Oct 2003 Sep 2005, a total of 180 cases were studied. *Results:* In the present stud of 180 cases, 150 (83.3%) were males and 30 (16.7%) females. Male, female ratio of 5:1 was observed. The maximum number of cases, 53 cases (29.5%) were seen in the age group of 21-30 years. The next in frequency was 25 cases (25.0%) seen in the age group of 31-40 years between 71-80 years 2 cases (1.1%) were seen. Most of the accident (20.0%) occurred between 3pm to 6pm and between 9am to 12noon and 6pm to 9pm 27 (15.0%) cases occurred. In 2 (1.1%) cases the time of accident was not known. In the study most of the victims 137 (76.1%) died on the spot. The maximum time of survival was up to 6 hrs. Lorry and Truck was the commonest offending vehicle. Next in order was bus and unknown case was 7 (3.9%). *Conclusions:* The male preponderance may be due males are more exposed to outdoor activities traveling. The reason for young adults most affected because they are the prime breads earners of the family, remains outdoor. The reason for the peak incidence of the accidents at 3-6hrs is multifold and includes hurry to reach home from place of work timed people after hectic work, rush traffic hours, in-adequate traffic control and fatigue to drive. Most victims died on the spot, this may be due to the severity of injuries sustained, lack of knowledge of first aid, delay in shifting the patient to trauma center etc.

Key words: Road Traffic accident, Head injury, Autopsy, Demographics.

Introduction

Birth & death are two extremes of the life and death is the ultimate truth. But unnatural death is known for its immense striking power and is always a surprise. Deaths due to road traffic accident are one of the common forms of unnatural death and its history is old as the invention of the wheel. The head is the most prominent of the exposed parts of human body by virtue of its situation, choice in great majority of situations involving blunt trauma which may be accidental, suicidal or homicidal. The mechanism of head injuries, diagnosis and treatment are still challenging to medical profession creating major problem in modern society. Head injuries, diagnosis and treatment are still challenging to medical profession creating major problem in modern society. Head injuries are progressively and alarmingly increasing with modernization in addition to an inclination of man more towards materialistic gains with advanced methods. Extensive and indiscriminate uses of explosives for different purposes have increased the nature of assaults and accidental fatalities.

"Head injuries" as defined by National Advisory Neurological Disease and Stroke

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Council is a morbid state, resulting from gross or subtle structural changes in scalp, skull and/or the contents of the skull, produced by mechanical forces.

Crania-cerebral injuries have assumed paramount importance in recent times due to mechanization and industrialization. These injuries have shown an alarming rise in the recent times owing to fast modernization as a result of adaptation of man to machine and motor. Despite supreme measures in the form of sophisticated protective gadget usage, usage, tremendous advances in public education, the subject continues to be a major cause of mortality and morbidity.

Head injury occur every 15 seconds and patient dies from head injury every 12 minutes in a day and, these injuries account for a significant portion of health care costs today. Head is the most prominent of the exposed parts of the body by virtue of its position and is very vulnerable to trauma.This study is a sincere attempt to dissect and deduce, in a step-wise approach, the possible causes and mechanisms of the trauma to the head.

Materials & Methods

The present study was undertaken on fatal head injury cases of road traffic accidents brought by the police to the mortuary of Al-Ameen Medical College and District Hospital, Bijapur for medico-legal autopsy between Oct 2003 Sep 2005.

Inclusion criteria- All cases of head injuries that have definite history of road traffic accident.

Exclusion criteria- bodies without specific history or were findings of head injury not found.

A total of 180 cases were included in the study.

Results

Table 1: Showing the sex wise distribution in fatal road traffic accidents

Sex	No. of Victims	Percentage
Male	150	83.3
Female	30	16.7
Total	180	100

In the present stud of 180 cases, 150 (83.3%) were males and 30 (16.7%) were females. The male, female ratio of 5:1 was observed.

Table 2: Showing the age sex wise distribution in fatal road traffic accidents

Age group (Years)	No. of Victims		Total No of Victims	Percentage (%)
	Male	Female		
0-10	01	03	04	2.2
11-20	11	02	13	7.2
21-30	45	08	53	29.5
31-40	34	11	45	25.0
41-50	26	04	30	16.7
51-60	23	01	24	13.3
61-70	08	01	09	5.0
71-80	02	00	02	1.1
Total	150	30	180	100

The maximum number of cases, 53 cases (29.5%) were seen in the age group of 21-30 years. The next in frequency was 25 cases (25.0%) seen in the age group of 31-40 years between 71-80 years 2 cases (1.1%) were seen.

Table 3: Showing the time of accidents in fatal road traffic accidents

Time of accident	No. of Victims	Percentage
6am – 9am	22	12.2
9am – 12noon	27	15.0
12noon – 3pm	23	12.8
3pm –6pm	36	20.0
6pm –9pm	27	15.0
9pm –12am	24	13.3
12am –6am	19	10.6
Not Known	02	1.1
Total	180	100

Most of the accident that is 36 (20.0%) cases occurred between 3 pm to 6 pm. and between 9 am to 12 noon and 6 pm to 9 pm 27 (15.0%) cases occurred. In 2 (1.1%) cases the time of accident was not known.

Table 4: Showing survival period in 180 cases of fatal road traffic accidents

Duration of Survival (Hours)	No. of Victims	Percentage (%)
Died on the spot	137	76.1
½- 1 hrs	03	1.7
1 – 6 hrs	12	6.7
6 – 12 hrs	05	2.7
12 – 24 hrs	02	1.1
24 – 48 hrs	03	1.7
48 – 72 hrs	03	1.7
72 – 96 hrs	04	2.2
96 – 120 hrs	03	1.7
More than 120 hrs	08	4.4
Total	180	100

In the study most of the victims 137 (76.1%) died on the spot. The maximum time of survival was up to 6 hrs.

Table 5: Showings the distribution of the vehicles causing fatal road traffic accidents

Vehicle	No. of Victims	Percentage (%)
Lorry / Truck	35	31.3
Bus	21	18.8
Maxi Cab	03	2.7
Car	10	8.9
Jeep	03	2.7
Motor Cycle	09	8.0
Scooter	03	2.7
Moped	01	0.9
Tempo / Auto	04	3.6
Tractor	01	0.9
Matador / Van	13	11.6
Unknown	09	8.0
Total	112	100

Lorry and Truck was the commonest offending vehicle. Next in order was bus and unknown case was 7 (3.9%).

Discussion

This study is undertaken on 180 fatal head injury cases of road traffic accidents brought by the police to the mortuary of Al-Ameen Medical College and District Hospital. Bijapur for medico-legal autopsy between Oct 2003 – Sep 2005.

Sex distribution: In the present study male comprised a majority and constituted 150 (83.3%) cases compared to females 30 (16.7%) cases. The male to female ratio in the study is 5:1.

A male preponderance is almost in consistence with the study reported by Patel NS et al. [7], Tirpude et al. [8], Rowbotham et al. [1], Fregtag et al [3], Agarwal & Agarwal et al. [9], Chandulal et al. [10], Tonge et al. [11], Shrivastava et al. [12].

The male preponderance may be due to the effect that males are more exposed to outdoor activities traveling between the home and place of work to earn bread for the family. While woman remains mainly indoor involved in household work. Vehicle driven are usually males, in all the cases facing the danger of traffic accident and hence responsible for high fatalities among them.

Age distribution: In the present work the age of the victims varies from 1-80 years, maximum victims 53 (29.5%) are seen in the age group of 21-30 years followed by 25.5% in the age group of 31-40 years. In other words 98 cases (34.5%) comprised in the age group of 21-40 years. Individuals in the age group of 71 to 8 years is the least affected 4 cases (2.2%): maximum no of males 45 is seen in the age group of 21-30 years between 71-80 years 2 cases of male 4 cases of female is seen.

This is in accordance with studies done by Patel et al. [7], Tirpude et al. [8], Rowbothan et al [1], Freytag et al. [3], Chandulal et al. [10], who reported that age group between 21-30 years were commonest.

It does not agree with the study done by Agarwal & Agarwal et al. [9] who observed that age group of 0-9 years was more commonly involved.

Individuals in the first (2.2%) and seventh decade (1.1%) are the least affected, the lowest age being 3 years and highest is 80 years. The reason for the above is the young adults are the prime breads earners of the family, remains outdoor during most of the day and have a tendency to take undue risk. While persons in the extremes of age usually remain indoor whereas children are confined to the residential premises.

Time of accidents: In the present study most of the accidents occurred between 3pm to 6pm compromising 20% of total cases, followed by 9am to 12 noon and 6 pm – 9 pm each having 15% and 15% cases respectively. The least number of accidents occurred between 12am to 6am having 10.6% cases. While in two cases the time of accident is not known.

The present study is agreeable with N.S. Patel et al. [7] who stated that accidents between 6pm to 6am hours to be commonest i.e., 31.9% and Shrivastava et al. reported that the peak accidents 25% was between 8 am t 10 am followed by 6 pm to 8 pm 15%.

The reason for the peak incidence of the accidents at these hours is multifold and includes hurry to reach home from place of work timed people after hectic work. Rush traffic hours, rash driving, in-adequate traffic control and fatigue to drive.

The period of survival: 137 (76.1%) victims died on the spot, 12 (6.7%) died after 6 hours of the accident. N.S. Patel, Tonge et al reported that almost 66% and 48.9% died on the spot and these finding co-relate with the present study. Shrivastava and Gupta et al [13], Agarwal et al. [9], findings are also familiar with the present study.

The period of survival has not shown an increase despite the advances of medical facilities, this may be due to the severity of injuries sustained, lack of knowledge of first aid among the people at the scene of accident delay in shifting the patient to trauma center and no change in attitude of people due to fear of getting into legal hassles.

Offending vehicles: Amongst the offending vehicles lorry and buses are most common offending vehicles seen in 68 (37.91%) cases followed by buses 47 (26.1%), of the 7 (3.9%) unknown cases.

Similar observation was reported by Srivastava and Gupta who reported that heavy vehicles like bus and trucks 59.96% were frequent source of traffic accidents.

This study is also comparable with the study of Chandra et al. [14] and Agarwal et al. [9] who reported that becomes, trucks & buses were the commonest vehicle causing accident.

It can thus be deduced that heavy traffic vehicle remain the main offending vehicle causing accident. The reason for this may be due to number of ring roads and bypasses being constructed on the outskirts of the city to make movement of Lorries more convenient and reduce the city traffic. Buses are in the second number and this may be due to increase in the number of buses on the route due to increased population but road, being the same old ones. The drivers of these buses drive recklessly without caring for the lives of other road users.

Conclusion

The present study is undertaken on fatal head injury cases of road traffic accidents brought by the police to the mortuary of Al-Ameen Medical College and District Hospital, Bijapur for medico-legal autopsy between Oct 2003 Sep 2005.

The following are the few conclusion and suggestion evolved from the present study. Male comprised a majority and constituted 150 (83.3%) compared to females who were only 30 (16.7%). The male to female ratio in the study was 5:1 (male=15, Female-30). The age of the victims varied from 1-80 years. The peak incidence was observed in the age group of 21-30 years comprising 29.5 of the cases. Most of the incidents irrespective of the cases occurred between 3 pm to 6 pm comprising 20% of total case, while in two case time of incident was not known. Maximum number of victims died on the spot 135 (76%).

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Original Article

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Association of Primary Tooth Metrics and Body Mass Index Among Chennai Children

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Abstract

Introduction: Tooth morphometrics show variations across gender, phenotypes, race, age and populations. These variations are evolutionarily determined but maybe modified by environmental factors such as socioeconomic conditions, nutrition, childhood health, maternal effects such as gestation and systemic conditions. Despite strong genetic contribution, the tooth may fail to reach its maximum potential size due to the role of environmental influences. A relation between tooth size and body size would compound the notion that teeth size, though dependent on genetic contribution, are not insulated from external influences. Previously attempts to corelate tooth size and body size by other authors have shown differing results. There is also a dearth of information regarding the same on deciduous dentition. Hence this study aims to corelate Body Mass Index (BMI) and clinical crown length (CL), mesiodistal width (MDW) and buccolingual width (BLW) of primary maxillary canines and first molars, among Chennai children. *Materials and methods:* A cross-sectional study was conducted among 100 school going children, of both genders, in the age group of 3-6 years. Weight and height were calculated by metric standards and BMI was obtained. The participants were grouped as healthy, underweight and overweight. The different groups were measured intraorally, with a digital Vernier caliper for crown lengths, mesiodistal and buccolingual widths of primary upper canines and molars. Data was statistically analyzed. *Results:* Total of 49,22,18 belong to healthy, underweight and overweight. Comparison of the mean (SD) of CL, MDW, BLW of upper primary canine and first molar among participants of different body size using one-way ANOVA test was found to be statistically significant ($P<0.05$). *Conclusion:* A positive correlation exists a between body mass index and tooth metrics. Evident deciduous crown size variations of individuals of different BMI belonging to the same population should be taken into consideration while studying population comparisons of different odontometric standards.

Keywords: Morphometrics, Body Mass Index, Crown length, Mesiodistal width, Buccolingual width

Introduction

Quantitative analysis on size and shape of teeth, or Odontometrics, are frequently used in anthropology, archeology, dentistry and forensic dentistry [1]. They have provided as a means of clinical study material on living as well as non-living populations. There are abundant studies in literature on tooth size measurements, as teeth provide valuable data on phylogeny and ontogeny [2]. Within a forensic context, teeth make ideal candidates in times of identification crisis due to their resistance to natural agents such as fires. Teeth act as stable anatomical landmarks; well defined, easy to locate, and with parameters that remain stable over time. Odontometric data have been useful to geneticists to study heritability in size and chromosomal influences and to pedodontists to understand normal and abnormal occlusion, and tooth-jaw size discrepancy, among others. In addition to this, these data are of great value to anthropologists who compare odontometric variations with a historical and evolutionary perspective, given that variations in tooth size can

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be correlated with different populations, customs, lifestyles and eating habits.

There exists a wealth of evidence to support the fact that these odontometric measurements show variations across the globe. It is a well acknowledged that variability in tooth morphometrics exists between genders and plays a significant role in the identification of an individual [2,3,4]. There is also noted variation among different age groups, phenotypes and populations [5,6,7].

Studies have revealed that variations in tooth metrices are determined by genetic factors, but maybe influenced by environmental factors such as nutrition, gestational conditions and childhood health. Just as the growth of the body is influenced by genetic factors and the individual's surroundings, the growth of teeth is thought to be similarly influenced. This implies that, despite strong genetic contribution, the tooth may fail to reach its maximum potential size due to the role of environmental influences [8].

The difference in patterns of tooth size are thought to reflect difference in contribution of environmental and genetic factors to their contribution. Moreover, odontometric parameters show a difference in specific populations and even within the same population [9]. There exists a need to establish normative data with specificity in regards to region and population.

A possible relation between tooth size and body size has been explored in different studies previously. Body size has been touted as the single most important determinant of body architecture, physiology, ecology, evolutionary history and social organization in mammals [10]. Studies have attempted to corelate tooth size to body size in mammals using length of the skull, femur and head and body length as a measure of body size [11,12]. A relation between tooth size and body size would compound the notion that teeth size, although dependent on genetic contribution, are not insulated from external influences.

There is meagre scientific data pertaining to this among the Indian population. Furthermore, there is a scarcity of studies on deciduous population. Quantitative information on this would not only aid pediatric dentists, anthropologists and forensic odontologists, but would also cast a light on the odontometric trends of the population.

Hence the present study aims to establish a relation, if any, between Body Mass Index (BMI) and clinical crown length (CL), mesiodistal width (MDW) and buccolingual width(BLW) of primary maxillary canines and first molars, among Chennai children.

Materials and Methods

The study was undertaken following approval from the institutional ethical committee. This cross-sectional study was conducted among 100 school going children, of both genders, in the age group of 3-6 years, present in the outpatient ward of Department of Pedodontics, Saveetha Dental College and Hospitals, for a period of 3 months from October to December 2017. The children were included via random selection sampling, based on the inclusion criteria.

The inclusion criteria were: (1) caries free teeth with healthy gingiva and peridontium, (2) fully erupted deciduous teeth (53, 54, 63 and 64), (3) normal overjet and overbite, (4) normal molar and canine relationship. Participants with the following criteria were excluded: (1) mobile deciduous teeth, (2) incompletely erupted deciduous teeth, (3) presence of dental or facial anomalies, (4) apparent loss of tooth structure due to fractures, attritions and restorations, (5) any long standing systemic illnesses.

Following informed consent from parents of the children, demographic details were taken. All measurements were assessed by a single examiner to avoid inter-observer errors.

Calculation of Body Mass Index (BMI):

The weight of the individual was measured on a portable glass electronic weighing machine, in kilograms, measured to the nearest 0.1 kg. The height of individual was measured from vertex to floor, according to metric standards via a stature meter attached to the wall, to the nearest 0.1 cm. Body Mass Index was calculated by the metric formula: [Weight in Kg]/ [Height squared in meters]. The values were plotted on the age growth graph to obtain the percentile ranking of the child, which give the relative position of the child's BMI among other children of the same age and sex [13].

Based on the age and gender specific percentile curves given by Centers For Disease Control and Prevention, the children were classified into four groups: those with BMI below 5% of standard were considered underweight, between 5% and 85% as normal, Overweight between 85% and 95%, and those with above 95% as obese [14].

Clinical examination

The participants were measured for Crown length (CL), mesiodistal width (MDW) and buccolingual width (BLW) of primary maxillary canines and first molars using a digital Vernier caliper, to the nearest 0.01mm.

The parameters are explained as follows

CL: Greatest distance along the facial axis of tooth, from gingival margin to buccal cusp tip in case of canines, and from gingival margin to mesiobuccal cusp tip incase of molars.

MDW: Greatest distance between mesial and distal contact points of the crown, with the long axis of the caliper parallel to the occlusal surface.

BLW: Greatest distance between labial/buccal and lingual surface of the crown, measured with beaks of caliper perpendicular to MDW.

Statistical analysis

The anthropometric measurements and tooth dimensions were tabulated. Data was expressed in mean ± Standard deviation. The children of different BMI groups were compared on the basis of crown lengths, mesiodistal and buccolingual lengths, by ANOVA test. A two tailed $p<0.05$ was considered statistically significant. The data was compared and analyzed by SPSS software version 17.0.

Table 1: Demographic characteristics of study participants (n=100)

Variables	Subgroups
Gender	Male
	Female
BMI groups	Underweight
	Healthy
	Overweight

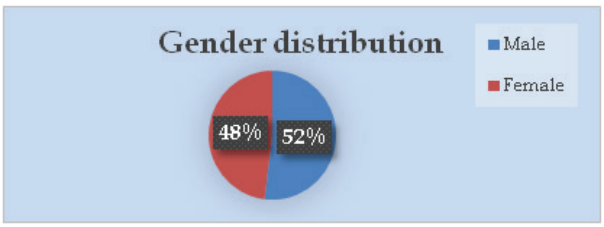

Fig. 1: Gender distribution among study participants

Table 2: Comparison of the mean±standard deviation of crown length of primary upper canine and molar among participants of BMI using one-way ANOVA test

Status	Primary canine	Primary molar
Healthy	4.9461±0.75	4.6392±0.66
Underweight	4.2909±0.57	4.4252±0.38
Overweight	5.2667±0.52	4.8661±0.49
p=0.00		

Results

Of total 100 participants, 52 were male and 48 were female. Considering the BMI of the participants, 49 were healthy weight, 33 were underweight, and the remaining 18 were of overweight status. Distribution of the children based on gender and BMI categories are represented (Table 1, Figure 1, 2). The data shows the comparison of the mean (SD) of CL, MDW, BLW of upper primary canine and first molar among participants of different body size using one-way ANOVA test (Table 2-4). There was a significant difference observed between the groups in relation to the CL, MDW and BLW (p <0.05). This statistical comparison is represented in Figure 3, 4 and 5.

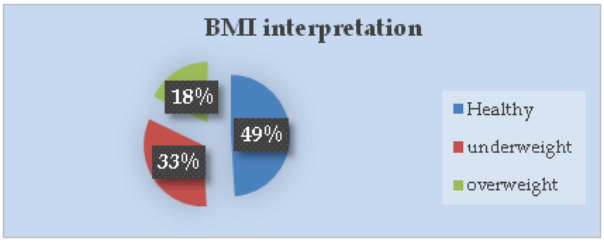

Fig. 2: Distribution of participants based on Body Mass Index criteria

Table 3: Comparison of the mean±standard deviation of mesiodistal width of primary upper canine and molar among participants of BMI using one-way ANOVA test

Status	Primary Canine	Primary Molar
Healthy	5.7129±0.57	5.9965±0.58
Underweight	4.877±0.46	5.3552±0.43
Overweight	5.2522±0.52	6.2717±0.488
p=0.00		

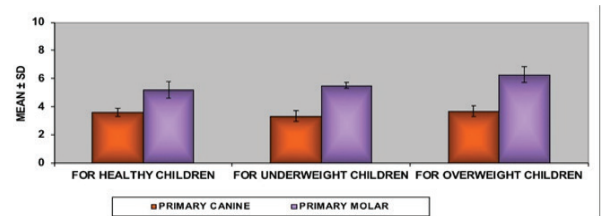

Fig. 3: Comparison of the crown lengths among participants of different BMI

Table 4: Comparison of the mean±standard deviation of buccolingual width of primary upper canine and molar among participants of BMI using one-way ANOVA test

Status	Primary Canine	Primary Molar
Healthy	3.6165±0.30	5.2216±0.58
Underweight	3.3367±0.39	5.5203±0.21
Overweight	3.6867±0.36	6.2822±0.54
p=0.00		

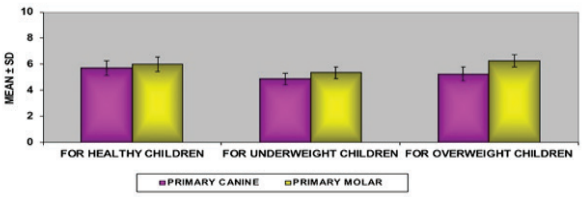

Fig. 4: Comparison of the mesiodistal widths among participants of BMI

Discussion

It has been recognized for a long time that variations among tooth morphometrics exist across genders, age, populations and phenotypes. This study was initiated as a review of literature revealed a scarcity of evidence to support a variation of primary tooth metrics with body mass index. This study primarily focuses on presenting the utility of a correlation between primary tooth metrices and BMI. The results could have positive implications in pedodontic operative dentistry and orthodontics. Moreover, differences in variation could provide a means of studying evolutionary mechanisms across a particular population and may provide an insight into the nature of factors influencing this variation. The scientific data obtained would also be viable within a forensic context in development of a biological profile.

The current analysis shows a positive relation in variation of CL, MDW and BLWs among participants of different body sizes (Underweight, healthy and Overweight). Underweight individuals showed smaller CL, MDW and BLW compared to their overweight counterparts. The statistically significant variation in tooth measurements of the three BMI groups suggest that while genetic influences may play a role, there is significant stimulus from environmental influence, which may be socioeconomic conditions, nutrition, childhood health, maternal effects such as gestation and systemic conditions [8,9,15].

Previously conducted studies to establish a relation between tooth morphometrics and physical profile have shown differing results.

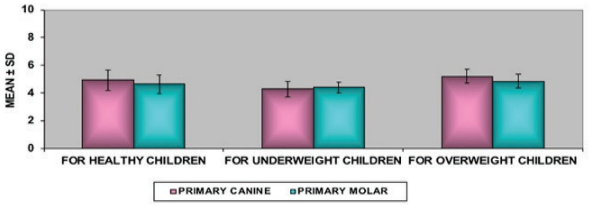

Fig. 5: Comparison of the buccolingual widths among participants of BMI

Jayawardana CK et al. conducted a study on Srilankan Sinhalese individuals, attempting to find a relation between permanent Incisal tooth lengths and stature, and found no significant association [16]. Sterrett et al conducted a similar study on Caucasians, comparing width, length and width/ length ratios of permanent maxillary anteriors to stature, and came to a similar conclusion that tooth morphometrics do not have an association with body height [17]. However, a study by Prabhu et al comparing multiple dimensional parameters of permanent maxillary centrals to stature, had a low, albeit statistically significant result. Few studies have been carried out on deciduous dentition [18]. A study carried out by Ramanna et al showed a definite predictive relationship between deciduous clinical crown length and height of the individual [19]. The findings of our study contrasted that made by Zameer et al, who reported non-significant variations on comparing MDW of primary second molar among children with different BMI [8]. The conflicting results from the previous studies may be attributed to the choice of dentition, choice of parameters of tooth dimensions, different ethnicities and racial differences among the study groups.

Discrepancies in tooth size have been reported across various ethnic groups such as Mongoloids, Japanese, North American Caucasians and racial groups such as Eskimos, Bushmen and Australian Aboriginals. We chose our study population from Chennai, a metropolitan city having a mix of North Indians of Aryan origin, and South Indians of Dravidian Origin, as there is little information regarding normative data involving this population [5,6,7,20].

In this study, deciduous dentition was chosen over permanent dentition, as these dental structures carry on them the stamps of genetic traits as well reflect the effects of environmental influences [21]. The functional matrix theory, popularized by Melvin Moss in 1960, supports the above hypothesis, as it is firmly based on the fact that teeth, as functional matrices, are influenced

by genetic, epigenetic and environmental factors, and that any disturbances in these, would in turn effect the related skeletal unit [22]. A domino effect triggered by this functional interference could result in an overall impact on other related skeletal structures, and hence, overall body size of the individual. Evidence has confirmed that while polygenic inheritances do influence deciduous tooth size variability, teeth fail to attain their maximum genetic size potential when there is an influence of stressors such as disease and malnutrition. Other external factors that may influence the size of developing deciduous dentition include maternal health, short prenatal growth periods, poor perinatal and early postnatal development [6,23]. This is clearly evidenced in a study by Garn et al, who, in collaboration with The National Collaborative Perinatal Project (NCPP), showed that maternal hypertension, low birth weight and short gestational periods resulted in diminished mesiodistal and buccolingual dimensions of all deciduous teeth, while conversely, conditions such as maternal diabetes, maternal hypothyroidism, and large size at birth resulted in larger maxillary and mandibular deciduous dentition, as compared to healthy neonates [6].

Children in the age group of 3 to 6 years were chosen as primary teeth begin to erupt around 2 ½ years and their replacement around the age of 6 [24]. Thus, it was imperative that children within this age group were chosen as the inclusion criteria.

The teeth selected for measurement were maxillary primary Canines and Molars. Previous studies have supported the use of maxillary teeth in a forensic context, the reason being, in cases of mass disasters where only fragmentary remains may be available, the maxilla offers the advantage of being firmly attached to base of skull and having standard anatomical landmarks by which they may be easily identified, for measurement of odontometric parameters [25]. In our study, maxillary teeth were chosen with the same intention. Canines and molars were selected due to their discrete morphologies which will add to the value of evidence.

The odontometric parameters chosen for this study were crown length (CL), mesiodistal (MDW) and buccolingual (BLW) widths. There appears to be a general consensus in literature that CL, MDW and BLW are the most commonly assessed, reliable parameters in tooth morphometrics due to the specificity and reproducibility of the variations obtained among them. An appreciable sexual variation among the parameters- MDW and BLW are larger in males compared to females- has long been established in literature and have been used as reliable forensic tools. Anthropologists have correlated mesiodistal widths and evolution of tooth size and drawn a parallel to this and populations and environmental adaptation. In our study, we have chosen to also include crown lengths and buccolingual widths as there is a dearth of information regarding these when it came to studies on primary tooth metrices [26].

The methodology used to measure the chosen parameters in the present study is based on work by Moorrees and Reed, who pioneered and standardized the location on the tooth where the measurement is to be made. As this method is the most commonly used in anthropological and dental literature, it facilitated easy comparison between results of the present study with those of others [27]. The measurements were made using a digital Vernier caliper, as they provide more reliable and accurate measurements, as compared to manual measurements done with dividers and calculators which result in measurement transfer and calculation errors [28]. The metrical data in our study was obtained directly from the patient's mouth. Majority authors used plaster models; however, there have been studies where direct intraoral measurements were taken from the mouth of the individual. Anderson's odontometric study comparing both direct and indirect techniques revealed no significant statistical difference comparing both methods [29].

Following these odontometric measurements, we proceeded to measure the anthropometric data. Body mass Index has been shown to have scientific and epidemiological consistency and has been used in numerous studies to effectively analyze anthropometric measurements. It's accuracy as a sensitive index, over other conventional indices have long been established. Studies have shown positive correlations between a high BMI and dental caries, blood pressure and periodontitis. BMI was our screening tool of choice for estimation of body size, owing to its effective categorization of individuals of different heights and weights based on age and gender [30,31,32].

The results of this study support the notion that while teeth may have substantial biological stability, it is evident that other definable factors operate on it, accounting for variance in crown size. The study provides normative data among individuals with different BMI in Chennai population and should be

considered in population studies relating to tooth size and in understanding of different evolutionary trends. The similarities in odontometric values within a population may be explained by the impact of similar environmental prenatal influences on crown lengths and widths of developing teeth, or by the population's adoptive response to their diet. The normative data provided in this study for the pediatric Dravidian population of Chennai city, may plausibly allow for accurate prediction of ethnicity of the child, hence narrowing down the variables in a forensic situation. With multiple differences to work with, in terms of race, age, weight and gender, identification of the individual in a forensic situation may be a complex exercise. Attempts to even out these differences with more studies such as ours, will prove to be of indispensable value in studies of forensic odontology.

The quantitative information could be also be imperative when dealing with cases of tooth jaw size discrepancies, space management and in deciding deciduous crown size dimensions.

The limitations of the study lie in the small size of the chosen study sample and the random nature of sampling technique and hence, the findings may not replicate in a larger sample size. Thus, the authors recommend a larger cohort, chosen via systematically distributed sampling technique to provide substantial evidence to support these findings, which maybe then further generalized to an entire population.

Conclusion

A positive correlation exists a between body mass index and tooth metrics. Evident deciduous crown size variations of individuals of different BMI belonging to the same population should be taken into consideration while studying population comparisons of different odontometric standards, in forensic scenarios and clinical situations involving the fields of Orthodontics and Pediatric Operative dentistry.

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Original Article

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Pattern of Hanging Deaths in Raichur Region

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Abstract

Background: Violent asphyxial deaths are one of the important causes of death nowadays. Hanging is one of the preferred mode of committing suicide. Pattern of suicidal death is a reflection of the prevailing social set up and mental health status of region. *Material & Methods:* A Prospective study was conducted from Jan 2013 to December 2013 in which 106 autopsy cases of hanging deaths were taken out of 976 autopsies conducted in the mortuary of Raichur institute of medical sciences, Raichur. *Results:* The maximum incidences of hanging deaths were in 21- 30 years age group (37.7%). Majority of the victims were married (67.9%). The most common place of hanging was closed space (93.3%). On external examination the ligature mark was at or above the thyroid cartilage in all the cases with no fracture of thyroid cartilage or hyoid bone. *Conclusion:* Hanging is the most commonly observed mechanical asphyxial death. The cause of death profile is an important set of public health information and forms the cornerstone of the health information system

Keywords: Hanging; Asphyxial Deaths; Ligature Mark.

Introduction

WHO reported approximately one million people die from suicide and 10 to 20 times more people attempt suicide worldwide every year. This represents one death every 40 seconds and one attempt every 3 seconds on average. All over the world, suicide is now one of the three leading causes of death among people aged 15-34 years [1]. Suicide (Latin *suicidium*, from *sui caedere*,"to kill oneself") is the act of intentionally causing one's own death. According to Durham, the French biologist, suicide is death resulting directly or indirectly from a positive or negative act of the victim himself, which he knows will produce this result [2].

Suicide is a major socioeconomic and public health issue worldwide. Hanging is one of the 10 leading causes of death in the world accounting more than a million deaths annually [3]. In India, hanging is second common method of committing suicide after poisoning. Over the past 30 years the incidence of suicide by hanging is on increase, especially among young adults [4]. Suicide and attempted suicide, while previously criminally punishable, is no longer in most Western countries. It remains a criminal offence in our country. All cases of hanging are considered to be suicidal until the contrary is proved [5].

A detailed knowledge of various factors associated with suicidal hanging in that particular geographical area is very much necessary to prevent such suicides. Keeping this in mind we conducted a prospective study at Raichur to focus on the various factors associated with suicidal hanging with a view to identify the areas of intervention. Thus suicide which is very much a byproduct of the advancements of society needs a careful and refined approach so as to study the factors related to it, the causes and if possible to find ways to prevent such a tragedy.

Materials And Methods

A prospective study was conducted on 106 victims subjected to medico-legal autopsy at mortuary of Department of Forensic medicine,

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Raichur institute of medical sciences, Raichur over a period of one year from January 2013 to December 2013. The study design comprised of thoroughly scrutinized information gathered from the police and the relatives of the deceased, hospital records and laboratory report of viscera and their contents, fluids, diseased tissues and organs and other relevant suspicious samples available in our department. Suicide notes if any were also included.

Statistical Methodology

The results were analyzed using Statistical Software Package SPSS version 2.0. Statistical analysis was done for frequencies, percentages, proportions & ratios and results were interpreted.

Results

A total of 976 dead bodies were brought for post-mortem examination at Raichur institute of medical sciences, Raichur during a period of one year from January 2013 to December 2013. After post-mortem examination and correlation with the history received from the police and relatives of the deceased, it was confirmed that in 106 cases (10.9%), the victims had died because of hanging. These 106 cases were part of our study. This incidence rate coincides with studies by Patel A et al. [6] (4.65%), Sharma B R et al. [7] (3.41%) and Bhagora et al [8] (8.03%) (Table 1).

Table 1: Comparative study of incidence of hanging deaths

Author of study	Total autopsy	Total hanging cases	Percentage
Current study	976	106	10.9%
Patel A et al	6880	320	4.65%)
Sharma B R et al	2668	91	3.41%)
Bhagora et al	1270	102	8.03%

Table 2: Age wise distribution of deaths due to hanging

Age group	Number	Percentage
0-10 yrs	0	0%
11-20yrs	21	19.8
21-30yrs	40	37.7
31-40 yrs	17	16.1
41-50 yrs	15	14.2
51-60yrs	9	8.5
>60 yrs	4	3.7
Total	106	100%

Table 2 shows the age wise distribution of deaths due to hanging. The largest group was found to be in 21-30 yrs (37.7%) followed by 31-40 yrs (16.1%) which was in consistent with the study done by Amandeep et al. [9] (59.24%) but in contrast with the study Azmak et al. [10] (20.8%) in which the highest incidence of victim where in the age group of 30 -39 yrs. The above findings can easily be explained by the fact that 21-30 years of age group is most active,entrusted with responsibilities of family and are susceptible to frustration in life because of many factors like marriage, financial crunch, failure of love affairs and pressure of making a good career after completion of studies etc.

Table 3: Sex wise distribution of deaths due to hanging

Sex	Number	Percentage
Male	73	68.9%
Female	33	31.1%
Total	106	100%

Table 3 shows that the incidence of death due to hanging has male preponderance (68.9%) almost double than that of female. Similar male predominance was revealed by study of Sharija et al. [11], Gargi J et al. [12] and Wagmare PB [13] et al. This high incidence of hanging death among males could be attributed to failure in domestic life, failure in love affairs, unemployment, frustration in life, maladjustment to the society etc.

Table 4: Place of hanging

Place of hanging	Number	Percentage
Open space	7	6.7%
Closed space	99	93.3%
Total	106	100%

Table 4 shows that the most common place of hanging was closed space (93.3%) which was in consistent with the study done by Patel A et al. [6] and Bhagora et al. [8].

Table 5: Marital status of hanging

Marital status	Number	Percentage
Married	72	67.9%
Unmarried	31	29.2%^
Undetermined	03	2.9%
Total	106	100%

Table 5 shows that the most common victims were married (67.9%) which was in consistent with the study done by Bhargora et al. [8] and Sharija S et al. [11]. This high incidence in married persons may be due to various psycho socioeconomic factors in which domestic problem may play an important role which may lead to the lethal step taken by the victim.

Table 6: Post mortem findings on external examination

External findings		Number	Percentage
Placement of ligature mark (oblique)		106	100%
Place of ligature mark at the neck	At & above thyroid	106	100%
	Below thyroid	0	0
Congestion of face		52	49%
Dribbling of saliva		24	22.6%
Discharge of semen		20	18.9%
Discharge of urine/faecus		18	16.7%

Table 6 shows that the ligature mark was oblique (100%) in all the cases and the ligature mark was situated at and above the level of thyroid cartilage (100%) in all the cases which was consistent with the study done by Patel A et al. [6] and Bhagora et al. [8]. Dribbling of saliva from the angle of mouth was noticed in 24 cases (22.6%) which was in consistent with the study done by Bhagora L et al. [8] (22%) but in contrast with the study done by Patel A et al. [6] who noticed in 71.25% of cases. Discharge of semen (18.9%), discharge of urine and faecus (16.7%) was seen in the study which was in consistent with the study done by Patel A et al. [6] and Bhagora L et al. [8].

Table 7: Post mortem findings on internal examination

Internal findings		Number	Percentage
Subcutaneous tissue	White glistening	106	100%
	Contused		
Fracture of thyroid		0	0
Fracture of hyoid		0	0

Table 7 shows that the on internal examination the subcutaneous tissue were white glistening in all the cases (100%)and there were no fracture of thyroid cartilage and hyoid bone which was consistent with the study done by Patel A et al. [6] and Bhagora L et al. [8].

Conclusion

Hanging is the most commonly observed mechanical asphyxial death. The cause of death profile is an important set of public health information and forms the cornerstone of the health information system. At provincial level it is needed for health planning and deciding on intervention strategies. In present study, most of the victims were married males of 21-30 years age group. The result of this study indicates that a multi disciplinary approach is required to prevent the suicidal hanging deaths.

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Histopathological Study of Cardiac Lesions in Medicolegal Autopsies

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Abstract

Context: Cardiovascular diseases are an important cause of morbidity and mortality in both developing and developed countries. The prevalence of coronary artery disease has doubled in Indians during the past three to four decades. Hence, the study was undertaken to evaluate the prevalence of various heart diseases in this region of western Maharashtra. *Aim:* The aim was to assess the pattern and prevalence of atherosclerosis involving the coronary arteries and to study the gross and microscopic features of various lesions affecting the valves, myocardium, endocardium and pericardium. *Design:* This was a prospective analytical study. *Material and methods:* The study included 250 complete heart specimens of medicolegal autopsy cases received from August 2012 to July 2014. Thorough gross examination of atria, ventricles and valves was done followed by examination of the coronary arteries and representative tissue bits were submitted for microscopy. *Results:* Atherosclerosis was the most common lesion involving 123 cases with 48 cases of triple vessel disease. Ischemic heart disease was seen in 62 cases, 60 being associated with atherosclerosis. Fourteen cases of left ventricular hypertrophy, nine cases of valvular heart disease, three cases each of cardiomyopathy and disseminated intravascular coagulation, two cases of acute leukemia and one case each of papillary fibroelastoma, amyloidosis, ventricular septal defect and sickle cell anaemia were observed. *Conclusion:* Present study emphasizes the role of atherosclerosis in ischemic heart disease. Amyloidosis and rare tumors like papillary fibroelastoma of the heart can be accurately diagnosed on histopathology underscoring the usefullness of an autopsy based study.

Keywords: Atherosclerosis; Ischemic Heart Disease; Valvular Heart Disease.

Introduction

Cardiovascular diseases have emerged as a major health problem worldwide with atherosclerosis being the major cause [1]. However, study of atherosclerosis in the living population is difficult, invasive and expensive. An autopsy based study gives a good measure of the prevalence, grading and distribution pattern of atherosclerotic lesions. Valvular heart diseases especially Rheumatic heart disease (RHD) continues to be an important cardiac problem even today. Heart is also involved in a variety of systemic diseases. Hence the study was undertaken on medicolegal autopsies to evaluate the prevalence of various heart diseases in this region of western Maharashtra.

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Material and Methods

250 specimens of complete heart from medicolegal autopsies were studied over the period of two years from August 2012 to July 2014. The specimens were fixed in 10% formalin. The heart was examined externally to assess the size, weight, scars if any and status of coronary vessels was noted. Gross photographs of the lesions were taken. Then the heart was opened by the flow of blood method. Bread loaf technique was employed for myocardial infarction [2].

After opening the heart, atria and ventricles were thoroughly examined. Condition of heart valves, thickness of cusps and calcification if any were recorded. The right and left coronary arteries, left anterior descending artery and left circumflex artery were examined for atherosclerosis, presence of any thrombus or aneurysmal dilatation.

Tissue bits were taken from left ventricle, right ventricle, coronary arteries and interventricular septum. Additional bits were taken from any gross pathological lesion found. Fixation was done in 10% Formalin followed by routine tissue processing. Sections were stained with haematoxylin and eosin. Special stains were employed wherever necessary. Microscopic findings were correlated with gross features.

Results

The total number of heart specimens received was 300. In 41 cases, only part of the heart was received while in nine cases, it was completely autolysed. Excluding these 50 cases, total 250 specimens of heart along with root of aorta were studied.

The age ranged from less than one year to 90 years. Total number of males was 155 (62%) and females 95 (38%) giving M: F ratio of 1.63: 1. (Table 1)

The various lesions encountered are shown in table 2. The most common lesion was atherosclerosis involving coronary arteries in 123 out of 250 cases (49.2%), affecting 103 males and 20 females (M:F = 5.15:1). No specific lesion was found in 91 (36.4%) cases.

Typing of atherosclerosis was done according to the classification provided by the American Heart Association [3]. In this classification, atherosclerosis is divided into six types, initial lesions including type I and II, intermediary lesion corresponding to type III, advanced lesions including type IV and V and complicated lesions consisting of type VI. Atherosclerosis involving the coronary arteries was seen in total 123 cases (49.2%). The most commonly involved vessel was Left anterior descending (LAD) coronary artery accounting for 103 out of 123 (83.74%) cases followed by right coronary artery (RCA) in 80 (65.04%) and left circumflex coronary artery (LCX) in 75 (60.97%) cases. The predominant type of atherosclerosis involving coronary arteries was type V seen in 55 cases (44.71%) followed by type III in 21 cases (17.07%), type IV in 18 cases (14.63%), type VI in 16 cases (13.08%), type II in ten cases (8.13%) and type I in three cases (2.43%). Triple vessel disease accounted for the maximum number of cases, 48 out of 123 (39.02%), followed by double vessel involvement in 39 cases (31.70%) and single vessel involvement in 36 cases (29.26%). Intraluminal thrombus in association with atherosclerosis was seen in 14 cases, ten in LAD and four in LCX. It was occlusive in a single case of LAD.

Spectrum of Ischemic heart disease (IHD) included acute myocardial infarction (AMI), chronic ischemic heart disease (CIHD) and acute co-existing with chronic ischemic heart disease. On microscopy, AMI showed necrosis of myocardial fibers, heavy neutrophilic infiltrate and hemorrhage while CIHD included scars representing old healed myocardial infarcts and small foci of replacement fibrosis [1]. In cases with coexistent AMI and CIHD, histopathological features of both were seen. IHD was seen in 62 out of 250 cases affecting 56 males (90.32%) and six females (9.68%). Out of these 62, coronary atherosclerosis was seen in 60 cases. Two cases of IHD did not show atherosclerosis. Maximum number of IHD, 34 out of 62, was observed in triple vessel disease. Prevalence of atherosclerotic involvement of coronary vessels and their relationship with ischemic heart disease is shown in Table 3.

Table 1: Age and sex incidence of cases

Age group (years)	Males	Females	Total	Percentage (%)
<1 Year	3	2	5	2
1-10	3	3	6	2.4
11-20	4	16	20	8
21-30	24	51	75	30
31-40	42	9	51	20.4
41-50	29	6	35	14
51-60	25	4	29	11.6
61-70	17	1	18	7.2
71-80	8	0	8	3.2
81-90	0	3	3	1.2
Total	155	95	250	100

Table 2: Various pathological lesions found in hearts & their prevalence

Sr.No.	Pathology	No of Lesions (%)
1	Atherosclerosis involving coronary arteries	123 (49.2%)
2	Ischemic heart disease	62 (24.8%)
3	Soldier's plaque	23 (9.2%)
4	Left Ventricular hypertrophy	14 (5.6%)
5	Valvular heart Disease	09 (3.6%)
6	Cardiomyopathies	03 (1.6%)
7	Tumors of the Heart	01 (0.4%)
8	Systemic diseases involving the heart	7 (2.8%)
9	No Specific lesion	91 (36.4%)

In IHD, left ventricle (LV) was involved in total 40 cases. In 18 cases, only LV was involved while in 22 cases, LV was involved along with interventricular septum (IVS), apex or right ventricle.

Isolated left ventricular hypertrophy (LVH) was seen in 14 cases, affecting 13 males and one female. History of hypertension was available in eight of these cases.

Nine cases of valvular heart disease, six suggestive of healed rheumatic heart disease (RHD), two cases of acute infective endocarditis and one case of prosthetic mitral valve thrombosis were observed. In three cases, cardiomyopathy was suspected, hypertrophic cardiomyopathy in two cases and dilated (Peripartum) cardiomyopathy in one case.

We also had one case of perimembranous ventricular septal defect (VSD) in a 25 days old female child. One case of papillary fibroelastoma (PF) involving the mitral valve was encountered. Grossly, tiny warty excrescences were seen attached to the valve cusps. Microscopy confirmed PF.

Soldier's plaque was seen in 23 cases affecting 20 males and three females. In 12 cases, the plaque was situated on the anterior surface of the LV, in six cases on the anterior surface of RV and in five cases on the posterior surface of LV.

Systemic diseases we came across were three cases of disseminated intravascular coagulation (DIC), two cases of acute leukemia and one case each of systemic amyloidosis and sickle cell anemia.

Discussion

In the present study of 250 complete heart specimens, the most common lesion encountered was atherosclerotic coronary artery disease involving 123 out of 250 cases, with a prevalence of 49.2%. Similar findings have been reported by Marwah et al (71%), Dhruv et al (23.3%) and Shiladeria et.al (46%) [4,5,6]. The order of involvement of coronary arteries in descending frequency was LAD (103 cases, 83.74%), RCA (80 cases, 65.04%) and LCX (75cases, 60.97%). Jha et al have reported the frequency of coronary vessel involvement as LAD 33%, RCA 29% and LCX 15% while Garg et al reported LAD 38.1%, RCA 35.1% and LCX 34.1% [7,8]. Table 4 depicts comparison of our findings with other authors.

Type V atherosclerosis was the most common type involving the coronaries accounting for 55 out of total 123 cases (44.71%), LAD in 31, LCX in 14 and RCA in ten cases. Type VI atherosclerosis accounted for 16 cases (13.08%) which included two cases of plaque rupture in LAD and 14 cases of thrombi. Out of 14, in ten cases the thrombi were in LAD and in four cases, in LCX. Jha et al have also reported type V & type VI atherosclerosis as the most common types [7]. Marwah et al, Dhruva et al, Garg et al and Agravat et al have also reported similar findings [4,5,8,9]. Triple vessel involvement was most common, noted in 48 out of 123 cases (39.02%) followed by double vessel involvement in 39 cases (31.70%) and single vessel involvement in 36 cases (29.26%).

Table 3: Prevalence of atherosclerotic involvement of coronary arteries and their relation with ischemic heart disease

Sr. No.	No. of coronary vessels involved	No. of cases	CIHD (39)	AMI (11)	AMI with CIHD (12)
1	No atherosclerosis	2	0	1	1
2	Single vessel disease	12	5	0	0
3	Double vessel disease	14	14	4	3
4	Triple vessel disease	34	20	6	8

CIHD – Chronic Ischemic Heart Disease

AMI - Acute Myocardial Infarction

Table 4: Comparison of coronary involvement by different authors.

Coronary vessel involved	Dhruva et al [5]	Jha et al [7]	Garg et al [8]	Agravat et al [9]	Present study
LAD	60%	33%	38.1%	40%	83.74%
RCA	50%	29%	35.1%	32%	65.04%
LCX	42%	15%	34.1%	30%	60.97%

We had 62 cases (24%) of IHD affecting 56 (90.32%) males and six (9.68%) females. Majority of cases were in the age group 51-60 years (15 cases, 24.19%). Out of 62, atherosclerosis involving any one or more of the three major coronary arteries was seen in 60 cases while in two cases of IHD, one AMI and other CIHD, all the coronary arteries were normal.

In the spectrum of IHD, maximum number was CIHD with 39 cases (62.91%). Acute MI contributed 11(17.74%) and combined AMI with CIHD 12 cases (19.35%). Marwah et al reported an incidence of 51 out of 200 (70.83%) for CIHD, 14 (19.44%) for AMI and seven cases (9.72%) for combined AMI & CIHD [4].

Out of 48 cases of triple vessel disease, 34 showed IHD with CIHD in 20 cases, AMI in six and combined AMI with CIHD in eight cases. Hence out of total 62 cases of IHD, 34 (54.83%) were seen in triple vessel disease, highlighting the strong association of triple vessel disease with IHD. Marwah et al and Jha et al have reported similar findings [4,7].

Intraluminal thrombus in association with atherosclerosis was seen in 14 cases, ten cases in LAD and four cases in LCX. In a single case involving LAD, it was occlusive. Myocardial lesions in these cases were CIHD in six, combined CIHD and AMI in four and AMI in four cases. Marwah et al reported thrombosis in 13 cases, 11 involving LAD and two involving RCA [4].

In present study, IHD with involvement of LV alone was seen in 18 out of 62 cases (29.03%) while LV and IVS combined in seven cases (11.29%). Marwah et al have reported involvement of LV alone in 15 out of 72 cases (20.83%) while LV and IVS combined in eight cases (11.11%) [4].

Fig. 1: Gross photograph showing rupture of anterolateral wall of left ventricle following acute myocardial infarction.

In two cases, rupture of the anterolateral wall of LV was seen as a complication of AMI. Both were males with triple vessel disease. (Figure 1)

We encountered 23 cases of Soldier's plaque, 20 in males and three in females. The plaque was whitish rough area ranging in size from 1- 2.5 cms and was situated on the anterior surface of the LV in 12 cases, on the anterior surface of RV in six cases and on the posterior surface of LV in five cases. Microscopically, the pericardium showed collagen deposition and mononuclear cell infiltration.

We had 14 cases of isolated LVH affecting 13 males and one female. History of hypertension was available in eight cases. The LV wall thickness varied from 1.8 to 2.2 cm. One case of LVH also showed acute infective endocarditis affecting the aortic valve with large friable vegetations.

There were nine cases of valvular heart disease, six suggestive of healed RHD, two cases of acute infective endocarditis and one case of prosthetic mitral valve thrombosis. Mitral valve was involved in all six cases of RHD while in two cases, aortic valve was involved additionally. Typical fish mouth appearance of mitral orifice with fusion of chordae tendinae and dilatation of left atrium was seen in two cases. Microscopically, valve leaflets showed fibrosis and neovascularization. However, Aschoff bodies were not seen in any of the cases. One case of prosthetic mitral valve showed a thrombus completely occluding the mitral orifice. Marwah et al observed two cases of RHD out of total 200 cases [4].

Two cases of acute infective endocarditis (IE) were seen, one involved the tricuspid valve in a 14 year old girl. Unfortunately details of this case were not available. The other case was a 30 year old male with large friable vegetations on the aortic valve. Concentric LVH with foci of CIHD were also seen in this case.

In three cases, cardiomyopathy was suspected; hypertrophic cardiomyopathy in two cases and dilated (Peripartum) cardiomyopathy in one case. Both the cases of hypertrophic cardiomyopathy were young, one 23 years male and the other 32 years female with history of sudden death. On gross examination, the heart was enlarged with mean weight of 400 gms and IVS thickness of 3.3 cm in one and 3.5 cm in other. The left ventricular cavity was banana shaped and revealed a distinct subaortic bulge. Microscopy in both the cases showed myofibre disarray with marked myocyte hypertrophy, nuclear enlargement and pleomorphism, interstitial fibrosis and luminal narrowing of intramural coronary arteries [5].

Peripartum cardiomyopathy (PCM) is a type of dilated cardiomyopathy which develops during the last trimester or within first six months after pregnancy. In our study, we had one case of a 27 years female with 30 weeks gestation with clinical and echocardiographic diagnosis of PCM. On gross examination all four chambers of the heart appeared dilated. Microscopy revealed focal myocyte hypertrophy, interstitial fibrosis and mononuclear inflammatory infiltrate.

All three cases of DIC were postpartum females with a clinical diagnosis of DIC. The myocardium showed focal haemorrhages. Fibrin thrombi were seen in the blood vessels of myocardium, pericardium, lungs and kidneys.

PF is an endocardial based papilloma lined by endocardial cells with proteoglycan rich avascular stroma. It is a rare benign tumor accounting for less than 10% of primary cardiac tumors and is almost always detected incidentally. Sporadic cases are most common on the cardiac valves while iatrogenic tumors tend to occur in a variety of non-valvular endocardial surfaces [10]. We had one case of PF in a 24 years female affecting the mitral valve which showed tiny warty excrescences on both the cusps. Microscopy confirmed PF (Figure 2).

The only case of VSD in our study was a 25 days female child with a perimembranous VSD with a diameter of 1.3 cm.

A single case of sickle cell anemia was observed in a 38 year old female. Blood vessels of the myocardium, kidney and lungs showed sickled red blood cells in the lumina.

Heart can be involved in any form of systemic amyloidosis. In our case, the heart was enlarged weighing 420 gms and all the coronaries appeared thickened. Microscopically, amyloid deposits were seen in the subendocardium, myocardium, walls of coronary vessels and pericardial fat. (Figure 3) Kidney and spleen also showed amyloid deposits.

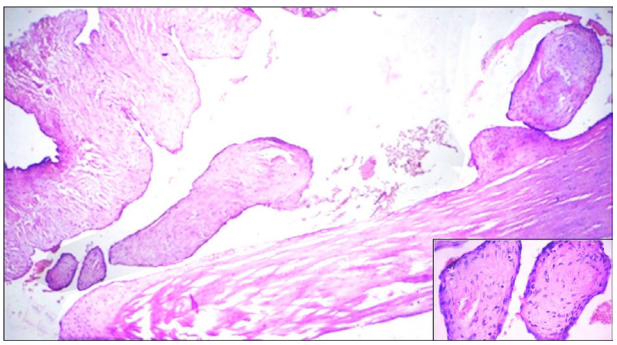

Fig 2: Photomicrograph showing multiple papillary fibroelastomas. Inset- High power view (H and E, x100)

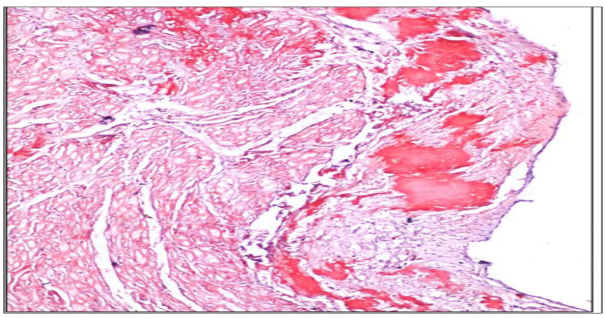

Fig 3: Photomicrograph showing Congo red positive deposits of amyloid in the subendocardium and myocardium. (Congo red, x 40)

We confirmed the deposits to be amyloid by Congo red stain followed by polarizing microscopy which showed the characteristic apple green birefringence.

Conclusion

Autopsy based studies are cost effective for estimating the prevalence of coronary atherosclerosis. In the present study, atherosclerotic coronary artery disease was the most frequently encountered lesion with a strong association between triple vessel disease and ischemic heart disease. Histopathology is crucial in the accurate diagnosis of amyloidosis and rare cardiac tumors like papillary fibroelastoma.

Key message

Every specimen of heart must be thoroughly examined on gross and microscopy.

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Original Article

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Profile and Causes of Delayed Deaths in Burn Cases at a Tertiary Care Hospital

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Abstract

Context: The death due to burns may be instantaneous i.e. on the spot, or the victims may escape the immediate death and may die after one day of survival. All these deaths occurring after one day of survival will be considered as delayed deaths. *Aims:* To study the profile of burn victims and to study the causes and manner of death among them *Settings and design:* Department of Forensic Medicine and Toxicology, Gandhi Medical College and Hospital Secunderabad, Telangana, India. *Methods and material:* One hundred deaths which had occurred due to burns after one day of infliction are selected from May 2009 to September 2009 in Gandhi Hospital Secunderabad. The entire data was analyzed and the cross sectional statistics were prepared by highlighting the causes and complications of delayed death due to burns. *Statistical analysis:* The data was analyzed using proportions and presented as charts and tables. *Results:* The male and female deaths were 36% & 64% respectively with highest number of cases among the age group 21-30 years (male and female 25.9% & 74.1% respectively). Maximum deaths were due to septicemia as the complication leading to the death i.e. 36% of total death (male and female 36.1% & 63.9% respectively). The highest death rate is between 3-7 days after the infliction of burns (Total 49%, with males & females 17%, 32% respectively), followed by 24-72 hours (29%) *Conclusion:* Septicemia is the main complication in delayed deaths and the proportion is more in females compared to that of the males. The most common causes of burns are accidents and suicides. Dowry deaths & marital issues are more common in females where as financial and ill health issues are more common in males.

Keywords: Septicemia; Delayed Deaths; Complications; Dowry; Marital Issues.

Introduction

Deaths do occur due to fire and burns. These deaths are accidental in nature but sometimes they may be suicidal or homicidal. The excess heat produces many changes in the body which may prove fatal. Heat doesn't produce uniform changes in all the people. There are several factors which influences the outcome of the burns. They are 1) The amount of surface area involved, 2) The depth of the burns, 3) Age 4) Sex 5) Pervious morbidity of the victim etc. There are some deaths which occur on the spot. Some people escape the spot death, but succumbs to burns in due courses. These people who survive prolonged period and die later are included in the delayed deaths. In India, they rank second, after road traffic accidents, as a leading cause of death [1].

According to the literature these deaths are caused because of the complications produces by the burns in the victim. The occurrence of the complications is also dependent on several factors. Hospitalization & amount of medical care are the important factors. Even the highly sophisticated hospitals with the highest treatment modalities adapted, death is not preventable.

In our country, there has been a steady increase in the incidence of female victims of burns, particularly the newly married ones, over the years, clearly indicating that such deaths cannot always be attributed to accidents and that something more sinister is at play-bride burning, for want of dowry [2].

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Hence it is thought to make a study on those deaths which are occurring in the burned persons in the late period, due to some complications. The present study is made to analyze the different factors which affect both local and systemically which is influencing the fatal outcome of the burns in late period [3].

1. Local effects are

i. Interstitial edema formation due to

a. Increased capillary filtration coefficient
b. increased capillary hydrostatic pressure
c. reduced interstitial fluid hydrostatic pressure
d. reduced capillary protein permeability
e. Increased colloid osmotic pressure of the intestinal fluid

ii. Haemolysis

iii. Changes in lymph flow

iv. Inflammatory process

v. Intra cellular edema formation etc.

2. Systemic effects are in

i. CVS - a. Hypovolemia b. low cardiac output c. Shock & hypoxia

ii. Metabolic effects - a. Effect of ambient temperature b. Endocrine response c. Effect of feeding

iii. Immunological effect - a. Changes in non specific defense b. Changes in immune defense c. Causes of immune Suppression [4].

The Complications that are commonly noticed are 1. Thermal damage to the Airways 2. Intoxications and Hypoxia 3. Irritatants 4. Tracheo Broncial damage 5. Pulmonary parenchymal damage and 6. Burn wound infection and invasive sepsis [5].

The common causes of death in burns are–

1. Immediate / Instantaneous causes 1) Neurogenic shock & Trauma

2. Early Causes (within 24 hours of infliction) are a. Hypovolmic shock b. Dyselectolytemia c. Asphyxia d. Laryngeal edema

3. Intermediate causes (1-3 days) are respiratory distress

4. Delayed causes (3days-1 week) a) Acute renal failure b) Fat embolism c) Broncho Pneumonias

5. Late causes (more than 1 week) a) Chronic renal failure b) Multiple organ failure c) Septicemia [6].

The present study was aimed to make a critical analysis of those deaths occurring due to burns after one day of survival resulting due to complications.

Burns are always associated with some or other complications. People succumbs directly to the burns on the spot or sometimes they become vulnerable to the complications

Methods

Study design: Hospital based record analysis study

*Study period***:** May 2009 to September 2009.

Settings: Present study was carried out at Mortuary of Gandhi Medical College and Hospital, Secunderabad attached to the Department of Forensic Medicine and Toxicology.

*Sample size***:** A total no. of 100 cases of burn deaths brought to mortuary for post-mortem examination who died 24 hours after infliction of the burns were selected studied for the present study.

Inclusion Criteria

Deaths occurred after one day survival after infliction of burns are selected.

Cases which are admitted and had medical aid are selected.

Cases from both sexes, inquests done by both Tahalsildar and Police are taken.

Exclusion Criteria

Deaths occurred at the scene (spot deaths) are excluded.

Deaths occurring within one day of the infliction of burns are excluded.

Unidentified dead bodies are excluded.

Dead bodies in advanced state of putrefaction are also excluded as the post mortem examination findings are not clear.

Methodology

Present study was planned to study delayed deaths in burns (deaths due to burns occurring

only 24 hours after the infliction) brought to the mortuary of Gandhi Medical College and Hospital, Secunderabad attached to the Department of Forensic Medicine and Toxicology.

During the study period a total no. of 100 cases were subjected to postmortem examination in the mortuary of Gandhi Hospital. A detailed pre designed, pre tested, semi structured study questionnaire was approved for the present study.

Inquests, First information report, Statements made by the relatives, Panchanama of scene of offence are collected from Police. The Post-mortem examination reports are taken from the Department of Forensic Medicine, Gandhi Medical College, and Secunderabad to collect the data for analysis purpose.

Some information is also collected from the relatives who attended the Mortuary at the time of Post-mortem examination by personal enquiry, regarding previous illness which might have interfered with the work. Visit to the scene of offence is also made in some cases.

Photographs of the victims, at the scene of offence and also at the time of conducting the Post-mortem examination are taken. Some photographs of the scene of offence are collected from the Police.

After collecting the above information, a data sheet is prepared and filled in, to analyze them. The data is processed, to get various brakes up of the information. All the information is tabulated.

The tables are studied under the prescribed Aims and Objectives. The observations are made out. These observations are compared with the standard information available in the literature from India and west. Subsequently, the conclusions are derived. In the last a summary is prepared about everything.

Statistical Analysis

The data was analyzed using proportions and presented as charts and tables.

Results

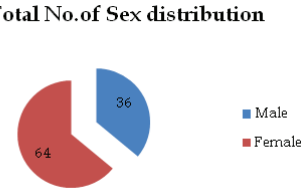

Fig. 1: Distribution of study subjects as per sex

Figure 1 shows sex distribution of study subjects. Females were found to be more than males i.e. 64% females vs. 36% males. Thus showing that the incidence of burns deaths more common among females than males. This may be due to close intimacy of females in kitchen.

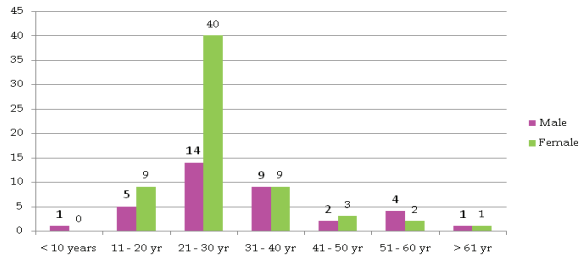

Fig. 2: Age and sex wise distribution of study subjects

Figure 2 shows age and sex wise distribution of study subjects. Majority of the study subjects were in the age group of 21-30 years in both the sexes followed by 31-40 years. Very few cases were reported in children and old age.

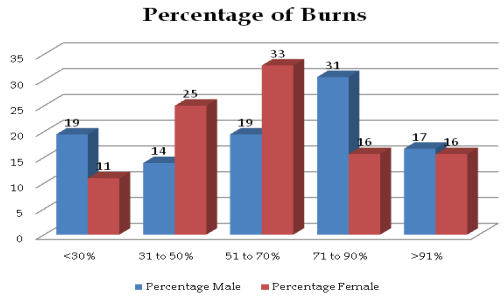

Fig 3: Distributio of study subjects as per the percentage of burns

Figure 3 shows distribution of study subjects as per the percentage of burns. When the percentage of burns less than 30% and when it is between 71-90% the death proportional is more in males. For burns of more than 91% the difference between male and female was minimum. But for the categories of burns 31-50% and 51-70% it was the females among whom the proportion was more than males.

Table 1: Time of infliction and sex among the cases

Time of infliction	Total percentage	
	Male	Female
Early morning	5.6	4.7
Morning	16.7	15.6
Mid day	19.4	14.1
Evening	25	34.4
Night	33.3	31.3

Table 1 shows time of infliction and sex among the cases. The most common time of infliction in both males and females was evening and night.

Table 2: Marital status of victims in delayed deaths

Marital status	Male		Female		Total	
	Number	%	Number	%	Number	%
Married	24	66.7	48	75	72	72
Unmarried	11	32.4	8	12.5	19	19
Widowed	1	2.9	8	12.5	9	9
Total	**36**	**36**	**64**	**64**	**100**	**100**

Table 2 shows the marital status of victims in delayed deaths. Majority were married in both the males (24%) and females (48%). Proportion of unmarried and widowed was lesser.

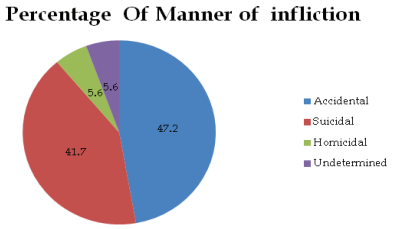

Fig. 4: Manner of infliction among study subjects

Figure 4 shows the Percentage of Manner of infliction. Majority of the burn cases were accidental (47.2%) followed by suicidal (41.7%), and homicidal (5.6%). But in 5.6% of the cases the manner of infliction could not be decided and hence classified as undetermined.

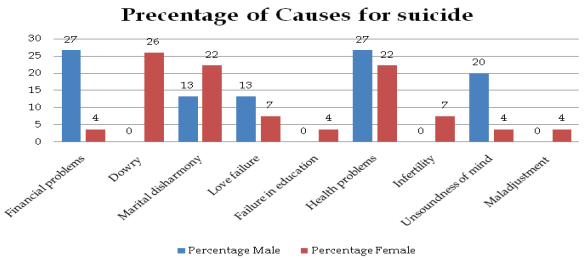

Fig. 5: Percentage of Causes for suicide

Figure 5 shows percentage of causes for suicide. Financial problems (26.6%) and ill health (26.6%) are major causes in Males where as in Females, Dowry deaths (25.9%), marital disharmony (22%) and ill health (22%) are the major causes.

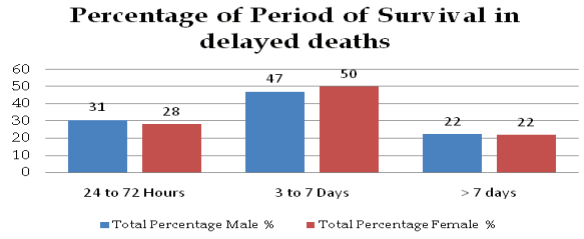

Fig. 6: Percentage of Period of Survival

Figure 6 shows percentage of period of survival. The Maximum deaths occurred in the period of 3-7days without much specific difference between male and females i.e. 47% and 50% and followed by 24-72 hours i.e. below 3 days (31% & 28% respectively)

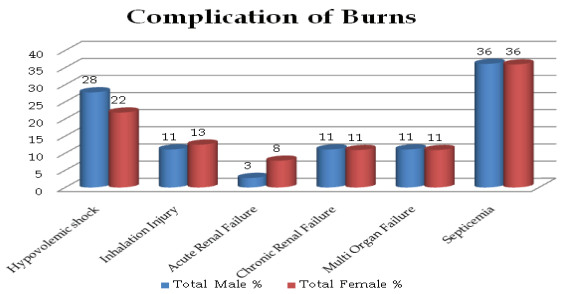

Fig. 7: Percentage of Complications due to burns

Figure 7 shows percentage of Complications due to burns. In most of our cases Septicemia is the highest cause of death (36%) with a difference among Males (36.1%) and Females (63.9%) followed by Hypovolemic shock (28% & 22% respectively)

Discussion

The present study was carried out on the delayed deaths due to burns at mortuary of Gandhi hospital. We included the deaths occurring after one day of infliction of burns. In fact deaths in the delayed period include those which occur after 3 days of infliction. But in our observation complications had started after one day of infliction only. Hence an attempt was made to analyse the complications that are arising after one day of infliction of burns and, which were admitted in Gandhi General Hospital, Secunderabad.

In the delayed deaths due to burns the number of females is more than males and this may be because of easy availability of the kerosene in the houses. The number of homicides is also significant due to various causes which include domestic violence & dowry deaths.

In the 21 – 30 years of age group, especially the married female are more prone for these deaths, as they have specific problems.

0ut of 100 cases of burns victim 36 cases were developed septicemia. In which 13 were males and 23 were females.

The result of the study indicates that young and productive population (21-30 years of age group) is the main victims. Similar findings have also been reported by Harish et al. [3], Sharma et al. [4-

6], Singh et al. [7] and Taneja et al. [8] The hotter months from March to August recorded 41 burns cases with 49% incidence of septicemia, whereas the colder months from September to February had 48 burns cases that had 69% incidence of septicemia. Ideally it is expected that infection rates should be lower in colder conditions so a lower septicemia incidence is expected, but a higher TBSA involved in burn injury was seen in these cooler months so the resultant increased risk of septicemia was recorded. Similar findings of burns involving higher TBSA in colder months has been reported by Harish et al [3], Sharma et al. [4-6 & 9] and Alireza et al. [10] The overall incidence of septicemia was recorded at 72% for rural population, 70% for slum and 45% for the urban population. Moreover gender analysis showed that incidence risk of septicemia is more in rural females (81%) than in rural males (54%). The low socioeconomic status, unhygienic living conditions and poor access to burn care health facilities contribute to expose these post burn patients to multiple infection sources producing a higher septicemic incidence in this group. [1-8,11,12] TBSA burnt is the most important risk factor for development of septicemia as well as post burn mortality and this risk is even higher in females

It is a known fact that literacy makes a man more analytical and understanding. As the educational standards increases, the ability to take precautions increases and thoughts of suicidal tendencies decreases. The present study is also proving the same analysis (i.e. illiterates are 63%)

It is obvious that people from low socio-economic groups have variety of problems for which they think that the death is the only solution. It is proven once again in the present study (i.e. 50% of victims are from low socio-economic status).

There is not much difference seen in the number of deaths occurring in the night and evening time. However the deaths in the late hours of the day may be because of the precipitated factors for committing suicide or homicide. However accidents, because of stoves are once again possible in the evening and night.

People with 100% of burns, most of the times succumbs within 24 hours of infliction. However, people having less than 30% burns escape the death. Hence complications leading to the death are seen only in the burns which are more than 30%. In the present study also more people died in the range of 31 to 90% burns in varying proportions.

Dowry is once again the enemy of the woman in the early days of married life which is similar to that of Sharma BR et al. study [2]. It is proved in the present study also, (7 suicides and 2 homicide). However married woman committing suicide is also seen due to marital disharmony, infertility and domestic violence.

In males financial problems and ill health are the main causes for the suicides. Unsoundness of mind and marital disharmony are other factors which resulted in suicides in the present study. The magnitude of the other problems is less in comparison with the financial burdens.

In the present study accidental infliction is seen more common than suicidal and then homicidal similar to that of Sharma et al. [4] study.

Complications are more common in females, and half of them died between 3-7days of infliction. Ultimately septicaemia is taken as the major precipitating factor for causing the death.

Conclusion

Septicemia is the major complication which is leading to the death in burn cases. The percentage of deaths is more in females compared to that of male. The common causes for burns are accidents and suicides. In females the common causes are dowry deaths & maternal issues, where as financial problems and health issues are common in males. Time of infliction are common at late hours of the day, may be because of the precipitated causes for committing suicide or homicide. However accidents, are because of stoves are once again possible in the evening and night.

Key messages: Delayed deaths occur due to complications developing in burn cases.

Suggestions

1. Fire safety should be installed in all buildings including schools shopping malls Hospitals, Public gatherings etc.
2. The availability of kerosene and gas should be restricted to the trained persons
3. Cross ventilation should be advocated in the houses
4. Those who are having suicidal tendencies are to be treated by the psychiatrist promptly
5. Domestic violence cases should be counseled promptly to avoid Dowry deaths

6. Depressions due to any ill health or financial problem or any other issues need to be identified and proper counseling need to be given by the experts
7. Separate sophisticated and well equipped burns wards & ICU's need to be provided in the Hospitals to overcome the complications of the burns

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Original Article

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The Study of Styloid Process: A Morphometric Analysis with Clinical Implications

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Abstract

Eagle syndrome represents symptoms manifested by compression of regional structures by elongation of the styloid process or ossification of the stylohyoid membrane. The aim of the study is to assess the distribution of SP length and its correlation with side asymmetry. Present study was conducted in collaboration with department of Anatomy and department of Forensic Medicine at Jaipur National University Institute for Medical Sciences and research Center, Jaipur. A total of 38 dry skulls held by the Department of Anatomy were analyzed. The measures were synthesized in one mean measure. Descriptive statistics involved the calculation of central tendency and dispersion measures for each side of the styloid process and for each anatomic position. The length of the SP ranged from 5 mm to 43 mm and from 10 mm to 46 mm, based on the lateral view of the left and right styloid, respectively. From the posterior view, the values for the left and right sides of the skulls, respectively, ranged from 10 mm to 54 mm and from 15mm to 58 mm. This morpho-metric data of the styloid process is important to the physicians, neurosurgeons, otorhino-laryngologist and dentists for accurate diagnosis and treatment of dysphagia and chronic neck pain. The mere presence of an elongated styloid process does not automatically confirm a case of Eagle syndrome. The knowledge of SP variability apart from its anatomic value is of special interest for clinicians when managing atypical pain in the head and neck area as well as for forensic medicine and medico legal cases.

Keywords: Eagle's Syndrome; Styloid Process; Elongated Styloid Process.

Introduction

The stylohyoid syndrome is a generally unknown and rarely identified anatomical and clinical entity involving the oro-maxillo-facial region. The styloid process (SP) is a slender, cylindrical, smooth bony projection of the petrous part of the temporal bone immediately posterior to the tympanic plate and vaginal process, which hide its attachment. The SP, stylohyoid ligament (SHL) and lesser cornu of the hyoid bone constitute the stylohyoid chain that derives from Reichert's cartilage. The stylohyoid chain is divided into distinct segments: the tympanohyal, stylohyal, ceratohyal and hypohyal. The ossification of SP begins before birth and continues over the first 8 years Goss 1973 [1].

The first studies on the styloid process date back to the 16th century. In 1543, Vesalius [2] observed some stylohyoid chain abnormalities in animals, and in 1652 Marchetti [3] first described an elongated styloid process, considering it to be a "paraphysiologic" variant. From 1937 to 1949, Eagle carefully investigated the syndrome, which would later bear his name [4,5,6] pointing out that approximately 4% of individuals with an elongated styloid process suffered from facial-pharyngeal pain. Although Eagle suggested tonsillectomy as the causative event, in the same period Fritz evaluated 43 patients reporting that only 11 had had tonsillar surgery [7].

The stylohyoid chain arises from the second Reichert's brachial arch, initially consisting of cartilage, in the second week of fetal life. During the third month Reichert's arch divides into four

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segments. The proximal segment (formed by an inferior part called the stylohyal and by a superior infratemporal part called the tympanohyal) gives rise to the styloid process. Respectively the ceratohyal, the hypohyal and the basihyal segment become, through ossification, the stylohyoid ligament, the hyoid minor horn and the hyoid body [8,9]. Ossification begins in the first or second year of life and is complete in 7 to 8 years [10]. Normal SP length varies between 2.5 and 3 cm Eagle 1949 [6], while Moffat et al.1977 [11] regarded the normal range as being between 1.5 and 4.8 cm. Generally, if the length is more than 3 cm, the process is considered elongated, and in 4% of the subjects, this elongation causes a plethora of symptoms known as Eagle's syndrome Eagle1958 [12]. The aim of the study is to assess the distribution of SP length in Jaipur population and its correlation with side asymmetry.

Material and Method

Present study was conducted in collaboration with department of Anatomy and department of Forensic Medicine at Jaipur National University Institute for Medical Sciences and research Center, Jaipur. A total of 38 dry skulls held by the Department of Anatomy were analyzed. The osteological collection consisted of disarticulated skeletons that had been selected 3 years previously for educational and research purposes. Included in the study were specimens that exhibited the two styloid processes without damage and/or fracture signs. The skulls of children, damaged skulls and skulls with pathological conditions were excluded from the study. An exclusion of 2 dry skulls was necessary, resulting in a sample of 38 skulls. As In two dry skulls both the styloid processes were damaged. Two points were determined to standardize measurements, which were obtained using a sliding caliper. The measures were as follows, Posterior Measure. This was obtained by measuring the distance from the tip of the styloid process to the flat surface on the side of stylomastoid foramen. Lateral Measure, This was obtained by measuring the distance from the tip of the styloid process to its base, on the side of it, where it joins the surface of the anterior wall of the ear canal.

Statistical Analysis

The measures were synthesized in one mean measure. Descriptive statistics involved the calculation of central tendency and dispersion measures for each side of the styloid process and for each anatomic position (posterior or lateral). We checked for the normal distribution of each variable, using small sample T tests ($p < 0.05$). We compared the measures for the both sides of the styloid process in each anatomic position, using small sample T test ($p < 0.05$).

Results

The results obtained from the metric parameters of the lengths are summarized in Table 1. There was a large variability in the length of left and right sides of the styloid process (in lateral and posterior views). There was no normal distribution for these measures ($p < 0.05$). The central tendency measures of each side in each view are presented on Table 1. In Posterior measure there is no as such significant difference between right and left styloid process according to our study. In Lateral measure there is a difference between right and left styloid process.

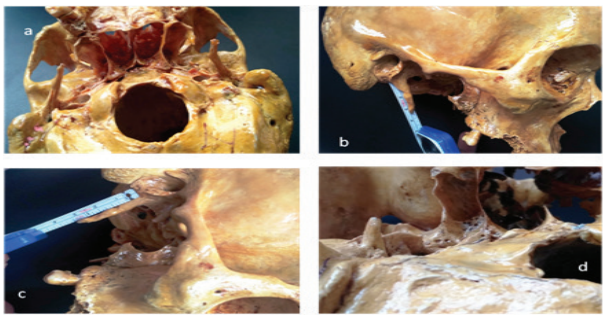

Fig. 1: a: Inferior view of the skull base, where the asymmetrical styloid processes appear, b: Posterior View and measurement of SP, c: Lateral view and measurement of SP d: Small size Styloid process.

Skull Details		Mean	Standard Deviation	Confidence Interval
Left	Lateral Measurement	1.15526	0.57643	1.1553 ± 0.1833
	Posterior Measurement	1.68684	0.62436	1.6868 ± 0.1985
Right	Lateral Measurement	1.42632	0.68721	1.4263 ± 0.2185
	Posterior Measurement	1.82895	0.69434	1.829 ± 0.2208

Left Lateral = Right Lateral P - value = 0.03323 < alpha = 0.05 Left Lateral = Right Lateral P - value = 0.17564 > alpha = 0.05

Discussion

The SP is located in the parapharyngeal area adjacent to the neural and vascular structures, which can be stimulated by the process elongation and/or angulation, resulting in a plethora of symptoms. Thus, meticulous knowledge of the anatomy of the process and surrounding structures is important for clinicians Piagkou et al. 2009 [13]. During embryological development, the SP came from Reichert's cartilage of the second pharyngeal arch [14]. Its length ranges from 15.2 mm to 47.7 mm [15], but other studies have found different dimensions: Jung et al. (2004) [16] suggested that the length of this bone process was longer when it presents more than 45 mm.

There are a variety of ways to determine the dimensions of SP and diagnose Eagle syndrome: panoramic radiographs, X-ray lateral views of the neck, orthopantomograms, and computed tomography. In addition, many studies are based on measurements of dry skulls or cadavers. In some cases the elongated SP can be clinically detected by palpating the tonsillar fossa [17]. These variations can occur due to the technique used to measure this length.

In the literature, the elongated SP is the most described type due to its association with clinical manifestations. Although Eagle's syndrome is thought to be caused by an elongated process, it has been documented that abnormal angulation rather than process elongation is responsible for symptoms Bas¸ekim et al. 2005[18]. The lateral angulation may impinge on the ECA bifurcation; the posterior may affect cranial nerves IX–XII; the ICA and internal jugular vein and the anteromedial angulation may irritate the tonsillar fossa Piagkou et al. 2009 [13]. In addition, branches of the mandibular nerve and the chorda tympani may be compressed and entrapped by a deviated process Rechtweg and Wax 1998 [19]

The variability of SP and especially its elongation may coexist with other ossification abnormalities, such as atlas occipitalization, paracondylar processes, ossified pterygoalar and pterygospinous ligaments Natsis et al. 2013 [20], torus palatinus Sisman et al. 2009 [21] and osteophytes of the cervical spine Guo et al. 1997 [22]. In addition, abnormalities of the vascular structures at the atlanto-axial level may occur in subjects with ossified SHLs.

Understanding the frequency of elongated SP in Jaipur can help clinicians diagnose Eagle syndrome and treat it. In the present study, the length of the SP ranged from 5 mm to 43 mm and from 10 mm to 46 mm, based on the lateral view of the left and right styloid, respectively. From the posterior view, the values for the left and right sides of the skulls, respectively, ranged from 10 mm to 54 mm and from 15mm to 58 mm. The normal length of SP varies in the literature from 15.2 mm to 47.7 mm, according to Mofft et al. 1977 [23]; measures less than 30 mm, according to Kaufman et al. 1970 [24]; and measures from 20 mm to 30 mm, according to Lindeman 1985 [25]. Considering the normal length of SP as defined by Eagle (i.e., 25 mm to 30 mm) 1937 [4], the presence of one elongated SP was observed in this research among 17 dry skulls with a prevalence rate of 5% of the total analyzed. The prevalence of elongated styloid process in the earlier studies was 1% [26], 4% [27], and 8.2% [28]. The 5% prevalence rate in the present study is similar to the rate observed by Eagle. Other Indian studies by Rathva et al. 2013 [29] reported the prevalence of elongated styloid process as up to 2%.

Apart from the clinical interest, SP elongation has forensic significance, as it may result in blood flow disturbances in the ECA or ICA (aneurysm, pseudoaneurysm, carotid artery dissection and sudden death) Dao et al. 2011 [30]. Furthermore, SP elongation helps in the identification of unknown individuals. Also the complete ossification of the stylohyoid chain may have medicolegal implications for manipulations of the cervical region due to the risk of fracture Vougiouklakis 2006 [31].

Conclusion

This article adds important information about the length of SP and its diversity in a previously unstudied population. Anatomical knowledge of the styloid process and elongated styloid process is clinically important because of its close proximity to important neurovascular structures. Any anatomical variations may present with compression symptoms, dysphagia and neck pain. This morpho-metric data of the styloid process is important to the physicians, neurosurgeons, otorhino-laryngologist and dentists for accurate diagnosis and treatment of dysphagia and chronic neck pain. The mere presence of an elongated styloid process does not automatically confirm a case of Eagle syndrome. The knowledge of SP variability apart from its anatomic value is of special interest for clinicians when managing atypical pain

in the head and neck area as well as for forensic medicine and medico legal cases. We believe that this study provides additional information about the frequency of elongated styloid process in the Jaipur population. Nevertheless, the actual research would be more accurate with a larger number of samples. Another limitation of the present study is the lack of gender-related variation which was not taken into consideration.

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Original Article

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Pattern of Congenital Anomalies: A Hospital Based Fetal Autopsy Study

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Abstract

Congenital malformations are most common cause of perinatal death. Antenatal imaging studies can easily detect the problem, and can give an idea of diagnosis. However autopsy still plays a pivotal role in confirming the diagnosis and identifying actual cause of fetal loss. *Materials And Methods:* This is a descriptive, cross-sectional study on 101 fetuses, over a period of 2 years from October 2014 to September 2016 referred to the Department of Pathology, Dr PSIMS & RF; which were an outcome of spontaneous abortions, intrauterine deaths, still births and of therapeutic abortions due to anomalies. This study is to determine overall incidence and distribution of various congenital anomalies and data was analyzed statistically. *Results:* Total 101 consecutive perinatal autopsy were performed, 31 (30.6%) fetuses showing congenital anomalies with female (16.8%) predominance and M:F ratio 1:1.2. Common congenital anomalies were observed in this study included central nervous system defects - anencephaly and meningomyelocele being common. Other systemic anomalies are genitourinary system, gastrointestinal system, respiratory and musculoskeletol system were seen. Multiple syndromes such as Prune-belle, Meckel- gruber were observed in this study.

Keywords: Perinatal Autopsy; Congenital Anomalies.

Introduction

Congenital Malformation can be a physical, metabolic or anatomic defect which may be evident before birth, at birth, or detected during the first year of life. The malformations can present itself in a single organ, single system, or may involve multiple organs of the body [1]. Congenital malformations remain a common cause of fetal deaths and accounts for 25-30% of fetal deaths in developed countries and 10-15% of fetal deaths in developing countries like India [2].

The malformations can be detected prenatally by ultrasound, maternal serum analysis etc.; and by autopsy after the fetal death. Fetal autopsies can provide a diagnostic clue to determine the cause of death. Various studies on fetal autopsy was found to be confirmative in 28.6-89%, diagnostic in 10-38%; provided additional information in 3.9-24% cases; and it had changed the predicted probability in 18% cases [3].

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Aims and Objectives

To represent an analysis of autopsy findings including congenital anomalies of fetuses and to study clinical and pathological findings (Gross & microscopic) in fetal death referred to department of pathology, Dr. PSIMS & RF.

Materials and Methods

This was a descriptive, cross-sectional study on 101 fetuses, over a period of 2 years from October 2014 to September 2016 referred to the Department of Pathology, Dr PSIMS & RF; which were an outcome of spontaneous abortions, intrauterine deaths, still births and of therapeutic abortions

due to anomalies. Maternal history, age and sex of the fetus were also recorded. Verbal and written consent was taken from the mother.

Autopsy was performed by standard technique adopted by Edith L. Potter. Each fetus was examined according to a predesigned protocol which included photograph, morphometric parameters, external examination, and internal examination by giving a straight line incision starting from chin to pubic symphysis passing to the left of the umbilicus. Skin and subcutaneous tissue was retracted. Cervical, thoracic, abdominal, pelvic cavities were opened and any deviation from the normal anatomy noted. The autopsy protocol included the removal of thoracic, cervical, abdominal and pelvic organs en block and subsequently dissected into organ blocks. Tissues from the organ blocks were sent for histopathological examination. The placenta, fetal membranes and umbilical cord were also studied. All the available information was correlated to ascertain the cause of death.

The types of birth defects were classified according to International statistical classification of diseases and related health problems, 10th revision (ICD-10). The study was approved by the Institutional Ethics Committee (Dr PSIMS &RF).

Results

Out of total 101 fetal autopsies, 51 (50.49%) specimens were from intrauterine deaths, 38 (37.62%) were from induced abortions followed by 12 (11.88%) specimens from neonatal deaths.

A total 101 fetal autopsies, 44 were males and 57 were female fetuses; out of which the incidence of congenital anomalies in males and females was 13.8% and 16.8% respectively.

When the maternal age was taken in to account, most of the fetal deaths were seen in mothers in the age group of 21-30 years corresponding to 72.27% of cases. Out of these cases 23.7% presented with anomalies.The incidence of fetal deaths was highest in primigravida which accounted for 76.2% of cases.

Out of 101 foetal autopsies, Congenital anomalies were seen in 31 cases which accounts for 30.6% of fetal deaths. Most of the cases were that of the central nervous system, (11cases, and 35.48%), of which anencephaly and myelomeningocele were the predominant.

The second most common congenital malformations were seen in genitourinary system (16.12%), followed by gastrointestinal system (12.9%), cardiovascular system (6.45%), respiratory and musculoskeletal system (3.22%). In the miscellaneous group (22.58%) 7 cases were encountered which included 2 cases of single umbilical artery, 2 cases of cystic hygroma, 1 case of diaphragmatic hernia, and 2 cases with multiple anomalies, leading to probable syndromes like Prune Belle Syndrome and Meckel Gruber Syndrome.

Table 1: Incidence of fetal & neonatal deaths

	No. of cases	Percentage%
Intrauterine deaths	51	50.49
Induced abortions	38	37.62
Neonatal deaths	12	11.88
Total	101	100

Table 2: Congenital anomalies in relation to sex

Anomaly	Sex		Total
	Male	Female	
Absent	30	40	70
Present	14 (13.8%)	17 (16.8%)	31
Total cases	44	57	101

Table 3: Congenital anomalies encountered in autopsies as per maternal age

Maternal age in years	Anomaly		Total
	Absent	Present	
<20	20	4	24
21-30	49	24 (23.76%)	73 (72.27%)
>30	1	3	4
Total	70	31	101 (100%)

Table 4: Congenital anomalies encountered in autopsies as per gravid

Gravida	Anomaly-Absent	Anomaly-Present	Total
Primi	52	25	77 (76.2%)
Second	8	4	12
Third	6	1	7
Fourth	3	0	3
Fifth	1	0	2
Total	70	31	101 (100%)

Table 5: System wise distribution of congenital anomalies

	Type of anomaly	No : 31	Percentage 100 %
1	CNS	11	35.48
2	GUT	5	16.12
3	GIT	4	12.9
4	RS	1	3.22
5	CVS	2	6.45
6	MSK	1	3.22
7	Miscellaneous with Multiple anomalies	7	22.58

Table 6: List of anomalies

Anomalies of central nervous system	
Type	**No. of cases**
Anencephaly	3
Myelomeningocele	3
Hydrocephaly	1
Choroid plexus cyst	1
Meningocele	1
Lissencephaly	1
Acrania with amniotic bands	1
Anomalies of Gastro intestinal system	
Type	**No of cases**
Gastroschisis	2
Omphalocele	1
Cleft lip and cleft palate	1
Anomalies of the Genitourinary system	
Bilateral Multicystic Renal dysplasia	3
Bilateral Renal Agenesis	1
Single kidney	1
Anomalies of Cardiovascular system	
Cardiac Hypoplasia	1
Cardiomegaly	1
Anomalies of Musculoskeletal system	
Arthrogryposis multiplex congenita	1
CTEV	2
Anomalies of Respiratory system	
High airway obstruction syndrome	1
Miscellaneous with multiple anomalies	
Diaphragmatic hernia	1
Cystic hygroma	1
Cases with Multiple anomalies	2
Potter sequence	1
Probable Syndromes considered	
Meckel Gruber Syndrome	1
Prune Belly Syndrome	1

Table 7: Number of Anomalies Comparison with other studies

System involved	Sunethri et al [5]	Datta et al [9]	Present study
Central nervous	12	5	11
Genitourinary	7	3	5
Gastrointestinal	8	8	4
Cardiovascular	1	2	2
Respiratory	0	0	1
Musculoskeletal	0	3	1
Miscellaneous	0	24	5
Syndromes	0	3	2
Total	28	48	31

Fig. 1: Anencephaly

Fig. 2: Potters Sequence(external rotation of both lower limbs, low set ears, pre auricular tags, depressed nasal bridge, with multi cystic renal dysplasia in box)

Fig. 3: multiple anomalies such as absence of two digits on right foot, imperforate anus, absent spleen, single enlarged multicystic dysplastic kidney and single umbilical artery

Discussion

Over a ten year period, there has been a decline in the number of fetal autopsies. Fetal autopsy, however was found to contribute significantly to the diagnosis of Intrauterine fetal death and to detect congenital anomalies [4]. Hence the present study was an attempt to study various parameters responsible for still birth, intrauterine death or therapeutic cause for termination and significance of autopsy in making final diagnosis.

In the present study on 101 fetal autopsies, 31 cases (30.6%) had showed congenital malformations. This incidence was slightly higher in comparision with the study by Sunethri et al [5] where it was 27%, and was less with the incidence observed by Harsha Mohan et al.[6] (38.7%). In the present study CNS malformations were most common Majority were due to defective closure of neural tube between the 23rd and 26th day of gestation resulting in anencephaly or meningomyelocele. Out of 3 cases of anencephaly, one case was associated with cleft lip and cleft palate. Our study is in accord with the study of Tomatir AG et al.[7]. (31.1%), and Swain et al.[8] (39.5%). Out of 3 cases of myelomeningocele, one case was associated with bilateral CTEV and had a history of Arnold –Chiari malformation.

The second most common congenital anomalies were encountered in genitourinary system. The present study coincides with the observations of Sankar et al.[2] (17.2%). Multicystic renal dysplasia was the most common presentation of which one case was presented with cystic hygroma. Gastrointestinal system anomalies (12.9%), in which gastroschisis was the most common, of which one case was associated with cystic hygroma and absent right lower limb.

The observation of the present study was also compared with studies of Sunethri et al. [5] and Datta et al. [9] and was found to accord more with the observations of Sunethri et al. [5].

A total of five cases with multiple anomalies were encountered and we discuss them. The first case was a 17 weeks female fetus born to 24 year old women with history of severe oligohydramnios had external rotation of lower limbs, low set ears, pre auricular tags, depressed nasal bridge and multi cystic renal dysplasia resulting in Potters Sequence.

The second case was a 13 week dead fetus with distended abdomen with deficient anterior abdominal wall muscles and imperforate anus. On opening the abdomen, bladder was markedly distended and measured 4 cm in diameter and was filled with clear fluid. Both the right and left kidneys showed total replacement of the renal parenchyma by the dilated pelvicalyceal system along with bilateral cystic renal dysplasia. The findings were suggestive of Prune belly syndrome.

The third case was a 19 weeks female fetus with multiple anomalies such as post axial polydactyly, single umbilical artery, absent anal opening, single fissure in right lung, incomplete left lung fissure, absent left kidney, and single ectopic kidney with cystic renal dysplastic changes. Possible syndrome considered was Meckel Gruber Syndrome, though we did not see classical meningocele association and hence advised cytogenetic analysis for further confirmation.

Fourth case was a 12 weeks male fetus born to 22 year old women with anterior abdominal wall defect, absent right limb, with cystic hygroma. Fifth case was a 19 weeks terminated male fetus born to 29 year old women with history of severe oligohydramnios had showed multiple anomalies such as absence of two digits on right foot, imperforate anus, absent spleen, single enlarged kidney with multicystic renal dysplasia and single umbilical artery.

Conclusion

Foetal death is common clinical problem and the family seeks and deserves answers regarding the cause of death. The findings shall helps in parental counseling and future pregnancy planning.

Now a days, merely decline in autopsy rates, continous presentation and publication of the fetal autopsy findings shall rejuvinate the dying science and create awareness to encourage foetal autopsies and genetic studies by Gynaecologists, Radiologists, Paediaticians, and Pathologists as a team work.

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A Retrospective Observational Study of Delayed Death in Rescued Hanging Cases

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Abstract

Introduction: Hanging is one of the most common mode of suicide in Asian countries as well as countries worldwide. Survival period in hanging does not follow a fixed pattern and fatality varies from few seconds to few minutes depending upon various factors such as duration of suspension, type of ligature material, force applied for compression of neck, position of the person etc. Victims usually fail to resist pressure and succumb to death speedily almost within few minutes. However in a few reported cases patient has survived for certain period after immediate and prompt resuscitative measures, but died at a later stage which can specifically be called as delayed or near hanging death. More than 25-30% of suicidal death cases due to hanging are reported in India and the data is expanding every year. We have studied certain number of cases in which people of young adult groups succumbed to death following consequent complications after rescued hanging. *Aims & Objectives:* The present study is conducted to analyse the cases of delayed death in hanging and their comparison with other cases of hanging as well as preventive aspects in such cases. *Materials and methods:* Total Nos. of delayed death in hanging were 07 during 2016 and 2017, among 131 cases of death due to hanging autopsied, which were brought to mortuary of KGH, Raigarh (C.G.), during the period of January 2016 to December 2017. *Observations & Results:* In our study, Male: Female= 1:6, Partial: Complete Hanging= 1:6, Age group-16-36 years, Cause of death= H.I.E followed by pulmonary oedema, Survival period= 24-48 hrs, in one case victim survived around seven days. Soft & Hard materials were used for the purpose of hanging. *Conclusion:* Predominant cause behind death is HIE and pulmonary oedema. Overcoming critical period can reduce morbidity and mortality.

Keywords: Rescued Hanging; Delayed Death; Near Death; Suicide; HIE.

Introduction

Hanging or self suspension is a type of violent asphyxial death which is caused by complete or partial suspension of the body by the ligature material encircling the neck and force of constriction being at least part of the weight of the body. It is one of the most common mode of painless death. There are several mechanisms of death in hanging but death usually occurs due to asphyxia or cerebral anoxia or vagal inhibition leading to cardiac arrest and scientifically it has been proven that pressure or force of minimum 2 kg (4.4 lbs) is sufficient to bring about death. Effective killing potential with mortality is 80-85% in hanging cases. Hanging is almost always suicidal. Homicidal hanging cases are extremely rare. Suicidal hanging is more common in India and China. Recent trends and statistics show hanging to be the commonest mode of commission of suicide in India followed by consumption of a poison.

Sometimes victim of hanging live for some period and sometimes even survive the hanging. The term *"near hanging"* refers to patients who survive a hanging injury long enough to reach the hospital. A person can be saved only if specific aggressive resuscitative clinical measures are applied, when rescued within a few minutes of commission of suicidal attempt. Only a few persons survive this critical period. The morbidity and mortality in survivors of delayed hanging death cases occurs

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due to variety of mechanism but most cases succumb to fatal complications after surviving for some time. Most cases die due to respiratory and neurological complications such as hypoxic ischaemic encephalopathy, aspiration pneumonia, infection and pulmonary oedema.

Review of Literatures

In Indian scenario Verma et al. (2000) [1], Aggarwal et al. (2000) [2], Nithin MD et al. (2011) [3], Bhoi etal (2013) [4], Kumar etal (2014) [5], Kumar et al. (2014) [6], Khetre et al. (2014) [7] Gadhari et al. (2015) [8], Sane et al. (2015) [9], Maled (2016) [10], Debbarma et al., (2016) [11] had documented the incidents of delayed death in hanging cases with it's causes. Apart from Indian scenario Maxeiner (1987) [12], Hausmann et al. (1997) [13] and Virendra Kumar (2007) [14] also reported such kind of cases (i.e. delayed death in hanging) from abroad.

Materials and Methods

The present cross sectional prospective study consists of total seven cases of delayed hanging death out of 131 cases of total hanging cases during two year period from January 2016 to December 2017. The data were collected from police inquest reports, hospital record and interview of relatives and family members of deceased. Out of 7 cases 4 cases reached at tertiary health care centre from other health care centers as referred one. In this study the subjects were included irrespective of caste, religion, dietary habits and socio-economic status.

Table 1: (P.M. Statistics)

Year	Total No. of P.M. Examination	Total No. P.M. examination of Hanging cases	Total No. of P.M. of delayed death in Hanging
2016	564	71	2
2017	515	60	5
Total	1079	131	7

Table 2: (Distribution of Hanging Cases in Male and Female Study Subjects)

Case No.	Age in years	Sex	Place of hanging	Type of suspension (Complete/ Partial)
1	18	F	Residence	Partial
2	35	M	Residence	Complete
3	33	F	Residence	Complete
4	36	F	Residence	Complete
5	16	F	Residence	Complete
6	22	F	Residence	Complete
7	19	F	Residence	Complete

Above table 2 shows distribution of cases of delayed death in hanging. The table shows that hanging cases are more common in young and adult age groups. The cases are more common in females as compared to males. Most of the cases are occurring inside home. In the present study maximum number of cases were of complete hanging while only one case shows partial hanging. (Table 2)

Results and Observations

Pictorial depiction of ligature marks in rescued hanging cases

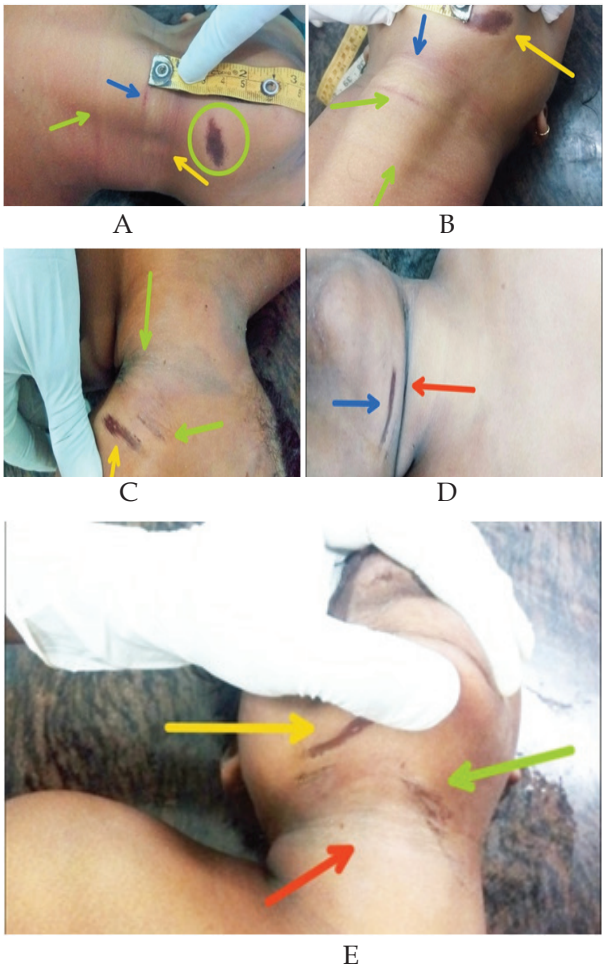

Fig. 1: A= Encircle part shows pressure abrasion mark below the chin and arrow marks show faint reddish ligature mark, B = Yellow arrow shows pressure abrasion mark, green and blue arrow indicates faint reddish ligature mark, C= Yellowish arrow shows pressure abrasion, whereas greenish arrow indicates faint greenish black ligature mark, D= Bluish arrow indicates pressure abrasion and reddish arrow indicates prominent ligature mark, E= Yellow arrow indicates prominent pressure abrasion, while greenish arrow indicates slight pressure abrasion and reddish arrow indicates faint ligature mark.

Table 3: Distribution of Ligature Material and its imprints over neck, Survival Period & Clinical course

Case No.	Ligature material	Visibility of ligature mark	Conscious/unconscious during the course of treatment	Survival Period
1	Dupatta	Yes	Unconscious	24-48 hours
2	Nylon rope	Yes	Unconscious	24-48 hours
3	Plastic rope	Yes	Unconscious with status epilepticus	24-48 hours
4	Scarf	Yes	Unconscious with status epilepticus	Around 7 days
5	Dupatta	Yes	Semi conscious to unconscious with status epilepticus	24-36 hours
6	Dupatta	Yes	Unconscious	24-36 hours
7	Dupatta	Yes	Unconscious	Less than 24 hours

Above table 3 shows that ligature mark was visible in almost all the cases. Among study subjects both hard and soft materials were used as ligature material. The table also shows that Period of survival was 24-48 hours in most of the cases, while in one case subject survived for 7 days, whereas survival period in another case was less than 24 hours. All the patients were unconscious during the course of the treatment and some also suffered from status epilepticus (Table 3).

Table 4: Distribution of Autopsy Findings in Neck Structures and Internal Organs

Case No.	Hyoid Bone	Thyroid Cartilage	Lungs	Brain	Cause of Death
1	Intact	Intact	Congested, intact	Congested	Asphyxia with cerebral anoxia and HIE
2	No	No	Congested, intact	Congested	Asphyxia with cerebral anoxia and HIE
3	No	No	Congested, intact	Congested	Pulmonary oedema with HIE
4	Intact	Intact	Congested, oedematous, intact	Congested, oedematous	Acute ARDS with aspiration pneumonitis and septicaemia
5	Intact	Intact	Congested, intact	Congested, intact	Acute Pulmonary oedema with HIE
6	Intact	Intact	Congested, intact	Congested, intact	Cerebral anoxia with acute encephalopathy, ARDS and shock
7	Intact	Intact	Congested, intact	Congested, intact	Acute Pulmonary oedema with HIE

HIE= Hypoxic Ischemic Encephalopathy, ARDS=Acute Respiratory Distress Syndrome

Above table 4 shows distribution of post-mortem findings in neck structures and internal organs. Hyoid bone and thyroid cartilage is intact in all cases. In most cases lungs and brain were found. congested and intact. In most of the cases cause of death was HIE followed by pulmonary oedema. In no any case, active surgical intervention like tracheostomy was performed (Table 4).

Discussion

Hanging denotes suspending the body by ligature material by encircling the same around the neck. It is one of the widely used methods of commission of suicide since it ensures narrow failure and painless death [15]. Young adults adopt hanging as a very common method of suicide [16]. In Indian scenario hanging constitutes about 25% of total number of suicides [17]. There are also reported cases where victims of near hanging were survived with complete neurological recovery [18,19]. In our study we found delayed death in hanging was occurred in both male and female subjects, the same thing was found in the study of Sane et al. (2015) [9] and Debbarma et al. (2016) [11], females are more prone to commit suicide than males [21], age range of victims were 16-36 years, which matches with other studies [9,11]. In the study conducted at Raigarh survival period of the victims were 24-48 hrs and in one case survival period was 7 days, there are references from other authors in the same aspect i.e. survival after hanging. [2,3,4,6,20]. In two cases hard material was used as a ligature material, even in the study of Sane et al. (2015) [9] and Debbarma et al. (2016) [11], where it was documented that incidents of delayed death in hanging also occurs in hard material used as ligature material. Delayed death in Hanging may occur in cases of both partial and complete hanging, which also matches with the other studies. [9,11]. In six out of total seven cases patients remained unconscious during the whole course of treatment, that can be matched with other studies [9,11].

Conclusion

Delayed death in hanging is a rare phenomenon. It has been observed that most of the cases suffered from HIE, apart from that pulmonary oedema and ARDS are the root causes behind death. Still today no standard framework has been devised which can make a rescued patient of hanging "out of danger". Duration of hanging and time between rescue and initial resuscitation is one of the shortcomings of our study, so for the purpose of reduction of this critical period, it is necessary to augment the critical care facilities at primary level.

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Dermatoglyphics Pattern in Patients with Ischemic Heart Disease

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Abstract

Objective: To study the association of Dermatoglyphics with Ischemic Heart Disease and it can be also helpful in identification of persons in court of law. *Study design:* Descriptive study *Place and duration of study:* Data was collected for the study which was conducted at Al-Ameen Medical College & Hospital, Bijapur, Karnataka from April 2017 to June 2017. *Materials and methods:* Finger prints were collected from the subjects after obtaining their informed consent in the month of 1 April, 2017 to 15 June, 2017. A total of 100 IHD diagnosed patients were selected from the OPD of Al-Ameen Medical College & Hospital and data were analyzed. The finger prints of both the hands were recorded on a plain white paper with a stamp ink pad by rolling method and each finger print was assigned by their Name, Age, and Sex. *Results:* A total of one hundred patients were selected for this study which were all known case of Coronary Heart disease patients. Out of these one hundred patients the majority of the patients were belonging to whorl pattern of finger prints i.e., 90 (57%) where as the number of patients belonging to Loop pattern was 40 (29%) pattern of Arch and composite was same i.e., 10 (7%) each, and so these various types of fingerprint patterns can be used for genetic correlation and screening. *Conclusion:* Majority of the patients was belonging to whorl pattern of finger prints followed by patients belonging to Loop pattern and the least patterns were Arch and composite. Each fingerprint is unique hence it can also be very effectively used as an evidence for identification in the court of law.

Keywords: Dermatoglyphics; Ischemic Heart Disease; Whorl; Loop; Arch; Court of Laws; Identification.

Introduction

The term dermatoglyphics was first coined by Cummins and Midlo in 1926 and was derived from Greek words "derma" means skin and "glyphic" means carvings. So dermatoglyphics is the scientific study of epidermal ridges their configurations on the palmar region of foot and toes. The type of fingerprint is unique based on the genetical characteristics of each individual. In the recent decades, a considerable improvement has been achieved in the concept of relation between the types of pattern of lines on the fingers and some individual disorders [1,2,3]. Genetic predisposition is one of the known risk factors, and studies have been previously done to establish the relation between dermatoglyphic pattern and cardiovascular diseases. Some studies also reports medical literature regarding the relation between dermatoglyphic pattern as an indication of genetic susceptibility in the incidence of Myocardial Infarction [5,6]. Ischemic Heart Disease (IHD) is the most common, serious, chronic, life-threatening illness in the developed world. High fat and energy rich diet, smoking, and a sedentary life-style are associated with its emergence. Obesity, insulin resistance, and type 2 Diabetes Mellitus are powerful risk factors for Ischemic Heart Disease [20]. A substantial increase in Ischemic Heart Disease is projected worldwide, and Ischemic Heart Disease is likely to become the most common cause of death worldwide [5]. IHD is the leading cause of mortality and morbidity worldwide with more than 4.5 million deaths occurring in the developing world. In the United States only, 1.5 million people are suffering from myocardial infarction annually out of which 45% of them are under 65 years [6].

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Epidermal ridges are formed between 11th and 24th week of gestation; after this period epidermal ridges do not change [8]. The critical growth of the brain is also occurring during this period. Since the skin and brain develop from the same ectoderm, dermatoglyphic variations are informative for early developmental brain disturbances [9]. There are three basic patterns of finger prints named Arch, Loop, and Whorl [10]. The arch type is divided to two subgroups: simple and tented and the loop type is divided to two subgroups: radial and ulnar [7]. The whorl type is divided to five subgroups as simple, central packed loop, twinned loop, lateral packed loop, and accidental [7]. The pattern area is the part of a loop or whorl which contains the core delta and ridges. Total finger ridges count is the most inheritable feature in dermatoglyphics. The most common pattern, a simple Loop (60-70%) is characterized by single triradius, is not advantageous for tactile perception and precession group. Whorl has two tri radi yielding two central, while simple arches have no true triradi, resulting in zero count [11,13,15] the dermatoglyphics are having some distinguishing features i.e. they are unique, permanent, universal, inimitable and classifiable.

Materials and Methods

Finger prints were collected from the patients after obtaining their informed consent in the month of 1 April, 2017 to 15 June, 2017. A total of 100 known cases of coronary heart disease patients were selected from the OPD and data were analyzed at Al-Ameen Medical College Bijapur. The finger prints were obtained by the method suggested by Cummins and Midlo. Finger prints were recorded on a plain white paper with a stamp Ink pad by rolling method and each finger print was labeled on the proforma by their Name, Age and Sex. Ethical clearance was obtained from the Institutional Ethical Committee. The study design was descriptive one. Patients of both sexes were diagnosed as a case of Coronary artery disease and belonging to and any ridge pattern of finger prints were included in the study. All those individual patients with history or family history of any disease like diabetes, mental illness, chronic skin diseases eczema, leprosy and chronic dermatitis, having scars, congenital or acquired anomalies due to trauma on fingers were excluded in this study.

Both the hands were thoroughly washed with soap and dried before taking the finger prints. Impression of all fingers and thumbs of both hands were taken by rolling the fingertips from medial side to laterally on a stamp ink pad and then on plain white paper. A proforma was designed in which data including name, age, and sex were entered. Screening of finger prints were done by using magnifying lens and scanner. Based on this data, the case had been diagnosed by direct supervision of a cardiologist. The dermatoglyphic pattern in patients with myocardial infarction is an interesting matter and little information is available about this relationship. The main objective of this study is to investigate the relation between the dermatoglyphic patterns with IHD and can also be effectively used as an evidence for identification in the court of law.

Results

The present study recorded the finger print patterns of all 10 fingers of 100 persons of age group 35-70 years. Analysis in this study was descriptive. A total of one hundred patients participated in this study which were all known case of coronary heart disease. Out of these one hundred patients the majority of the patients were belonging to whorl pattern of finger prints i.e. Ninety 57% where as the number of patients belonging to Loop pattern was Forty 29% pattern of Arch and composite was same i.e., Ten 7% each. There is need to develop a detailed and vast study to explore the association of finger print pattern with Ischemic Heart disease. This study offered sensible weighting on distribution of finger print pattern among the Ischemic heart disease patients. This study was only limited to Al-Ameen Medical College Hospital OPD patients and limited only to ischemic Heart disease patients. The study was considered on small and selected area, and if it will be conducted on Nationwide on larger scale we can find out the expected morbidity and mortality (Table 1-3).

Table 1: Distribution of finger print patterns viz-à-viz digits

Digit	Whorl	Loop	Arch
Thumb Finger	64	29	7
Index Finger	61	29	7
Middle Finger	61	33	7
Ring Finger	73	25	3
Little Finger	78	18	5
Total	337	134	29

Table 2: Distributions of primary finger print patterns in all fingers of both hands

Pattern of Finger Prints	Numbers	Percentage (%)
Whorl	337	67.40 %
Loop	134	26.80 %
Arch	29	5.80 %
Total	500	100 %

Table 3: Distribution of whorls, loops and arches among males & females

Digit	Sex	Whorls	Loops	Arches
Thumb (N=50)	Male	30	11	03
	Female	34	18	04
Index Finger (N=50)	Male	24	13	04
	Female	37	16	03
Middle Finger (N=50)	Male	27	12	06
	Female	34	21	01
Ring Finger (N=50)	Male	32	13	01
	Female	41	12	02
Little Finger (N=50)	Male	36	10	02
	Female	42	08	03

Discussion

The role of finger printing should not be underestimated and the patterns of finger prints are unique to each and every individual due to their uniqueness, they can be used to identify the culprits at crime scene and blast injuries and in mass disaster injuries and as well as for national identification 12. Identification is a set of individual physical characteristics, functional or psychic, normal or pathological that defines an individual 17. Dermatoglyphic is a scientific method for anthropological, medico legal and genetic studies 12. A number of studies have indicated dermatoglyphic correlation in a large number of genetic disorders, which include diabetes mellitus 16, Schizophrenia 14, Congenital heart disease 18, and down syndrome 20. Coronary artery disease is the most important cause of mortality and morbidity in the world 7. In our study we found Out of the one hundred and forty patients the majority of the patients were belonging to whorl pattern of finger prints i.e., 90 (57%) where as the number of patients belonging to Loop pattern was 40 (29%) pattern of Arch and composite was same i.e.,.10 (7%) each. The reason for such type of result might be due to sampling fluctuation, or the sample size is not adequate, sampling error or these two variables are independent and do not effect each other. Similar studies should be conducted on a larger sample at the National level so as to increase the accuracy of prediction [22]. A study by Rashad M.N on Japanese subjects, showed individuals with which shows significantly higher frequency of true whorls and correspondingly lower frequency of Ulnar Loop than the control may be supported the same [21]. Whereas another study done in Karachi, whorl pattern is predominant 48% followed by Loops 42.5% and than Arches 4.8% which is similar to the done in India [17]. Finger print patterns are related to genetic predisposition to various disorders [22]. Bhatt [23] in 1996 presented data showing significant higher incidence of whorl and lower incidence of loops in patients with MI.

Conclusion

According to the observations made by this present study add support to these earlier observations. It is apparent that there do exists a relation between dermatoglyphic patterns and IHD.

So it can be concluded that at present the IHD is most important cause of mortality and morbidity in the world and causes more death and disability with huge economic cost than any other illness in both developing and developed countries, the prevalence of risk factors for IHD is increasing everywhere especially in India. Majority of the patients was belonging to whorl pattern of finger prints followed by patients belonging to Loop pattern. With regard to high incidence of Myocardial infarction the knowledge of dermatoglyphics can be utilized to find out the genetic correlation. Each fingerprint is unique hence it can also be very effectively used as an evidence for identification in the court of law.

Recommendations

1. With the help of fingerprint pattern it might be helpful for screening of persons for IHD in rural areas where there are lack of diagnostic facilities.
2. Similar studies should be conducted on a larger sample at a National level so as to increase the accuracy of prediction.
3. There is a need to evaluate the finger printing in genetical diseases along with familial diseases.
4. There is a need to establish Finger printing bank for research purpose.

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Estimation of Stature by Multiplication Factor using Head Length in South Indian Population: A Cross Sectional Study

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Abstract

Background: Identity of an individual is an imperative aspect in any kind of investigating procedure. There are numerous ways and means to do so in human beings (alive or dead), when a human body is in its entirety, but very few when only a part of it is available. In such cases, complete identification becomes unlikely and partial identification assumes importance to proceed into further investigations. There are various data available for identification. The height (stature) of an individual is one of them. There is scanty information regarding stature estimation by multiplication factor using head length in South-Indian population. *Material and methods:* The present study is a crosssectional study includes 200 south Indian student population of S. Nijalingappa Medical College, Bagalkot. *Aims and objectives:* To correlate head length with stature, and to derive multiplication factor that can be applied for estimation of stature in South Indian population. *Results:* The average stature in the present study is 172.44 cm for males and 159.49 cm for females and the average head length from Nasion to Inion is 18.18 cm for males and 16.77 for females and from Glabella to Inion is 18.69 cm for males and 17.28 cm for females. *Conclusions:* There is a positive correlation between the head length with that of stature. The estimation of stature by derived multiplication factors are equally valid and can be used upon the South Indian population with fair degree of accuracy.

Keywords: Stature; Head Length; Multiplication Factor; South Indians; Anthropology.

Introduction

Stature is one of the various parameters of identification for establishing individuality of the person. It is well known that there is a definite relationship between the height of the person and various parts of the body like head, trunk and lengths of upper and lower limbs. The assessment of height of an individual from measuring different parts of the body has always been of immense interest to the Anatomists, Anthropologists and Forensic experts [1].

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The estimation of height from various parameters has been done by various workers. They have derived their own formulae for calculating the stature from different body parts. Universally applicable formulae have not been derived because the relationship between height and different body parts (long bones or other measurements) differ according to race, age, sex and side of the body. It is proved that each race, and age group require its own formulae [2].

There is no universally acceptable formula to express relationship between stature and head length of an individual. Estimation of stature of an individual in India by using formulae given by western workers involves an error of 5-8% [3]. Various factors like race, sex, side of body, climate, heredity and nutritional status are attributed to variations in the ratios of length of different bones to that of stature[4,5,6]. It is opined that the study of residents of one state is not necessarily applicable to the residents of another state [7].

Thus this work is undertaken because, our study includes subjects from South India (Karnataka,

Andhra Pradesh, Kerala and Tamil Nadu) and the only available method for stature estimation in South Indians is by using multiplication factors derived for Mysoreans [8]. Literature regarding multiplication factors from this part of the world is scant. Our study will be useful for identification of a person by estimating stature when only a head of the dead body is available.

Aims and Objectives

To correlate the stature with head length and to derive multiplication factor using a nasion to inion and glabella to inion head length to estimate the stature.

Materials and Methods

a. Source of data and materials: The south Indian student population (Karnataka, Andhra Pradesh, Tamil nadu and Kerala) of S. Nijalingappa Medical College, Bagalkot.

b. Study design: Cross-sectional study.

c. Sample size: 200 (100 male and 100 female)

d. Methodology:

Inclusion Criteria

1. Students hailing from Karnataka, Andhra Pradesh, Tamil Nadu, and Kerala.
2. Chronological age group above 18 years.
3. Both the sexes.

Exclusion Criteria

1. Students unable to stand.
2. Any pathological conditions of bones and limbs e.g., fractures, dislocations, poliomyelitis, osteoporosis, rickets, scoliosis and kypho-scoliosis etc.
3. Congenital anomalies.
4. Dwarfism and Gigantism.
5. Steroidal therapy.

e. Data collection: The study was performed in adherence to the principles established with the declaration of Helsenki (2000) and written consent was obtained for every student and all female subjects were examined in the presence of another female. Various socio-demographic factors and the following anthropometric data were entered in the pretested proforma. The measurements were taken at fixed time between 2 to 5 p.m. in order to eliminate discrepancies due to diurnal variation.

1. Standing height (Stature)

The subjects were made to stand bare foot on a base-board of a stadiometer in the Frankfurt plane where his/her head will be parallel to the floor with heels together and the weight evenly distributed between both feet. The height is measured in centimetres from the ground to the highest point on the subject's head with the head piece of stadiometer firmly contacting the scalp.

2. Head Length

Subjects were made to sit on a chair keeping head looking straight and measurement will be taken with spreading calipers between two points nasion to inion and glabella to inion. Head length is measured in centimetres.

Multiplication factor for the individual head length were calculated for each person and mean of all was calculated. The following equation was used to get the multiplication factor:

$K=H/L$

Where, H= Height, L = Length of head

K= A constant multiplication factor which was specifically determined for individual head length from the various data so obtained. After taking the measurements, statistical analysis is done using statistical regression equations as given below:

$\sum y = Na + b\sum x$

Where, $\sum$ = Sum value, y = Value of stature, N = Number of cases studied, x = Value of Head length, a = Unit greater than x value by y value, b = Regression coefficient.

From the above equations, regression formulae, standard errors and co-efficient of correlations were developed to fulfil the aims and objectives of the study. The multiplication factors so obtained were tested on a fresh sample (100) of south Indian population in order to validate the outcomes.

Results

The average stature in the present study is 172.44 cm for males and 159.49 cm for females and the average head length from Nasion to Inion is 18.18 cm for males and 16.77 for females and from

Glabella to Inion is 18.69 cm for males and 17.28 cm for females. The results are presented in the form of Mean ± SD (Min-Max). (Table 1).

Table 1: Showing average standing Height and Head Length (HL)

	Height	Nasion-Inion(N-I)	Glabella-Inion (G-I)
Male	172.44 5.34 (160 – 184)	18.18 1.05 (15.9 – 20.5)	18.69 1.05 (16.3 – 21)
Female	159.49 6.19 (136 – 178)	16.77 1.29 (13.2 – 19.8)	17.28 1.29 (13.7 – 20.3)

Head length from Nasion to Inion (N-I) and Glabella to Inion (G-I) shows a positive correlation (Karl Pearson's) with stature for male, female and combined (both male and female) with p-value < 0.001 (Table 2).

Table 2: Showing correlation coefficient(r) between height &Head Length (HL)

Head Length	Male		Female		Combined	
	R	P	R	P	R	P
N-I	0.507	< 0.001	0.440	< 0.001	0.651	< 0.001
G-I	0.530	< 0.001	0.428	< 0.001	0.652	< 0.001

The multiplication factors for head length for both males, females and combined were derived. (Table 3)

Table 3: Showing Multiplication Factors

	Male	Female	Combined
N-I	9.51(0.46)	9.55(0.64)	9.53(0.56)
G-I	9.24(0.43)	9.26(0.61)	9.25(0.52)

When the estimated stature by derived multiplication factors was compared with the estimated stature by regression equation, the average difference is < 1cm. this difference was statistically insignificant (p > 0.05). Thus, the derived multiplication factors are equally valid.(Table 4).

Table 4: Showing comparison between the estimated stature by Regression Equation (R.E.) and stature estimated by Multiplication Factors(M.F)

	Head length	Mean difference between predicted height and estimated height(in cms)	Standard Deviation	Degree of freedom	Paired t	P
Male	NI	0.41	7.31	99	0.564	0.574
	GI	0.38	6.89	99	0.552	0.582
Female	NI	0.71	9.63	99	0.743	0.459
	GI	0.66	9.28	99	0.717	0.475
Combined	NI	0.58	7.43	199	1.105	0.271
	GI	0.53	6.99	199	1.071	0.286

Discussion

We have estimated the stature amongst the South Indian student population of S.Nijalingappa Medical College, Bagalkot. The students were an admixture of equal number of population from South India (Karnataka, Andhra Pradesh, Kerala and Tamil Nadu), i.e. 50 students from each state

In present study, we have observed positive correlation between head length and height in the age group of 18-29 years with correlation coefficient of 0.507 (N-I) and 0.530 (G-I) in males and 0.440 (N-I) and 0.428 (G-I) in females. Head length was measured from nasion to inion and glabella to inion according to Ashley Montagu [1] and Indera P Singh.

Being the second most common method in practice, the stature so estimated from percutaneous bone length with the help of formulated multiplication factor is compared with average living stature and stature estimated by regression formula. The average multiplication factor is calculated in this study as per method proposed by Pan [13] in 1924.

These multiplication factors vary from one another. As per principles of statistics, finding a multiplication factor by considering averages is not accepted as a sound and satisfactory method.

According to Lal C.S and Lala J.K. [14] (1972) Multiplication factor (M.F) remains more or less constant in age group of 18-21 years. In present study similar age group was selected for study. Some of the authors derived the multiplication factor for long bones to get the stature, but the data regarding multiplication factor for head length is scant.

According to the textbook of Forensic Medicine by Glaister [15] (1957) head length is 1/8th of the total height of an individual. However, the age and sex of the individual included in the study are not available.

Table 5: Coefficient of Correlation Values from previous studies regarding stature and Head length and correlation with current study

Workers and age of study group	Mean head length (Cm) Points Measured.	Correlation coefficient	Correlation with current study
Saxena9 (1981) 25-30 Yrs	18.464 Nasion – Inion	+0.2048	No
Jadhav & Shah10 (2004) 17-22 Yrs	17.65 Glabella - Inion	+0.53	Yes
Krishnan11 (2008) 18-30 Yrs	16.50 Glabella - Inion	0.78	No
Ilayperuma12 (2010) 20-23 Yrs	17.60 Glabella - Inion	0.72	No
Present study (2018) 19-28 Yrs	18.18 (male) 16.77 (female) Nasion -Inion	0.507 (male) 0.440 (female) 0.651(combined)	----
	18.69(male) 17.28(female) Glabella-Inion	0.530(male) 0.428(female) 0.652(combined)	

Stature estimation from Head lengths by using formulated Multiplication Factor (M.F)

Naini et al [16] computed the average proportion of the images found most attractive and reported it as the height being 7.8 times the head length. When forced to pick a single image, most selected the one with height 7.5 times the head length, followed by height 8 times the head length. The preference regarding the most attractive image didn't vary by sex or ethnicity.

The authors also cited averages among North American young adults of European ancestry, the average man had height 7.7 times head length and 9.4 times face length and average woman height 7.6 times head length and 9.4 times face length [17]. The head length (taken from top of head to bottom of chin) in their study is differs from the head length in our study. Our values of multiplication factors are nearer to the values mentioned in standard textbook of Forensic Medicine (Table 3).

According to Trotter and Gleser [4] (1952) world population is getting taller and therefore relationship between height and length of bones is changed and fresh formulae or multiplication factors are needed for each generation. Accordingly our present study has provided fresh multiplication factors for South Indians (Table 3).

The mean difference was found to be less than 1cm in all the cases ($p > 0.05$) when average stature estimated by multiplication factor was compared with stature estimated from regression equation (Table 4); hence multiplication factor can be used as a second line formula for estimation of stature. Also these multiplication factors are valid and applicable to the South Indian population.

Comparison between males and females

There is no significant difference between male and female regarding applicability of multiplication factors for stature estimation with fair degree of accuracy. Hence common multiplication factor (both for male & female) can be used to estimate the stature in south Indian population.

Conclusion

It is possible and easy to take the measurements from nasion to inion (N-I) and glabella to inion (G-I) of the head by using spreading caliper (outside caliper).

There is a positive correlation between the head length with that of stature.

The estimation of stature by derived multiplication factors 9.55 for N-I and 9.26 for G-I in female and 9.51 for N-I and 9.24 for G-I in male; are equally valid and can be used upon the South Indian population with fair degree of accuracy.

The derived common multiplication factor 9.53 for N-I and 9.25 for G-I is not only easy but also accurate in estimation of stature in South Indian population.

The multiplication factor derived from particular region cannot be used in general population. However, can be used on that one particular region of population.

Further needs similar type of studies from various parts of the country to derive a multiplication factors specific for that region.

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Original Article

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Comparative Analysis of Clinical and Laboratory Parameters in Viper Bite Cases from Northern Kerala

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Abstract

Context: India is a country with highest rates of mortalities and morbidities resulting from snake bite. There is a concept that four snake species namely Naja naja, Bungarus caeruleus, Daboia russelii, Echis carinatus, together called the 'The Big 4 snakes of medical importance' are solely responsible for morbidities and mortalities. Indian antivenom is effective against aforementioned species only. *Aims:* Aim of the study was to compare the clinical and laboratory variables in patients bitten by hump-nosed pit viper (Hypnale hypnale) and other vipers. *Settings and Design:* Study was conducted in Kozhikode Government Medical College, located in Northern Kerala. It was a descriptive study on various clinical and laboratory parameters. *Methods and Material:* Study was conducted comparing various clinical and laboratory parameters in among patients bitten by Daboia russelii and Hypnale Hypnale. *Statistical analysis used:* Analysis was done using EPIINFO and SPSS software. Comparisons between viper bites were done by the chisquare test. *Results:* Analysis proved that except for parotid swelling, which was seen only among Daboia russelii bitten patients, there were no statistically significant difference among the various parameters studied, including mortality rate. *Conclusions:* Our study emphasizes the urgent need for anti snake venom effective in Hypnale Hypnale envenomations.

Keywords: Hump Nosed Pit Viper; Indian Anti Snake Venom; Russell's Viper.

Introduction

Yearly about 40,000 people die in India due to poisonous snake bites, which is highest in world [1]. Four snake species namely Indian cobra (*Naja naja*), the common krait (*Bungarus caeruleus*), the Russell's viper (*Daboia russelii*) and the saw-scaled viper (*Echis carinatus*) cause most of these mortalities [2,3]. Hence the concept of the "Big 4" snakes of medical importance had evolved as these four species are causing most of the mortalities related to snakebite in the subcontinent [2-4]. However there have been recent reports of many other snakes like hump nosed pit viper, Levantine viper causing considerable morbidity and occasional mortality [5-7].

Mortality and morbidity due to snake envenomation is a common medical emergency in Kerala. Farmers working in their rubber, paddy, and coffee plantations in hilly terrains are the most affected. Russell's viper and Hump nosed pit viper are predominant viper species envenomation, encountered in Northern Kerala. Saw-scaled viper bites are rare in the region when compared to rest of India.

Materials and Methods

Study was conducted in the snake bite treatment unit of Calicut medical college hospital during January 2011 to June 2012. Patients from northern Kerala including districts of Wayanad, Kozhikode, Kannur and Malappuram are treated in the unit for snake bite envenomation. Only envenomations due to viper bites were studied. Only those cases in which the snake which had inflicted the

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envenomation was brought to the hospital for species identification were included in the study. All cases in which the snakes were not brought to the hospital for identification or cases with ambiguity species identification were excluded from the study.

Clinical parameters studied include time since envenomation, site of bite, age, sex, first aid received or not, local swelling , or any other local reaction such as cellulitis, heamorrhagic bullae, gangrene. etc., lymphadenopathy, petechial spots, echymosis, epistaxis, heamoptysis, maleana, evidences of intracranial haemorrhage, urine volume , input output charts, heamaturia (Table 1).

Laboratory parameters studied include complete blood count (using Sysmex KX-21), heamoglobin, RBC count, packed cell volume, mean corpuscular volume, mean corpuscular heamoglobin, mean corpuscular heamoglobin concentration, total leukocyte count, 3 part differential count, platelet count, mean platelet volume, platelet distribution width , platelet large cell ratio (Table 2).

Peripheral smear was collected by finger prick method, air dried and stained by Leishman stain.

Urine albumin was detected by the sulfosalicylic acid test. Urine microscopy was assessed after centrifuging at 1500G for 5 minutes for evidence of heamaturia, RBC casts and granular casts.

Bleeding time was done using Duke Bleeding Time method.

Clotting time was assessed using 20 minute clotting time as per WHO guidelines [8].

2 ml of freshly sampled venous blood placed in a small, new or heat cleaned, dry, glass vessel and left undisturbed for 20 minutes at ambient temperature. The tube is tipped once. If the blood is still liquid (unclotted) and runs out, the whole blood coagulation time is prolonged.

Prothombin time and Activated prothrombin time were measured using 'Trinity Biotech destiny plus automated coagulometer'.

Blood urea and serum creatinine were assessed.

The study was approved by the institutional ethics committee of Government Medical College, Kozhikode.

The data was analyzed by EPIINFO and SPSS software. Comparison of laboratory and clinical parameters between bites by the three different types of snakes was tabulated (Table 1 and Table 2). The difference between Russell viper (n=15) and Hump-nosed pit viper (n=19) was done by the chi square test. Since there was only one case of saw scaled viper bite, it was omitted from this analysis

Results

35 cases were studied. Hump nosed (19) and Russell viper bites (15) occurred in all most in equal frequencies. Males were the victims in most

Table 1: Comparison of clinical characteristics of different types of snake bites

	A. Russel's viper [no. (%)]	B. Hump nosed pit viper [no. (%)]	C. Saw scaled viper [no. (%)]	p (A vs B)
Total number (N)	15	19	1	
Bite mark	15 (100)	19 (100)	1 (100)	-
Fang mark	10 (66.7)	8 (42.1)	1 (100)	0.505
Site of bite				
Lower limb	13 (86.7)	17 (89.5)	1 (100)	0.603
Upper limb	2 (13.3)	2 (10.5)	0 (0)	
Renal failure	4 (26.7)	4 (21.1)	0 (0)	0.505
Need for dialysis	1 (6.7)	2 (10.5)	0 (0)	0.590
Capillary leak syndrome	1 (6.7)	0 (0)	0 (0)	0.441
Parotid swelling	4 (26.7)	0 (0)	0 (0)	0.029
Spontaneous bleeds	2 (13.3)	2 (10.5)	1 (100)	0.603
Reaction at site of bite	13 (86.7)	19 (100)	1 (100)	0.187
Oliguria (daily output <400 ml)	0 (0)	3 (15.8)	0 (0)	0.162

Abbreviations: NIL

cases (27/35). Lower limb was the predominant site of bite in males (26/27), whereas in females upper limb (4/7) was the commonest site of bite. This is due to the fact that most of snake bites are encountered during agricultural activities or by walking barefoot at night and in Indian families it is mainly the male members who work in the farmland. Whereas in females most envenomations in upper limb occured during sweeping of the living areas or gardens with brooms. The culprit snake usually would have camouflaged among dry leaves. Similar observations have been made in previous studies [1,4,9].

Age of the patients varied from 14 to 72. The maximum numbers of bites (9) were in the age group 40-49. These represent the economically most productive age group. There were also 8 bites in age group 60 and above. This may be the population who venture out without any protective footwear.

Clinical and laboratory parameters are compared in Table 1 and Table 2. Symptoms suggestive of renal failure was noticed in 4 (26.7%) cases of Russell viper bites and 4 (21.1%) of the hump nosed pit viper bite (Table 1). 4 out of 19 cases of Hump-nosed pit viper bite in our study developed features of acute renal failure. This suggests that Hypnale hypnale accounts for a major cause of renal failure complicating heamotoxic snake bites in the region, taking into consideration the fact that only 20-30% of cases patients brings the snake to the hospital. All the patients with renal failure, either from pit viper bite or Russell bite, had features of systemic envenomation such as the prolonged clotting time. 8 cases of renal failure includes two mortalities, one was due to Russell viper envenomation and one due to Hump-nosed pit viper envenomation (Table 1). In two out of four cases of renal failure due to Hump-nosed pit viper bite, patient had to undergo heamodialysis. Heamodialysis was advised in two cases of the Russell viper bite, but was done only in one case since the other patient had rapid worsening of clinical conditions. Incidence of renal failure in our study is higher than

Table 2: Laboratory features in of different types of snake bites

	A. Russel's viper [no. (%)]	**B. Hump nosed pit viper [no. (%)]**	**C. Saw scaled viper [no. (%)]**	**p (A vs B)**
Anemia (Hb <11 g/dl)	4 (26.7)	2 (10.5)	0 (0)	0.219
RBC count <	3 (20)	1 (5.3)	0 (0)	0.215
PCV (M <40;F <36)	6(40)	5 (26.3)	0 (0)	0.390
Microcytosis (MCV <80)	6(40)	2 (10.5)	0 (0)	0.054
MCH < 27	3 (20)	3 (15.8)	0 (0)	0.472
RDW >14.5	2 (13.3)	1 (5.3)	0 (0)	0.384
Leukocytosis (TLC >11000)	8 (53.4)	10 (52.6)	0 (0)	0.447
Neutrophilia (absolute count > 8400)	7 (46.7)	9 (47.5)	0 (0)	0.5
Thrombocytopenia(Platelet <100000)	3 (20)	4 (21.1)	0 (0)	0.639
Toxic granules	2 (13.3)	1 (5.3)	0 (0)	0.409
Shift to left of myeloid cells	6(40)	1 (5.3)	1 (100)	0.019
Eosinophila	1 (6.7)	1 (5.3)	0 (0)	0.695
Atypical lymphocytes	3 (20)	2 (10.5)	0 (0)	0.384
Blood urea > 40 mg	4 (26.7)	4 (21.1)	0 (0)	0.505
Serum creatinine > 2 mg	4 (26.7)	4 (21.1)	0 (0)	0.505
Hematuria (RBC > 15 / hpf)	3 (20)	1 (5.3)	0 (0)	0.215
Albuminuria	5 (33.3)	5 (26.3)	0 (0)	0.471
Prolongation of Clotting time	9 (60)	7 (37.9)	1 (100)	0.159
Increase in PT	6 (40)	8 (42.1)	0 (0)	0.590
Increase in APTT	6 (40)	8 (42.1)	0 (0)	0.590

Abbreviations:

Hb - Heamoglobin, RBC count, RBC count - Red Blood Cell count, PCV-Packed Cell Volume, MCV-Mean Copuscular Volume, MCH-Mean Corpuscular Heamoglobin, RDW- Red cell Distribution Width, TLC-Total Leucocyte count, PT – Prothrombin Time, APTT-Activated Partial Thromboplastin Time

previous observations like Ariaratnam et al from Srilanka [6]. This may be due to the fact that study was conducted in a tertiary care centre. Prolongation of clotting time, a sign of systemic envenomation is almost met with equal frequencies in bites of Russell and Hump-nosed viper bites. Almost all the patients who developed prolongation of clotting time developed simultaneous prolongation of PT and APTT also. This can be attributed to the consumptive coagulopathy and fibrinolysis. Similar observations has been made by Suchithra et al. [10]. Premawardena et al had reported normal PT and APTT values in systemic envenomation due to Hump-nosed pit viper bite [11]. Based on this, they further suggested that the bleeding in Hypnale bites is due to primary fibrinolysis. Our findings do not support this contention.

Statistically significant differences in clinical and laboratory parameters were obtained only in case of parotid swelling which were seen only in cases with Russell's viper bites.

Polyvalent Anti snake venom was given in 10 cases with Russell's viper bites, 6 cases with hump nosed pit viper bites and in the lone case of saw scaled viper bite. Response to ASV was assessed by the normalization of the clotting time. All cases of Russell's viper bite and the saw scaled viper bite responded to ASV. None of the cases of hump nosed pit viper bite responded to ASV. Similar observations were made in previous studies from Srilanka [6].

In one case a 34 year old female who had Hump nosed pit viper bite developed herpes labialis. Two cases of Russell viper bites developed features of neurotoxicity including ptosis and opthalmoplegia. One case of Russell viper bite also had hepatitis with icterus and raised liver enzymes (Total bilirubin - 8.4mg/dl and SGOT – 484U/L). Another patient with Russell viper bite also developed pulmonary edema.

Discussion

Our study shows that snake bite is essentially an occupation hazard crippling lives of farmers. Males are predominantly involved with lower limb predominant site. Russell viper and Hump-nosed pit viper causes majority of heamotoxic envenomation in the region and saw scaled viper is rather rare, when compared to rest of India. There is not much difference in clinical and laboratory parameters studied among these viper bites, except for parotid enlargement, which was seen only in Russell's viper bites. Though well known to clinicians, published data about parotid swelling is scanty [12]. The letter by Chakraborty and Bhattacharjee from Midnapore medical college, West Bengal in a case of Russell viper bite is one of the rare cases in literature. No significant differences were noticed among other parameters including renal failure and mortality rates. Indian ASV is not helpful in Hypnale Hypnale bites. Recently, there have been some reports of lethal envenomation caused by hypnale bites observed in Kerala by Joseph et al and from Sri Lanka by studies such as by Ariaratnam et al. [5,6]. Published data about H.hypnale envenomation in India is rather scarce. In many of cases these snakes are misidentified as Russell viper. The culprit snake could be identified in 30 to 50 percent of the cases, whereas most victims come to hospitals as 'unknown' bites [9]. Hence the real burden of hump nosed pit viper bites in India is largely under estimated. There is urgent need for development of ASV effective in hump nosed pit viper bites. Study also points to the need for better technology such as ELISA for species identification since there is considerable overlap in the clinical symptoms.

Limitation of the study was that we could study only 35 cases. Study size was small because we followed strict inclusion criteria.

Conclusion

Our study proves that hump nosed pit viper can cause morbidity and mortality comparable to Russell's viper. Present ASV is ineffective in these cases and there is urgent need for effective therapy.

Key Messages: Our study proves that hump nosed pit viper can cause morbidity and mortality comparable to Russell's viper. Present ASV is ineffective in these cases and there is urgent need for effective therapy.

Abbreviations: ASV - Anti Snake Venom, WHO-World Health Organisation

Conflict Of Interest: NIL

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Review Article

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Renal Failure Associated with Plant Toxins

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Abstract

After cardiovascular disease, renal failure is a frequent cause of morbidity and mortality in the population worldwide. Humans are exposed to numerous plant toxins that cause deterioration of renal function with noticeable histopathological changes. Despite of extensive studies in past, recently only few articles have reported with an integrated approach to their nephrotoxic effects. In this article, we present plants which are involved in nephrotoxicity.

Keywords: Plant; Poisoning; Nephrotoxicity; Renal failure; Acute tubular necrosis.

Introduction

Plants contain various toxic substances that pose a serious risk of illness or death to humans or animals by causing systemic toxicity [1-3]. Nephrotoxic plants are commonly encountered both as common edible and medicinal plants [4]. More often, mistaken identification of these medicinal herbs and use of their toxic substitutes frequently lead to renal disease [5,6]. Herbal and traditional folk medicine nephropathy is common reported in China and Africa [7,8]. Several factors alter the physiology and histology of the kidney resulting in deterioration of the renal function and notable histopathological changes. These plant toxins may cause injury to the renal tubules at the transport site directly or by inducing renal ischemia, hemoglobinuria or myoglobinuria. Acute renal failure as a consequence of acute tubular necrosis and acute interstitial nephritis is most commonly reported [9]. In this paper, we conducted a comprehensive search using PubMed, ProQuest, ClinicalKey, Scopemed and Google Scholar from the year 1990 to 2018. All articles included were focused mostly on nephrotoxic effects on human. This paper attempted to appraise the importance of clinical toxicology by describing various plants that have been documented in the literature as causing nephrotoxicity.

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Literature

There are various plants which demonstrated the nephrotoxic effect. The results of review are presented in Table 1.

Aristolochiac lematitis (birthwort), *Magnolia officinalis* (magnolia bark) and *Stephania tetrandra* constitutes aristolochic acid, a carcinogenic compound derived from the seeds, demonstrated tubulointerstitial fibrosis associated with tubular atrophy and glomerular sclerosis on renal biopsy [10,11]. Tuber of *Callilepis laureola* (impila, ox-eye daisy) contains nephrotoxic principle atractyloside or carboxyatractyloside which causes renal tubular necrosis [12]. Irritant chemicals in the sap/ latex of the plant, *Euphorbia paralias* and *Euphorbia matabelensis* (spurge), a shrub showed focal segmental glomerulosclerosis associated with an acute tubular injury [13]. Active principles are methyl esters, diterpene polyesters and terpene compounds. Ingestion of *Archidendron pauciflorum* or *Pithecellobium lobatum* or *Pithecellobium jeringa* (djenkol or jenkol or jering bean) results in acute tubular necrosis with glomerular cell necrosis [14,15]. Active metabolite is djenkolic acid.

Table 1: List of plants manifesting nephrotoxicity

Common name	Region	Latin name	Active molecule	Renal pathology
Birthwort	Europe	*Aristolochia clematitis*	Aristolochic acid	Tubulointerstitial fibrosis, tubular atrophy, glomerular sclerosis,
Han Fang Ji	China, Taiwan	*Stephania tetrandra*		
Mognolia bark	China	*Magnolia officinalis*		
Ox-eye daisy Impila Black-eyed susan	South Africa	*Callilepis laureola*	Atractylosidecarboxyatractyloside	Renal tubular necrosis
Spurge	Europe, North Africa, Western Asia	*Euphorbia paralias, Euphorbia matabelensis*	Methyl esters, diterpene polyesters, Terpene compounds	Focal segmental glomerulosclerosis, acute tubular injury
Djenkol bean	Southeast Asia	*Archidendron pauciflorum*	Djenkolic acid	Acute tubular necrosis, glomerular cell necrosis
Rhubarb	China Tibet	*Rheum palmatum*	Emodin, aloe-emodin, oxalic acid, anthraquinone compounds	Interstitial fibrosis, kidney stones
Senna	Egypt	*Cassia acutifolia/ Senna alexandrina*	Anthraquinone glycosides (sennosides)	Renal tubular necrosis
Cascara buckthorn, sagrada	Northern America	*Rhamnus purshiana*	Hydroxyanthracene glycosides (cascarosides)	Acute tubulointerstitial nephritis
Buckthorn	Europe, Northern Africa, Western Asia	*Rhamnus frangula*	Anthraquinone compounds	Acute tubulointerstitial nephritis
Cape aloes, burn plant lily of desert	Asia, Africa	*Aloe capensis*	Aloins, aloinosides	Acute tubular necrosis, parenchymatous nephritis
Khat	Africa, Arabian peninsula	*Catha edulis*	Cathinone (S-cathionone, norephedrine, D-norpseudoephedrine)	Fat droplets in the upper cortical tubules, acute tubular necrosis
Autumn crocus, meadow saffron	Europe	*Colchicum autumnale*	Colchicine	Acute tubular necrosis
Liquorice	Southern Europe, parts of Asia	*Glycyrrhiza glabra*	Glycyrrhetinic acid/ glycyrrhetic acid	Acute tubular necrosis
Yam	Asia, Africa, America	*Dioscorea quinqueloba*	Diosgenin	Acute tubular necrosis, cortical necrosis, interstitial nephritis.
Chaparral, greasewood, creosote bush	North America	*Larrea tridentate*	Nordihydroguaiaretic acid	Tubular necrosis, renal cysts, renal cell carcinoma
Violet tree, wild wisteria	Africa	*Securidaca longipedunculata*	Alkaloid saponins, securinine, LD50 of Methylsalicylate, Gaultherin	Acute tubular necrosis, interstitial and glomerular haemorrhage
Marking nut tree	India	*Semecarpus anacardium*	Phenolic compounds (semicarpol)	Renal cortical necrosis
Broad bean	North Africa	*Vicis favus/ Vicis faba*	Divicine, isouramil	Acute renal failure
Tree cotton	India, Pakistan, East Africa	*Gossypium arboreum*	Gossypol (Phenolic compounds)	Distal renal tubular acidosis
Wormwood	Eurasia, Northern Africa, Northern America	*Artemisia absinthium*	Terpene	Acute renal failure with tubular casts
Cat's claw	South and central America	*Uncaria tomentosa*	Quinic acid, oxindole alkaloids and flavonols	Acute allergic interstitial nephritis
Bird flower, devil bean, rattle weed	Asia, Africa, Australia	*Crotalaria laburnifolia,Crotalaria retusa*	Pyrrolizidine alkaloids	Acute tubular necrosis
Cone flower	North America	*Echinacea purpurea*		Acute renal failure
Spearmint, lamb mint, mackerel mint, garden mint	Europe, Asia, Northern and western Africa, North and South America	*Mentha spicata*	Pulegone, menthofuran	Hydropic degeneration of tubular epithelial cells, atrophy of tubules and glomerules
Pennyroyal	Europe, North Africa, America	*Mentha pulegium, Hedeoma pulegioides*	Pulegone, menthofuran	Edematous hemorrhagic kidneys and acute tubular necrosis
Yohimbe Tree	Western and central Africa	*Pausinystalia yohimbe/ Corynanthe yohibi*	Yohimbine	Lupus nephritis and acute renal failure

Common name	Region	Latin name	Active molecule	Renal pathology
Cancer bush, balloon pea	Southern Africa	*Sutherlandia frutescens*	Canavanine, cycloartane glycosides, saponins, flavonoid	Renal tubular necrisis
Yellow wood	Australia	*Terminalia oblongata*	Terminalin	Avascular renal necrosis
Oduvan	India	*Cleistanthus collinus*	Arylnaphthalenelignan lactones, dyphyllin and its glycosides cleistanthin A, B and collinusin	Acute tubular necrosis
Thunder God Vine	China	*Tripterygium wilfordii*	Triptolide	Acute tubular necrosis
Mourning cypress	China, Vietnam	*Cupressus funebris*	Flavonoid	Acute tubular necrosis and interstitial nephritis
Easter lilies	Japan	*Lilium longiflorum*		Tubular nephrosis, interstitial edema
Jimson weed, devil's weed	North America, Australia	*Datura stramonium*	Tropane alkaloids such as scopolamine, hyoscyamine, and atropine	Acute tubular necrosis
Thorn apple	India, North America	*Datura innoxia*		
Chinese yew	China	*Taxus celebica*	Flavonoid (sciadopitysin)	Acute tubular necrosis, acute interstitial nephritis
Hemlock	Europe, North Africa	*Conium maculatum*	Cicutoxin, coniine	Acute tubular necrosis
Ma huang	China, Russia	*Ephedra sinica*	Ephedrine, norephedrine and pseudoephedrine	Nephrolithiasis, acute kidney injury
Star fruit	Southeast Asia, India	*Averrhoa carambola*	Ephedrine, oxalic acid	Oxalate nephropathy, tubular obstruction
Ting Kung Teng	Taiwan	*Erycibe henryi*	Cholinergic tropane alkaloids	Acute kidney injury
Yellow oleander	Mexico, Central America	*Thevetia peruviana/ Cascabela thevetia*	Cardiac glycosides (thevetin, oleandrin)	Acute tubular necrosis, glomerular vacuolation
Bladderwrack	Europe, North Russia, North America	*Fucus vesiculosus*	Arsenic	Tubular atrophy, heavy metal nephropathy
Willow bark	Europe	*Salix daphnoides*	Salicylate	Papillary necrosis
Cranberry, bearberry	North America	*Vaccinium macrocarpon*	Oxalic acid	Nephrolithiasis, obstructive nephropathy
Castor	Africa, India	*Ricinus communis*	Ricin	Acute tubular necrosis
Deathcap	Europe	*Amanita phalloides*	Cyclopeptides, (phallotoxins, amatoxins)	Acute interstitial nephritis and tubular necrosis
Deadly webcap	Europe, Australia	*Cortinarius speciosissimus*	Orellanine, orellin, orellinin and Cortinarin	Tubular necrosis with interstitial nephritis

Anthraquinone compounds are found in rhubarb, senna, cascara sagrada, aloe and buckthorn. Emodin, aloe-emodin, oxalic acid and related anthraquinone compounds are the active ingredients of Rhizoma Rhei (root) of *Rheum palmatum* Linne or *Rheum officinale (rhubarb)* cause diffuse interstitial fibrosis and kidney stones [16]. Toxic metabolites of anthraquinone glycosides, sennosides from *Cassia acutifolia* (senna) and angustifolia plants (leaf and pod) cause renal impairment with renal tubular cells necrosis [17]. *Rhamnuspurshiana* (cascara sagrada) containing hydroxyanthracene glycosides (cascarosides), and *Frangulae cortex/ Rhamni cathartics ftuctus/ Rhamnus frangula/* Frangulaalnus (buckthorn bark/berry) results in acute tubulointerstitial nephritis [18]. *Aloe capensis* (cape aloes) contains aloins and aloinosides which causes renal failure with acute tubular necrosis and parenchymatous nephritis [19].

Chewing of *Catha edulis* (khat) leaf revealed fat droplets in the upper cortical tubules and acute tubular necrosis on histology. The main metabolites are norephedrine, S-cathiononeand D-norpseudoephedrine [20]. *Colchicum autumnale* (meadow saffron, autumn crocus) constitutes colchicine which causes nephrotoxicity with acute tubular necrosis [21]. The active component glycyrrhetinic acid (glycyrrhetic acid) of *Glycyrrhiza glabra* (liquorice) induces acute tubular necrosis [22]. Dioscorea species like *Dioscorea quinqueloba (*yam) are tuberous plants results in acute tubular necrosis, cortical necrosis and interstitial nephritis [23]. It contains diosgenin, aglycone of saponoindioscin. Nordihydro-guaiaretic acid present in *Larrea tridentate* (Chaparral) reported to cause tubular necrosis, renal cysts and renal cell carcinoma[24]. The root of *Securidaca longipedunculata* (violet tree, wild wisteria) contains alkaloid saponins, LD 50 of

methyl salicylate and securinine. It also contains gaultherin, an amorphous steroid glucoside which cause the histopathologic changes of kidney including acute tubular necrosis with diffuse interstitial and glomerular haemorrhage [25,26]. Phenolic compounds (semicarpol, bhilawanol) in the sap of *Semecarpus anacardium*, the marking-nut tree of India, cause renal failure with renal cortical necrosis following prolonged exposure to the sap. Divicine and isouramil, active molecules in *Vicisfavus or faba*, broad bean can trigger hemolysis in certain subjects with Glucose-6 Phosphate Dehydrogenase deficiency, resulting in reversible acute renal failure. Gossypol, the principal ingredient of cotton seed oil, *Gossypium arboreum* could cause distal renal tubular acidosis [26]. *Artemisia absinthium* (wormwood essential oil) containing terpene result in acute renal failure with tubular casts [27].

Uncaria tomentosa, (cat's claw) documented acute renal failure with acute allergic interstitial nephritis contains quinic acid, oxindole alkaloids and flavonols [28]. *Crotalaria laburnifolia* (bird flower) and *Crotalaria retusa* contains pyrrolizidine alkaloids also been associated with renal damage with acute tubular necrosis [29]. Pyrrolizidine alkaloid contaminants is also present in *Echinacea purpurea* (cone flower) that cause acute renal failure [30]. *Mentha spicata* (garden mint) reported to cause hydropic degeneration of tubular epithelial cells along with some atrophic tubules and glomerules in experimental rat models [30]. Pennyroyal, an herb consisting of the leaves of either *Mentha pulegium* and *Hedeoma pulegioides* cause edematous hemorrhagic kidneys and acute tubular necrosis [32]. Mentha species constitutes containing pulegone and menthofuran. Yohimbine, indole alkaloid derived from the bark of *Pausinystalia yohimbe* or *corynanthe yohimbe* (yohimbe tree) reported to causelupus nephritis and acute renal failure [33]. *Sutherlandia frutescens* (cancer bush) contains canavanine, cycloartane glycosides, saponins and flavonoid, the extract possessed the potential to promote apoptosis, and alter the integrity of mitochondrial membranes in the renal tubules [34]. *Terminalia oblongata* (yellow wood) contains an unidentified nephrotoxic substance that causes avascular renal necrosis in mice and ruminants [35].

Toxic constituents of *Cleistanthus collinus* (oduvan) are arylnaphthalenelignan lactones, dyphyllin and its glycosides cleistanthin A, cleistanthin B and collinusin. Toxicity result in renal failure with acute tubular necrosis [36]. *Tripterygium wilfordii* hook F (Thunder God Vine) constitutes active molecule triptolide. It resulted in deterioration of renal function with acute tubular necrosis [37]. *Cupressus funebris* Endl (mourning cypress) possessing flavonoid exhibited acute tubular necrosis and interstitial nephritis [38]. Lilium species like *Lilium longiflorum* (easter lilies) have been documented to cause toxicosis in cats like interstitial edema and tubular nephrosis, characterized by epithelial cell necrosis in proximal tubule and exfoliation [39]. Leaves and flower of *Datura stramonium* (jimson weed) and *Datura innoxia* (thorn apple) produces ischemic acute tubular necrosis. In the renal cortex, there was shrinkage of the glomerulus with shrinkage of glomerulus in cortex. It contains tropane alkaloids such as scopolamine, hyoscyamine and atropine [40]. *Taxus celebica* (chinese yew) constitutes flavonoid, sciadopitysin reported acute tubular necrosis and acute interstitial nephritis [41]. The active components cicutoxin and coniinein *Conium maculatum* (hemlock) cause acute tubular necrosis [42]. *Ephedra sinica* (Ma huang) constitutes ephedrine, norephedrine and pseudoephedrine which revealed nephrolithiasis, acute kidney injury secondary to rhabdomyolysis [43]. *Averrhoa carambola (*star fruit) contain ephedrine and oxalic acid cause oxalate nephropathy and tubular obstruction [44]. Cholinergic tropane alkaloids in *Erycibe henryi* (Ting Kung Teng) cause acute kidney injury [45]. *Thevetia peruviana* (yellow oleander) has toxic metabolites cardiac glycosides. It reported to cause acute tubular necrosis and glomerular vacuolation [46]. *Vaccinium macrocarpon* (cranberry) contains oxalic acid which result in nephrolithiasis and obstructive nephropathy [47]. *Ricinus communis* (castor bean) containing active molecule ricin reported to cause acute tubular necrosis in sheeps [48]. *Salix daphnoides* (willow bark) containing salicylate cause renal dysfunction leading to papillary necrosis. *Fucus vesiculosus* (Bladder wrack), brown seaweed constitutes arsenic (from growth of plant in contaminated water) caused tubular atrophy and 'heavy metal nephropathy [49].

Propolis, a resinous substance collected by honey bees from various plants caused acute renal failure [50]. Acute renal failure with interstitial nephritis is even noticed in nutritional supplement containing bee pollen [51]. Wild mushrooms, *Amanita phalloides* (death cap) contain toxic agent cyclo peptides with components phallotoxins and the amatoxins. Renal pathology reported acute interstitial nephritis and tubular necrosis. Other species include *Amanita*

smithiana and *Amanita proxima* [52]. *Cortinarius speciosissimus* which possess the toxin orellanine exhibited tubular necrosis with interstitial nephritis [53]. Other mushroom like Galerina species also causes renal toxicity. Fava beans, poisonous mushrooms also causes acute kidney injury with acute tubular necrosis [53].

Conclusion

This systematic review provides details of various plants manifesting nephrotoxicity and enables the health care providers to diagnose and prevent the morbidity and mortality due to renal failure. We hope this review will stimulate the researchers for establishing the specific nephrotoxic principles.

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No potential conflict of interest relevant to this paper was reported.

Ethical clearance

None required

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Review Article

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Homicide Followed by Suicide in India: A Review

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Abstract

Violent unnatural deaths is a major menace of the society in India. The worst are those of Homicide-Suicides. Homicide followed by the suicide is a relatively rare act in which the perpetrator kills another person and subsequently commits suicide. The motives and circumstances that provoke the perpetrator to commit the crime may vary. This article by an integrated approach intend to describe the victim-perpetrator relationship, motivating factors and the cause of death of such cases of homicide-suicide reported in India which are documented in the literature.

Keywords: Homicide; Suicide; Dyadic Deaths; Perpetrator; Cause of Death.

Introduction

Dyadic death comprises both suicide pacts and homicide-suicide incidents [1]. Homicide-suicide denote an event of homicide by perpetrator, followed by his suicide almost immediately or soon after the homicide [2]. They are relatively uncommon and factors responsible and mode of implication vary from region to region [1]. The causes are multifactorial such as extramarital affair, mental illness, work stress, financial problems, domestic disputes etc. [3-5]. Majority of cases occurred between intimate partners, and parents and children. Males were the vast majority of the perpetrators and females being major victim [3-6]. In the study of Subba Reddy K et al., according to cases referred to National Criminal Record Bureau data of India 2014, 72 cases were considered in which perpetrator committed murder followed by suicide almost immediately or within a week. 91.66% (n=66) perpetrators were males and the remaining 8.34% (n=6) were females. Majority of crimes (45.83%) were committed by perpetrators of age group 15-30 years and 37.50% by 30-45 years age group, 12.50% by 0-15 year age group and least was observed in above 45 years age group (4.16%). The major reasons for the murder-suicide were infidelity and domestic disputes were (44.44%). Apart from this financial instability and debts also contributed as the major factor (34.72%), Stress (13.88%) and influence of addictive drugs (6.94%) were additional reasons for committing murder suicides [5]. As we could find any study with an integrated approach to such cases of homicide followed by suicide. This article makes an attempt to integrate and describe cases of homicide-suicide in India which are documented in the literature.

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Literature

Although research and reports pertaining to homicide-suicide are existing in many countries [1,2,6,7], only few are reported in India. The details are review are presented in Table 1.

Filicide-suicide is a special group of homicide-suicide where the victim(s) are children and the perpetrator being one of the parents or both [8]. In a study by Gupta BD et al. in Gujarat state from 2000 to 2004 reported 8 cases, in which 8 mothers committed murder of their children (age group of 6 months to 7 years) involving 10 female and 3 male victims, followed by their suicide. Methods of implication was either burning or drowning. The main motive for killing was family matters. History

Author	Victim-Perpetrator Relationship	Reason/ motive	Cause of death of victim	Cause of death of perpetrator
Gupta BD et al.9 (2008)	Mother (Eight Cases)	Family and family related matters, History of depression of the mother due to her previous miscarriage	Burning and Drowning	Burning and Drowning
Bardale R et al.10 (2010)	1. Mother 2. Mother 3. Mother	Mental illness Family disputes Family disputes and financial problem	Hanging Drowning Drowning	Hanging Drowning Drowning
Behera C et al.11 (2015)	Mother	Dowry harassment	Hanging	Hanging
Gadhari RK et al.12 (2015)	Mother	Marital quarrel and Dowry harassment	Drowning	Drowning
Garg S et al.13 (2009)	Father	Extramarital affair	Poisoning	Poisoning
Dhawane SG et al.14 (2007)	1. Husband cum father	Suspicion of infidelity	Stabbing	Jumping in front of truck
	2. Father	Wife's denial to give money to consume alcohol	Fall from height	Fall from height
	3. Father	Mental illness	Strangulation	Hanging
	4. Husband cum father	Domestic quarrel	Strangulation	Fire arm injury
	5. Father	Domestic quarrel	Fall from height	Fall from height
Bhengra A et al.15 (2017)	Husband	Suspicion of infidelity	Head Injury	Hanging
Ghormade PS et al.16 (2011)	1. Husband 2. Husband 3. Lover	Financial problems Domestic quarrel on unemployment Love failure	Stab Injury Strangulation Cut throat	Stab Injury Hanging Hanging
Chaudhari VA et al.17 (2016)	Lover	Monitory dispute	Fire arm injury	Fire arm injury
Behera C et al.18 (2009)	Brother-in-law	Frustration from love failure (rejection)	Fire arm injury	Fire arm injury

of depression of the mother due to miscarriage was reported in a case [9]. Bardale R et al. reported three cases of filicide. In first case, 26 years aged mother killed 18 months old daughter and committed suicide by hanging due to some mental illness. In other case, due to some family dispute, mother aged 33 years drowned her 6 years old daughter and later drowned herself. In third case, 22 years old mother killed his son aged 18 months and committed suicide by drowning due to family dispute and financial problem [10]. Case of double homicidal hanging by the mother aged 28-year-old of children, daughter aged 3 ½ years and son aged 2 years followed by her suicidal hanging, was reported by Behera C et al. in 2015 [11]. Gadhari RK et al. reported a case of 26 year old mother who committed suicide by drowning after killing her 2 sons aged 4 years and 2 years respectively by throwing them in the well water [12].

In a case reported by Garg S et al. father poisoned his two children and later poisoned himself by consuming Aluminum phosphide due to unfaithfulness of his wife [13]. Dhawane SG et al. reported 5 case series. In first case, due of suspicion of infidelity of wife, a 28-year man committed suicide by jumping before a running truck after stabbing his wife and two sons (aged 2 and 4 years). In another case, a 30-year father after throwing his 3-year son and 10 months daughter in the well committed suicide by jumping in the same well, out of anger as wife's denial to give money to consume alcohol. In third case, under mental illness, a middle aged widower man committed suicide by hanging after strangulating his 7 and 14 years daughters. In forth case, perpetrator in domestic quarrel shot himself after strangulating his 2-year daughter and wife. In last case, due to some domestic quarrel, a middle aged father committed homicide by throwing his 6 years son and 8 years daughter in well and committed suicide by jumping in the same well [14].

In a case reported by Bhengra A et al., a 37-year man killed his 34-year wife by the hitting with saline stand on suspicion of infidelity and later committed suicide by hanging [15]. In three case series reported by Ghormade PS et al., husband aged 39 years stabbed his wife aged 34 years and daughter aged 13 years and later stabbed himself due to financial burden. In second case, due to domestic quarrel on unemployment, husband (25 years) strangulated his wife (21 years) and hung himself. And in third case, boyfriend (22 years) cut the throat of his lover (19 years) and later hung himself [16]. In a case reported by Chaudhari VA, a forty-year-old male shot his lover forty-eight-year-old female due to some monetary dispute and committed suicide by shooting himself [17]. In a case reported by Behera C et al. in 2009, 25-year old brother-in-law shot a 21-year-old girl with locally-made pistol, and later, shot himself with the same gun. The reason being extreme frustration of rejection of his love by her [18].

The observations noticed from the documented cases of homicide-suicide in India suggest common victim-perpetrator relationship, motives and cause of death. The common perpetrators involved were mother, father, husband and lover. The common motives observed were domestic quarrel, family disputes, extramarital affair, love failure and financial problem. Death by asphyxia (strangulation, hanging, drowning) was common cause of death in both perpetrators and victims, followed by other causes like fall from height, fire arm injury, stab injury and poisoning.

Conclusion

Though frequency of homicide-suicide is uncommon, they reflect many facts and facets of life in society. For investigating officer, as the offender is no more, it is suffice to make appropriate investigations and close the case file. But for betterment of society, there should be social, psychological and psychiatric investigations to prevent or reduce the further occurrence of such incidences. Both targeted prevention efforts for prone victims and perpetrators and maintaining an awareness of the increased risk of Homicide-Suicide are needed.

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Case Report

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A Case of Death with 100% Burn Injury Due to Blast of Furnace in a Metal Industry from Raigarh, (C.G.)

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Abstract

Autopsy examination of 100% burn is one of the most critical case that is encountered in medico-legal practice. At the same time burden to fix the identity of the victim lies on the autopsy surgeon in such cases. To exonerate any false positive or false negative inference, the concerned autopsy surgeon must be very cautious during examination. Preservation of articles during autopsy is very essential to avoid future disputes.

Keywords: Burn; Medico-Legal Practice; Autopsy; Identity; Articles.

Brief History

An average built male aged around 34 years, while working in a metal industry died due to 100% burn injury caused by furnace blast on 02-09-2017 at Raigarh, Chhattisgarh. As per police inquest report the above mentioned incident had happened when the deceased was working in Metal Industry (Iron) furnace plant around 3.40PM. The body of the deceased was brought to K.G.H. mortuary and Post-Mortem examination was conducted at 7.30 P.M. on same day after receiving written approval of S.D.M. Raigarh (C.G.).

External Autopsy Findings:

1. Remnants of burnt clothings with metallic buttons were present at places, body smudged with dust and soil at places all over, multiple fine metallic particles were found at places all over the body. One rubber glove smudged with dust and metallic particles found in right hand.
2. Whole body was burnt and greyish blackish in appearance.
3. Eyes were closed, cornea hazy.
4. Mouth was open, tongue visible, protruded and clenched between teeth.
5. Teeth were visible and inside the mouth.
6. Face was swollen, burnt, distorted and not identifiable, face smudged with dust and fine metallic particles.
7. Body was in typical pugilistic attitude (upper limbs held out in front of body and flexed at elbow and wrists, fingers of both hands flexed in claw like position, lower limbs flexed at knee and hip, arching of body backwards).
8. Reddish fluid was coming out from mouth.
9. Both nostrils were filled with greyish blackish dust and metallic particles.
10. Dermo-epidermal to deep burns present all over the body.
11. Peeling of skin present at places all over the body.
12. Multiple small blisters were present at places all over the body.
13. Scalp hairs present at places all over the scalp.
14. Scalp, axillary and pubic hairs were singed and blackish.
15. Gloving and stocking of skin of hand and feet present.
16. Penis and scrotum were burnt and swollen.

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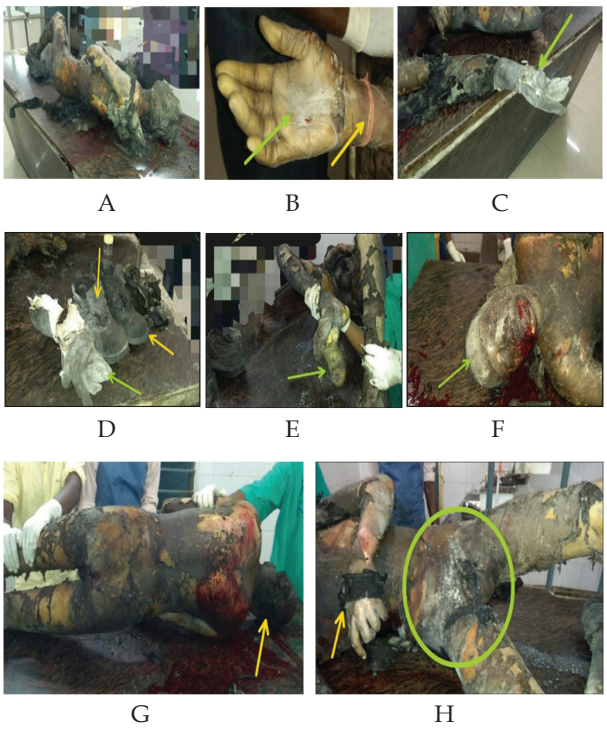
A[1] A[2]

(A[1]= Scene of accident from long range, A[2] = Position of the dead body at accident scene)

Fig. 1: Pictorial Description of Scene of Accident



A B C

D E F

G H

Fig. 2: Pictorial Depiction of External Autopsy Findings

A= Body showing 100% burn with typical pugilistic attitude, B= Palm of the hand contains deposition of metallic particles and red thread in wrist, which helps in identification, C=Shining metallic particles deposition on safety gloves, D=Deposition of metallic particles on shoes and gloves, E= Degloving of skin of foot, F= Diagram showing destructed facial structures along with deposition of metallic particles on head and face, G= Diagram showing back of the body with singed scalp hair and peeled off skin all over, H= Pubic region showing deposition of metallic particles along with burnt penis and scrotum, arrow mark showing remnants of burnt clothings in left hand.

I J

I= Arrow mark showing congested scalp, J= Deposition of carbonaceous soot particles in trachea and larynx.

Fig. 3: Pictorial Depiction of Internal Autopsy Findings

Internal Autopsy Findings-

All the internal organs were-

1. Intact.
2. Congested.
3. Stomach contains undigested semisolid food material about 500 gms with acidic smell.

Preservation

1. Blood preserved for-
   a. Blood grouping (2 ml. in a EDTA vial).
   b. Chemical analysis (25 ml. in a small bottle).
2. One molar teeth preserved for DNA analysis (if required)

Discussion

Thermal injury is injury to body resulting from localized or generalized exposure to extremes of temperature resulting in tissue destruction. In India there are several thousands of deaths occurring due to fire/burns and vast majority of these cases occur in the live. Burns may be divided pathologically or clinically. However most popular classification was by a French Surgeon Dupuytren Guillaume in 1832, who classified them in six degrees. Later Wilson and Von Hebra merged them into three degrees. To some extent the degree of burns can be estimated by clinical assessment i.e. naked eye examination. More precisely degree (depth) of burn can be measured by a high frequency ultrasound device. Other techniques include biopsy and microscopy, dye differentiation and fluorescence, fluorescent fluorometry, LASER doppler flow metry (Micro Radiography), light reflectance, MRI, Radioactive isotopes and thermography but each has severe limitations for practical application.

Thermal injuries are commonly encountered in forensic practice and sometimes provide a challenging problem in cases, which may have serious criminal aspects. The body may present a wide range of damage from mere reddening over wide areas to almost total cremation in which search may have to be made at the scene of the fire to collect or even discover the remnants. At > 70^0C exposure burn is instantaneous.

Death due to Industrial accident is one of the important incident in the segments of unnatural death investigation, since in this category of death investigation, several aspects are evaluated viz. Identity of the victim, Negligent act on the part of the victim or not, Negligence on the part of the owner or the operator of the plant. Even in the U.S. Department of Labor report (1942) [1] had acknowledged the fact of danger of burns from the molten metal. Even Suresh (2014) [2] had discussed the grounds for different types of fatalities in an existing steel plant blast furnace capacity of 0.6 MTPA (Metric Ton Per Annum) which produce around 1000 ton of hot metal known as pig iron daily. In Indian scenario death and casualties due to accident in Iron industry can be referred from the incidents of Bokaro Steel Plant [3], Keonjhar sponge iron plant [4] and Visakhapatnam Steel Plant [5]. Melting point of Wrought Iron, Gray Caste Iron, Ductile Iron, Steel are 1482- 1593^{0}C [6], 1127-1204^{0}C [6], 1149^{0}C [6] and 1371^{0}C [7] respectively. So considering the crime scene report as submitted by the Law Enforcing Agency (i.e. Police), deceased meet with an accident while working in a Metal Plant (Iron). Coupling this information with the melting point of Iron or associated alloys and > 70^0C exposure burn is instantaneous. Therefore the death was also instantaneous. With an object to exonerate any kind of foul play blood of the deceased was preserved. In the same line of action with an object to exonerate the future problem regarding identity of the deceased 3rd Molar teeth was preserved because in air accidents, burned and putrefied bodies dental pulp tissue could be obtained in most cases from materials obtained under experimental conditions and from forensic casework [8]. Even Madhya Pradesh High Court at Jabalpur in Ashok Dubey (Dr.) V. State of M.P., [9] had criticized the concerned autopsy surgeon for perfunctory autopsy coupled with non preservation of viscera.

Conclusion

Since as per police report the deceased had died while working in iron plant and P.M. finding also shows the deposition of metallic particles in different bodily parts as well as in wearings of the deceased (vide photographs B, C, D, E, F, H) on this basis knowledge about temperature of molten iron is needed to be co-related with the injury of the deceased. With an object to exonerate any foul play the body of the deceased should be photographed from different angles prior to autopsy for pictorial depiction. Meticulous autopsy should be performed. Body fluids for laboratory analysis and biological evidence for D.N.A. fingerprinting should also be preserved.

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Case Report

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Swimming Pool Injuries: Diving in a Swimming Pool can be Fatal

Abhishek Yadav[1], Mohit Gupta[2], Sudhir Kumar Gupta[3], Sanjay Kumar[4]

Abstract

Deaths in swimming pools are commonly attributed to drowning. There are other mechanisms also by which an individual can sustain injuries which can lead to an untimely death. We present a case of young male who sustained cervical spine injuries while diving in a swimming pool and died due to its complications. There is no separate registry or data in India compiling the number of swimming pool accidents and various injuries that are sustained by the patient. The authors aim to increase the public awareness regarding these hidden dangers with swimming pool activities which can cost permanent disability or even a life. This is not only a personal loss but a loss to the Community and Nation.

Keywords: Cervical Spine Injury; Drowning; Swimming Pool Accidents; Metallic Cervical Spine Implant; Septicaemia; Quadriparesis.

Introduction

Injuries commonly occur in various sporting activities particularly when enough precautions or proper supervision is not taken. Swimming Pool is considered as a complete body exercise for both adults and children and is undertaken by a significant number of people in warm climates. Children particularly enjoy swimming pools as a means of their entertainment for playing with their friends in the pool. In all the swimming pools invariably life guards are present to prevent any mis-happening but deaths due to accidental drowning are frequently are frequently reported. There are other mechanisms also by which an individual can sustain injuries which can lead to an untimely death. We present a case of young male who sustained cervical spine injuries while diving in a swimming pool and died due to its complications. The authors aim to increase the public awareness regarding these hidden dangers with swimming pool activities which can cost permanent disability or even a life.

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Case Report

A young, 24 years male, went for swimming practice in swimming pool. As he dived into the pool his head struck the base of the pool leading to cervical spine injury and hypoxic brain damage. He developed quadriplegia and was shifted to a specialized centre for spine management. He underwent anterior cervical discectomy of C5-6, C6-7 with C6 corpectomy, bone fusion using Iliac bone graft with anterior cervical plating. He subsequently developed bed sores, urinary tract infection septicaemia eventually succumbed to the complications of his injuries after nearly 5 months after sustaining the injury in the pool.

The autopsy was conducted in Department of Forensic Medicine, AIIMS, New Delhi. The deceased was of athletic built. Tracheostomy site was present over neck. Surgical scars were present on the lower third aspect of right side of neck and right iliac crest corroborating with the surgical treatment history with the surgical. On post mortem examination, the findings of surgical intervention were noted and the cause of death was opined as Septicaemia due to antemortem cervical spine injury (Image 1). Yellowish discoloration was present over the body tissues. Straw coloured fluid was present in the cranial, Pleural and Abdominal Cavity. Surgical

metallic implant with screws was present on the anterior portion of body of cervical vertebrae C4-C7 (Image 2). The underlying spinal cord was swollen and edematous. Signs of infection and septicaemia were present in the brain and lungs, as sequelae of cervical spine injury (Image 3).

Image 1: Surgical Scars over Right Side Neck and Right Iliac Crest

Image 2: Metallic Implant with Screws over the anterior portion of body of Cervical Vertebra

Image 3: Signs of Septicaemia in Brain

Discussion

Swimming and diving is probably the most common physical activity among children and the third most common activity overall [1]. Injuries and infections are not uncommon during Swimming. To spread awareness of infections and to promote healthy swimming, Centre for Disease Control celebrates Healthy and Safe swimming week every year [2]. A research of literature shows that the individual may sustain open wounds to different parts of body, spinal cord injuries, fracture of limb bones, head injury, lips and tooth injuries and sprains while swimming [3,4].

Deaths in swimming pools are commonly attributed to drowning [5-9]. There is no separate registry or data in India compiling the number of swimming pool accidents and various injuries that are sustained by the patient. According to Barss et al, Diving is the most frequent cause of spinal cord injury (SCI) from recreation and sport in Canada. [1] As described by Aito et al, Spinal cord injury usually occurs in younger individuals [10]. In most of the studies regarding injuries sustained during diving, male preponderance of injury was noted [4,10]. Usually injury involved C5 vertebral level and the neurological level was C6 [10].

In our case also the deceased was a young male who sustained injury to C5-6 vertebra resulting in quadriparesis. Deaths due to such injuries are rare. Aito et al describe that only one patient (n=65) died during hospitalization [10].

Conclusion

As in all other sports, injuries commonly occur during swimming. Some injures can be prevented by taking appropriate precautions like placing warning signs around the pool, appropriately labelling the depth of the pool, preventing people from taking dive in shallow depth and maintaining safety norm by having adequate life guards [1,9,11]. Spinal cord injuries during diving can be caused even with minor trauma in a predeceased individual and hence appropriate screening of swimmers/athletes should be done [12].

Funding

There is no funding involved with the article.

Conflict of Interest

There is no conflict of interests of any of the author.

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