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Original Article

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Incidence of Penetrating Injury Related Deaths in the Transkei Sub-region of South Africa (1996–2015)

B Meel

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Abstract

Background: Trauma is a leading cause of death in South Africa. Penetrating injuries are the cause of a high number of these traumatic deaths.

Objective: To study the incidence of deaths related top enetrating injury in the Mthatha region of South Africa.

Method: A record review was undertaken of all medico-legal autopsies performed from 1996 to 2015 at Mthatha Forensic Pathology Laboratory.

Results: Between 1996 and 2015 autopsies were performed on 22952 victims of unnatural death. Of these, 8 368 (36.45%) were killed by penetrating injuries. Anaverage of 62 deaths per 100 000 of the population were caused per year by penetrating trauma. The ratio between males and females affected was 6.7:1 in this study. Most victims of penetrating injuries (37.38%) were young people between the ages of 21 and 30.

Conclusion: The high incidence of death caused b ypenetrating injuryin the Transkei sub-region of South Africa (1996–2015) indicates that the situation needs urgent intervention to save lives.

Keywords: Cytotoxicity; Endothelium; Glyoxal; Proliferation.

Introduction

Penetrating trauma is becoming increasingly common in parts of the world where it was previously rare.[1] A study carried out at metropolitan hospital in South Africa (2011) showed that penetrating thoracic trauma has a high mortality rate of 30% insubjects with stab wounds and 52% inthose with gunshot wounds.[2] Less than a quarter of patients with a penetrating cardiac injury reach the hospital alive. Gunshot wounds of the thorax remain more lethal than stab wounds.[2] A recent (2015) study carried out in Durban by Moodley et al. has also shown that the rate of penetrating trauma remains high, although it is being overtaken by blunt trauma.[3]

Trauma in South Africa was already described as a malignant epidemic over two decades ago, and this remains an apt term. [4] The trauma burden in South Africa issignificant and the country experiences over 30,000 trauma-related deaths annually.[5] Interpersonal violence has always been a major contributor to trauma-related deaths in South Africa.[6] Violence and firearms are common features of South African society.[5] In 27 developed countries, there was a significant positive correlation between guns per capita per country and the rate of firearm-related deaths. The number of guns was a strong and independent predictor of firearm-related death

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in a country. The hypothesis that guns make a nation safer is no longer true.[8]

Although interpersonal violence exists in every society, the WHO estimated that 90% of it occurs in low-and middle-income countries.[9] South Africa's unique political history and resulting social and economic inequalities have been identified as some of the possible factors contributing to the high rate of interpersonal violence.[10] Several other factors reported to be associated with violent death include poverty, lack of education, unemployment, alcohol abuse, substance abuse and power (male dominance).[11]

The purpose of this study is to determine trends in deaths as a result of penetrating injuries, and to highlight the causative factors in the Transkei sub-region of South Africa. It will also discuss prevention of these deaths.

Materials and Methods

This is a retrospective descriptive study from the autopsy register of Mthatha Forensic Pathology Laboratory. The Mthatha Forensic Pathology Laboratory is the only laboratory in this region catering for more than half a million of the population in the region of Mthatha. It is attached to the Nelson Mandela Academic Hospital, which is the only teaching hospital in this province. This again is attached to the Walter Sisulu University Medical School; all medico-legal cases in this region of South Africa are examined there. A total number of 27 036 autopsies were conducted between 1993 and 2015. The details of names, addresses, age, gender, date of autopsy and cause of death were recorded in the post-mortem register. Fourteen forensic officers are engaged in collecting corpses round the clock from 17 police stations in four municipalities. These are the OR Tambo, Mhlontlo, Chris Hani and Mbashe municipal areas, comprising about 200 square kilometres (Fig. 1).

The OR Tambo municipality is the largest, and is covered fully by ten police stations. Mhlontlo municipality has four police stations, Chris Hani municipality two and Mbashe municipality one. The combined population was 400,000 in 1993, but it has been increasing by an average of 3% annually since then. We excluded conceptus material and foetuses, as their age and gender were not indicated in the post-mortem registers. Stab wound and firearm injuries combined are classified as penetrating injuries.

It is difficult to determine the cause of death in cases of advanced putrefied human remains, and such cases are therefore also excluded from the study. The terms 'stab wound' and 'stab injury' are used interchangeably and mean the same; 'gunshot' and 'firearm' injuries are also used interchangeably. All cases of penetrating (both stab and firearm) injuries are recorded. Data were collected on a sheet of paper designed to record the post-mortem number, year, gender and cause of death. These data were transferred to the Excel computer program and analysed by using the SPSS computer program.

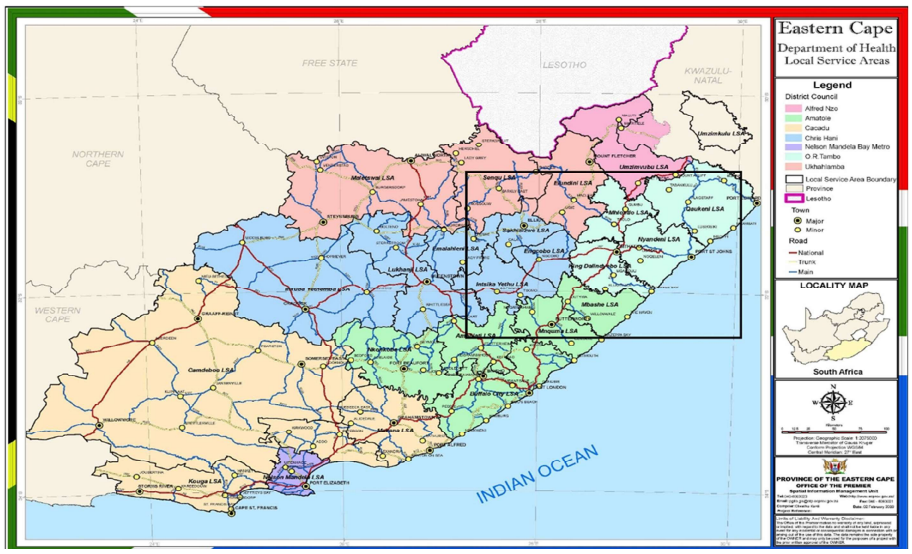

Fig. 1: Map of Transkei sub-region of South Africa catering population by Forensic pathology Laboratory indicated by a square.

Results

Between 1996 and 2015 autopsies were performed on 22,952 victims of unnatural death. Of these, 8 368 (36.45%) were killed by penetrating injuries (Table 1). Anaverage of 62 deaths per 100,000 of the population per year were caused by penetrating trauma (Table 2). The highest incidence (81.7 per 100,000) was in 1999 and the lowest (48.8 per 100,000) in 2009 (Table 2 and Fig. 2). The average rate of penetrating injury deaths was 54 per 100,000 per yearamong males, and eightper 100,000 per year amongfemales (Table 2 and Fig. 2). Among males the highest death rate was 69/100,000 in 1999, and the lowest was 44.2/100,000 in 2009 (Table 2 and Fig. 2). Among females the highest death rate was 13.4/100,000 in 2000, and the lowest was 4.6/100.000 in 2009 (Table 2 and Fig. 2).

Table 1: Ranks of percentage of cause of death by gender in Umtata area, South Africa (1996-2015).

Rank	Males (n = 18176)		Females (n = 4776)		Total (n = 22952)	
	Cause of death	n (%)	Cause of death	n (%)	Cause of death	n (%)
1	Penetrating	7280 (40.05)	MVA	1563 (32.72)	Penetrating	8368 (36.45)
2	MVA	4121 (22.67)	Penetrating	1088 (22.78)	MVA	5684 (24.76)
3	Assault	2173 (11.95)	Poisoning	481 (10.07)	Assault	2538 (11.05)
4	Hanging	1335 (7.34)	Assault	365 (7.64)	Hanging	1502 (6.54)
5	Drowning	914 (5.02)	Drowning	303 (6.34)	Drowning	1217 (5.30)
7	Collapse	783 (4.30)	Collapse	259 (5.42)	Collapse	1042 (4.53)
8	Poisoning	540 (2.97)	Burns	242 (5.06)	Poisoning	1021 (4.44)
9	Burns	389 (2.14)	Lightening	170 (3.55)	Burns	631 (2.74)
10	Fall from height	333 (1.83)	Hanging	167 (3.49)	Fall from height	446 (1.94)
11	Lightening	261 (1.43)	Fall from height	113 (2.36)	Lightening	431(1.87)
12	Gas suffocation	47 (0.25)	Gas suffocation	25 (0.52)	Gas suffocation	72 (0.12)
All causes of death		100%	All causes of death	100%	All causes of deaths	100%

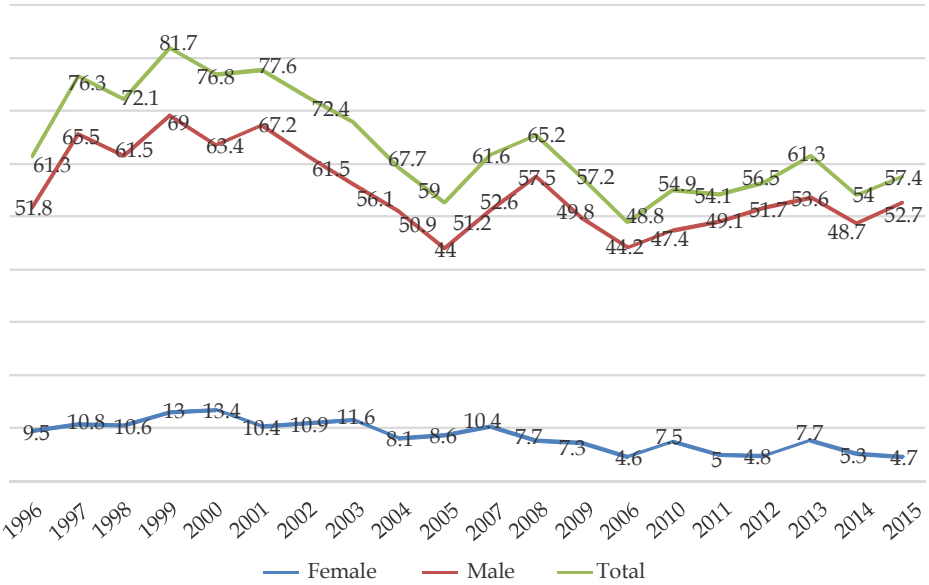

Fig. 2: Year wise pattern of deaths as a result of penetrating injuries in the Transkei sub-region of South Africa from 1996 to 2015 (n = 8368).

Table 2: Incidence of deaths as a result of penetrating wound in the Transkei subregion of South Africa from 1996 to 2015 (*n* = 8368).

year	Estimated population	Females (*n* = 1088)	Females (per 100,000)	Males (*n* = 7280)	Males (per 100,000)	Total (*n* = 8368)	Total (per 100,000)
1996	439091	41	9.5	223	51.8	264	61.3
1997	452264	49	10.8	295	65.5	344	76.3
1998	465832	49	10.6	283	61.5	332	72.1
1999	479807	61	13.0	331	69.0	392	81.7
2000	494201	66	13.4	311	63.4	377	76.8
2001	509027	52	10.4	336	67.2	388	77.6
2002	524298	57	10.9	320	61.5	377	72.4
2003	540027	63	11.6	303	56.1	366	67.7
2004	556227	45	8.1	280	50.9	325	59.0
2005	720304	62	8.6	317	44.0	379	52.6
2006	741913	77	10.4	379	51.2	456	61.6
2007	764171	59	7.7	437	57.5	496	65.2
2008	787096	57	7.3	389	49.8	446	57.2
2009	810708	37	4.6	358	44.2	395	48.8
2010	835030	63	7.5	394	47.4	457	54.9
2011	860081	43	5.0	422	49.1	465	54.1
2012	885883	42	4.8	455	51.7	497	56.5
2013	912460	70	7.7	488	53.6	558	61.3
2014	939833	50	5.3	453	48.7	503	54.0
2015	968028	45	4.7	506	52.7	551	57.4
Average	648810	51.4	4.8	345.2	54.0	396.3	62.0

Table 3: Age distribution among victims of penetrating injury in both gender in the Transkei sub-region of South Africa from 1996–2014 (*n* = 7750).

Age group	No. of males (%)	No. of females (%)	Total number (%)
1–10	71 (0.91)	32 (0.41)	103 (1.32)
11–20	1369 (17.66)	164 (2.11)	1533 (19.78)
21–30	2668 (34.42)	229 (2.95)	2897 (37.38)
31–40	1289 (16.63)	165 (2.12)	1454 (18.76)
41–50	706 (9.10)	160 ((2.06)	866 (11.17)
51–60	342 (4.41)	119 (1.53)	461 (5.94)
61–70	182 (2.34)	85 (1.09)	267 (3.44)
71–80	92 (1.18)	52 (0.67)	144 (1.85)
> = 81	10 (0.12)	15 (0.19)	25 (0.32)
Total	6729 (86.82)	1021 (13.17)	7750 (100)

Males are outnumbered at aratio of 6.7:1 in this study (Table 2 and Fig. 2). Most (37.38%) victims of penetrating injuries were young people between the ages of 21 and 30 years (Table 3 and Fig. 3).

Discussion

Transkei has the unique distinction of having produced a political leader of national and international repute, yet it has a long-standing history of violence. Long before any contact with whites, there were some vicious wars among black tribes. Using violence to deal with problems has a long, long history. At atime the people fought fearlessly againstthe apartheid regime, but now that freedom has been won the violentmentality is unchanged. Most of the black nations actually comprise many tribes. The tribe is not the entire nation. I don't know how many Xhosa tribes there are, but the Zulu nation, for example, is made up of round about 300 tribes. In fact, some pretty serious fighting among different tribes in the same nation has not been uncommon!

The majority of the people belong to the Xhosa in this region. In olden days the culture of the Xhosa people very much demanded respect for

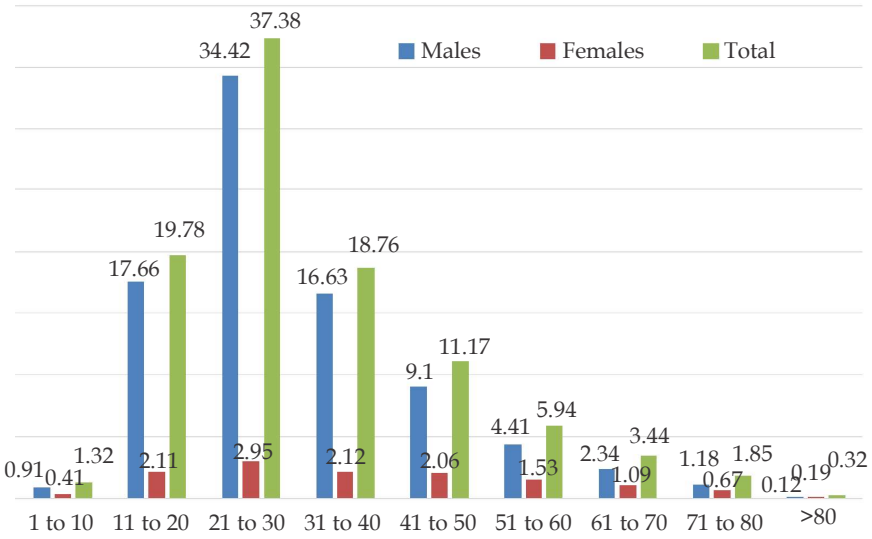

Fig. 3: Pattern of penetrating injuries in different age groups among both gender in the Transkei sub-region of South Africa from 1996 to 2014) (n = 7750).

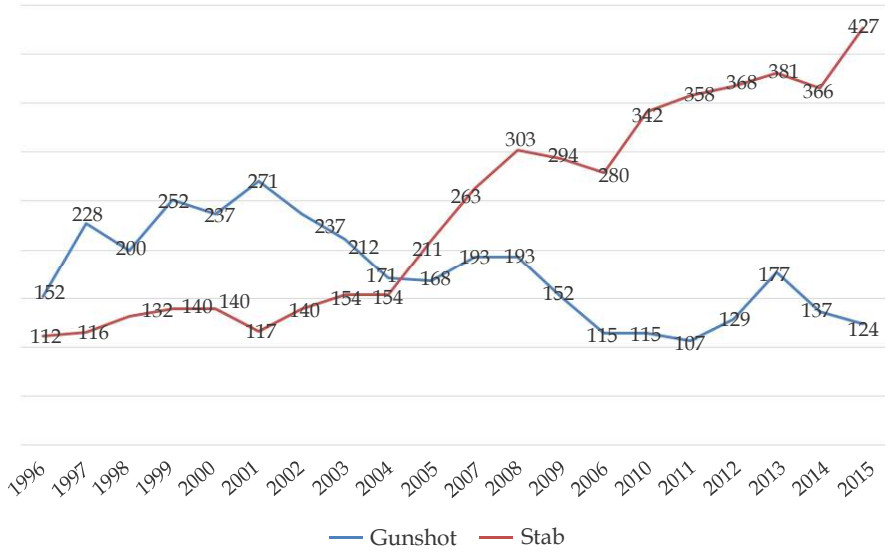

Fig. 4: The number of stab and gunshot related deaths among both gender from 1996 to 2015 (n = 8368).

the elderly, and looking after family and extended family members, but now things have changed. Families are fragmented and are not caring for their own children and family members. This could be a result of the impact of apartheid, which needs to be sorted out overtime. The areais rural to semirural, with poor infra-structure such as roads, hospitals and transport systems; this affects people's lifestyle.

This is probably the first autopsy report in South Africa covering specifically a rural region and involving a large sample size over a study period of 20 years. Only a few reports have been published on penetrating injuries in South Africa. Most of them are either case reports or discuss specific organ and system injuries, based on hospital study. Deaths related to penetrating injuries are considered an urban problem in South Africa, mostly limited to metropolitan cities such as Cape Town, Johannesburg, Durban and Bloemfontein, but this is not true;its incidence is no lower in rural regions.

Penetrating injuries arethe leading cause of death among all unnatural deaths. Such injuries cause about one-third 8 368 (36.45%) of all unnatural deaths (Table 1). Murder is apainful event, affecting not only the victim and the family, but also the community as a whole. It elicits great emotion, evidenced by the fact that the funeral service of

a murder victim is quite different from that of a person who died for another reason. Despite this, people seem oblivious to the problem and to turn a blind eye to this crime in this part of the country. Sadly, this is because they have seen this heinous crime being perpetrated so often that they tend to accept it as an unavoidable part of day-to-day life.

The average murder rate in the area as a result of penetrating injuries is 62 per 100,000 of the population per year (Table 2). There is insufficient published literature on fatalities as a result of penetrating injuries to compare with it, but it seems to be the rate of deaths as a result of penetrating is the highest in South Africa, as well as in the world. A mortuary-based published study (2014) showed that out of 1 105 trauma-related deathsin Durban, 69.4% were caused by blunt trauma, followed by 30.4% penetrating injuries.[6] The worst year was 1999, when the highest rate (81.7/100,000) of deaths as a result of penetrating traumawas registered (Table 2 and Fig. 2). Contrary to the conflict suggested by these statistics, no major episode occurredin this region in 1999, except for afight aboutcattle theft between the population of Qumbu and Tsolo.

The community has also been disappointed by the government, of which they had higher expectations, based on promises in the 1994 election. The lowest number of deaths was recorded in 2009, when the death rate came down to 48.8/100,000 of the population (Table 2 and Fig. 2). The average death rate was 54 per 100,000 among males, which is about four-fifths (87%) of the total number of deaths for this reason (Table 2 and Fig. 2). Women have better survival skills than their male counter parts. About seven men die for ever one woman who passes away as a result of penetrating injuries (Table 2 and Fig. 2). Women are generally not violent, and most of those killed were killed by their intimate partners. Several studies published have shown that South Africa has a high rate of women being murdered by their intimate male partners.[12] Guns play a significant role in violence against women in South Africa, most notably in killings by their intimate partners.[13]

The changing trend ininjuries and the method of causing them is quite obvious in this study (Fig. 4). It is not clear what is causing this change, but the implementation of the Gun Control Act in 2002 could be presumed to bean important factor in effecting are markabler eduction in the number of deaths as a result of firearm injuries. It does not mean that the total number of murders has decreased. Surprisingly, the number of deaths as a result of injuries caused by sharp-pointed objects has increased, and this has neutralised the benefit of gun control in this region (Fig. 4). However, firearm injuries are more lethal than stab injuries, and penetrating trauma is more lethal than blunt trauma.[4] Pre-hospital deaths caused by penetrating injuries could be reduced by providing efficient emergency care. The hospitals must be equipped to deal with these cases of emergency with trained staff. A study conducted by the author (2004) in the same region showed that 12% of pre-hospital deaths were preventable.[14] Chest and abdominal injuries due to penetrating trauma frequently cause death.[6] Injuries to vital organs such as the heart and lungs are more problematic, and saving these injured patients is really a challenge in this region, as paramedic services as well as expertise are lacking.

Males account for a high murder rate, and most murders (54/100,000–87%) were committed with penetrating objects in this sub-region of Transkei in the study period between 1996 and 2015. (Table 2 and Fig. 2). This is higher than 'Global status reports' of the WHO (2014) showed that males account for 82% of all homicide victims.[15] The highest percentage (37.38%) of young male murder victims in theage group from 21 to 30 years were victims of penetrating injuries (Table 3 and Fig. 3). It is generally expected that people will beless involved in serious crime with increasing age. This is probably because people become less emotional and wiser with age, as tendency of committing crime has lowered as age advances (Table 3 and Fig. 3). It is sad that 103 (1.32%) children under the age of 10 years were also killed by penetrating injuries in this region of South Africa in the study period (Table 3 and Fig. 3). The explanationis hypothetical but it is possible that this is related to the problem of multiple partnerships among Transkeians. Hospitals frequently have to deal with quarrelsin families about thelegitimacy of a child, and people approach medical personnel to carry out DNA testing. This could result in fighting between couples and the child could become the unfortunate victim.

Several factors playing a role in causing the high number of deaths as a result of penetrating injuries, such as poverty, alcoholism and mental status. All factors are synergistic and complement oneother to cause crime. Poverty is severe in the former Bantustans such as the Transkei region. Seventy-three percent of the rural people in the Eastern Cape were living on less than ₹300 per month in 2005/2006 and more than half of them on less than ₹220 per month.[16] A poor man often becomes either

a perpetrator or a victim of homicide inthe search for food. They take risks every day to procure their meal. They are also at a disadvantage when they need medical treatment because they are so poor. It is a vicious cycle; being poor, one is more prone toviolence, and violence propagates poverty. Weal thier people are associated with a decrease in the risk of violent death.[17] The poor often also consume excessive amounts of alcohol in an attempt to deal with the problems of poverty. Alcohol consumption rates in South Africa are the highest in the world, and are continuing to rise.[18] South Africa is a hard-drinking country. It is reckoned that the population consumes in excess of 5 billion litres of alcohol annually.[19]About half (49.5%) of traumatic deaths are related toalcohol in the Transkei region.[20] Alcohol and psychiatric illnesses both have a cause and effect relationship. A third of South African suffer from mental health disorders. More than 17 million people in South Africa are dealing with depression, substance abuse, anxiety, bipolar disorder and schizophrenia.[21] Trauma-related deaths arealso compounded by the high HIV infection rate in this region, which poses an even bigger threat to the country than does violence.[22]

There is no deterrent to committing murder in South Africa. Most perpetrators and victims are from slum areas, and they want to go to jail. Outside prison they do not have food to eat and potable water to drink. Prison is acomfortable place, as they are provided with comfortable beds to sleep, hot water showers, radio and television to watch, with three full meals. To them it is like living in a five-star hotel. It has been suggested that the death penalty should be re-introduced in South Africa to control the rate of murder, but although this is not feasible, a less harsh, but effective, punishment needs to be found soon. The South African government much prefers talking about road traffic accidents rather than murder and would prefer to side-line the issue of murder. This must not be allowed to happen. Government musttake action more firmly. People are killed by others every day, many more than those killed in road traffic accidents. Murder must always be criticised in a civilised society. It is not an unfortunate event that cannot be prevented, such as death by lightning! A single murder costssociety and the nation as a whole dearly economically and socially. Politicians must understand this issue and developan action plan to stop this trend.

Limitations

Despite the assistance of Statistics South Africa, it is difficult to estimate the actual population in South Africa as a whole and the region in particular accurately, because of the awkward geographical position of police stations and the fluctuating migration numbers. The annual growth in population is accepted as 3%, which may not be strictly accurate in view of the lack of precise death and birth ratios. However, the author has tried to estimate the rate as accurately as possible.

Conclusion

There is a high incidence of deaths as a result of penetrating injuries in the Transkei sub-region of South Africa over a 20-year study period (1996-2015). Nevertheless, the homicide rate as a result of penetrating weapons is at least two to three times higher than in the rest of South Africa, and three to four times higher than the international average. There is an urgent need to curb the occurrence of these death by government planning to set up acontrol system, policing to carry out investigations more quickly and fast-tracking the justice system to meet outharsher punishment to the perpetrators of these crimes. Revamping the health care system both at pre-hospital level and at hospital level in this sub-region of Transkei in South Africa is also crucial.

Ethical Issues

The author has ethical permission for collecting data and publication (approved project No. 4114/1999) from the Ethical Committee of the University of Transkei, South Africa.

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Correlation Analysis Between Oswestry Disability Questionnaire and Abdominal Flexor Endurance among Non-Specific Low Back Pain Patients

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Abstract

Introduction: Forensic ergonomics plays a vital role in understanding the vital relationship between legal problems and injuries. Core stability has an important role to play for an efficient functioning of both the upper and lower limb along with the task of stabilizing the trunk and maintaining proper posture, through a coordinated and integrated manner. The inadequacy of the core poses a risk for the development of low back pain and dysfunction as a result of poor ergonomic posture.

The reason has been attributed to an altered neuromuscular balance leading to an imbalance of the endurance of the trunk muscles.

Aim: To study the relation between flexor muscle endurance and non specific low back pain.

Materials and Method: 6 subjects (3 males and 3 females) were selected on the basis of Oswestry disability index (ODI) questionnaire score of the age group of 22–45 years with a non specific origin of low back pain. The flexor muscle endurance times were noted using the McGill's flexor endurance test for each of them. A Pearson's correlation coefficient was then calculated and significance of the testwas determined.

Results: The study revealed a Pearson's correlation coefficient r = 0.622, and a t-test value p-0.001, implying a significant result.

Conclusion: It can be concluded that there is a moderate correlation between flexor muscle endurance and non specific low back pain with a revelatory result and it can be utilized for clinical use, such as work ergonomics in an efficacious manner.

Keywords: Core stability; Endurance; McGill test; Low back pain; Synergistic movements, Altered coordination; Forensic ergonomics.

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Introduction

Forensic ergonomics has increased the awareness amongst the administrators, practitioners and researchers that musculoskeletal conditions such as low back pain (LBP) are often activity related and much of this activity occurs at the workplace.[1] Work-related factors can cause musculoskeletal disorders, aggravate their condition and impede rehabilitation.[1] Back pain and its accompanying problems plays an enormous burden on society,

health care systems and also toward the economies in the developed countries.[2] LBP results from localised muscle fatigue, in general, muscle fatigue is defined as a representation of a multifaceted phenomenon with physical and chemical changes in muscle, as well as alterations in nervous system efficiency, which are related to different causes, mechanisms and symptoms,[3,4] muscular endurance has been found to be more discriminant than strength to differentiate between healthy subjects and individuals with LBP.[5]

Stability of the core is essential as it responsible to produce complex functional tasks, produce and transmit the forces, in controlling the movements of the distal segment, all which is achieved through a synergistic work of the core muscles.[6,7] An inadequate stability of the core has been closely linked with injuries of the lower limb in athletes, as well as low back pain.[6] This has been closely attributed to a faulty neuromuscular control, and also to a higher degree of fatigability of the trunk muscles.[8,9] Since core stability cannot be directly measured, that can be assessed through its various components-endurance, flexibility, strength, function, and motor control.[6] Various studies have revealed that there is a close link between imbalance in the endurance of the trunk muscles with low back pain, rather than isometric strength.[10]

Hence, there is a need to assess the core endurance is essential using methods requiring less expense and equipments such as McGill's endurance test.

There is lack of sufficient work determining the relationship between low back pain and flexor muscle endurance, therefore, it is crucial to evaluate the subject from a clinical perspective, as an assessment apparatus but also as an important rehabilitation program.

Materials and Methods

The study was conducted at the PhD laboratory, Centre for Physiotherapy and Rehabilitation Sciences, Jamia Millia Islamia, New Delhi. The data was collected between 24th–31st January 2019 with a study population involving 6 subjects (3 males and 3 females). The instruments used for the study includeda stopwatch, plinth, stabilizing belts, goniometer and foam board for back support.

Inclusion criteria

Male and female subjects with in the age group 22–45 yeas, with a low back pain history of more than 3 months and havinga non-specific origin of low back pain were included. The subjects were made to fill up the Oswestry Disability questionnaire, and those found to be havingmoderate disability were chosen for the study.

Exclusion criteria

Individuals with a past history of any injury to the spine, any spinal surgery, spinal pathology (eg: spondylosis, spondylolisthesis, spine tumors, cauda equina syndrome), slipped intervertebral discs, history of neurological symptoms and deficits, spinal infections, pregnant women were excluded from the study.

Outcome Measure

The outcome assessment was done using the McGill's endurance test method that has a reliability of 0.97 for the flexor test.[11]

For the flexor endurance test, the subject's feet were stabilized either byusing a stabilizing belt or manually on the plinth.[12] Both the knees were flexed to 90°, while the trunk was made to incline at an angle of 60°, both the angles were measured by a goniometer to check the correct alignment. The subject was asked to cross the arms over the chest with the examiner providing back support using a foam board at 60° inclination making sure that the back is straight and not slouchesd.[11]

The subjects were instructed to maintain this position while the foam board or the support was pulled back 10 cm to begin the test and time recording using stop watch began simultaneously. The time for how long the patient was able to sustain the position was noted. The test was terminated as soon as the patient was unable to maintain the position either through arching of the back ordeviating from a neutral spine, or when the patient would touch the foam board behind them.[13]

It was made sure that the patient was not encouraged to sustain the position as it would cause error in the actual readings.[12]

The normal values for the flexor endurance test were as follows as determined by McGill et al.[11]

Table 1: Mean flexor endurance times (sec) with standard deviation and ratio normalized to extensor exercise.

Task	Men			Women			All		
	Mean	SD	Ratio	Mean	SD	Ratio	Mean	SD	Ratio
Flexor	144	76	0.99	149	99	79	147	90	0.86

Fig. 1: McGill flexor endurance test position.

Results

The results collected from the subjects were as follows

Statistical Analysis

The analysis of the data was done to reveal Pearson's correlation coefficient *r*, which helps to understand the extent of the relation between the two. The values of *r* can be interpreted as follows: 0.00–0.25 implies no to little relationship, 0.26–0.50 as fair amount of relationship, 0.51–0.75 as moderate to good relationship, 0.76–1.00 as good to excellent relationship.[14] The significance of the test was also determined using a two tailed *t*-test where $p < 0.05$ indicates a significant result.

Table 2: Low back pain disability and McGill flexor endurance times

Patient details	Oswestry Disability score	McGill flexor endurance time
Subject 1–38/M	[(16/45) × 100] = 35.5%	12.37 seconds
Subject 2–24/M	[(14/45) × 100] = 31.1%	20.1 seconds
Subject 3–33/M	[(15/50) × 100] = 30%	12.10 seconds
Subject 4–43/F	[(16/45) × 100] = 35.5%	6.35 seconds
Subject 5–35/F	[(13/45) × 100] = 28.8%	9.65 seconds
Subject 6–36/F	[(13/45) × 100] = 28.8%	8.43 seconds

The results of data analysis done were as follows:

The analysis demonstrated a Pearson's correlation coefficient as 0.622, and a two tailed test *p*-value as 0.001, between the Oswestry disability score and the flexor endurance time. It was also observed that females showed a slightly lower endurance time than men.

The analysis shows a significant correlation between non specific low back pain, assessed by the Oswestry Disability questionnaire, and flexor muscle endurance performed by the McGill's flexor endurance test. This implies that individuals with non specific low back tend to have less endurance of the flexor muscle.

Table 3: Correlation values

	ODI score	Endurance tests
Pearson's correlation	1	0.622
Significance two-tailed	–	0.001
N	6	6

Discussion

The purpose of the study was to find a correlation between non specific low back pain and the endurance of flexor muscles which is clinically important from ergonomic point of view. According to the results obtained, the subjects with non specific low back have shown significantly lower flexor endurance when compared to the normative data calculated by McGill et al, 1999. The test and the results provide us an insight into the stability of the spine and the performance of the trunk muscles.

One of the primary stabilizers of the trunk is the Transversus Abdominis (TrA), which is one of the first muscles to be active before the movement of the proximal or distal segment.[15,16] It functions by stiffening the lumbar and sacroiliac segments to prevent any uncoordinated and uncontrolled movements of the trunk with the limb movements[16] and helps to maintain correct posture during work. The thoracolumbar fascia (TLF) and the TrA are directly attached, and function of the TLF is to increase the Intraabdominal Pressure (IAP). Any weakness or inefficiency of the TrA reduces the shear strain function of the TLF, hence reducing the IAP making the lumbar spine unstable, increasing the inappropriate loading of the spineand contributing to poor ergonomic posture.[17]

It can be well understood that the trunk muscles are physiologically functioned to provide stability to the spine by working at low activity levels for a prolonged duration, hence they are abundant in Type I slow oxidative fibers.[18] The composition maybe altered due to deconditioning and changing to anaerobically functional resulting into instability and pain.[19]

The spinal stability and control depends on the coordinated action of the deepmuscles of the trunk.[15] It has been observed that recurrence of the non specific low back pain has been related with altered motor coordination and an increasing fatigability of the trunk muscle[8,9] and this may contribute to poor posture or poor ergonomics at work.

The muscles around the trunk when working insynergy, are able to provide adequate support. If any one of the groups, whether the agonist or the antagonist fails to activate and contract in a synergistic manner, the other group has to compensate by working more than it rather would. This leads to changes at a global level by changes in posture, or at a segmental level by alterations in the movement of each segment. All of this, leads to a lower endurance, an imbalance of strength as well as endurance, between the agonist and antagonist muscle groups hence, back pain. This persistent pain further changes the muscle activation pattern in the abdominals as well as the paraspinals, leading to a dysfunction in the deep abdominals hence becoming a vital contributor and component which results into LBP development.[20] It also increases the risk of lower limb injuries due to altered activation patterns and muscle function in their endurance.

Therefore, core endurance training is essential and must be incorporated into rehabilitation programs so as to reduce the risk of injury and to prevent recurrence of pain. Along with endurance training, interventions that aim to restore the balance between the two muscle groups, a coordination between the core and lower limb muscle function, as well as adequate strength of the muscles is essential for the management of low back pain with a non specific origin.

Limitations

The study sample was small, consisting of 6 subjects only, hence, the results cannot be generalized to the whole population. Most of the subjects were endomorphic, implying a change in the body composition and presence of morebody fat than lean mass. This certainly would lead to a lower endurance result.

Conclusion

The result of this study shows a considerable reduction in flexor muscle endurance in individuals with non specific low back pain. Moderate correlations were shown between the Oswestry disability score (ODI) and the flexor endurance times, and these values were shown to be highly significant. Hence, it can be concluded that there is a relationship between the two, and this can be incorporated as a tool of assessment and can be used in the rehabilitation programs to enhance patient's function and efficiency. This data may be used in the ergonomic training of people suffering from non specific low back pain at work. Correct posture during work is of utmost importance for adequate functioning of the neuromuscular system as well as the musculoskeletal system and appropriate load transfer.

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Analysis of Histomorphological Spectrum of Stillbirth in Diabetic Pregnancies: An Autopsy Based Study in A Tertiary Care Teaching Hospital

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Abstract

Background: Forensic Pathology remains a mainstay in diagnosing all forms of fetal death including stillborn and it is an indispensable tool in the process of evaluating the underlying cause of death. Diabetes mellitus (DM) being a common clinical condition with hyperglycemic state, it has a major impact on the growing fetus during gestation causing several morbidities including still birth. Histopathological evaluation of the systemic organs yields adequate information of the etiopathogenesis for the cause of death thereby aiding clinicians to proceed with further management and counselling to the parents

Methodology: The study was conducted between 2012 to 2020 covering 25 cases. The cases were categorized into 2 groups like Diabetes in Pregnancy (Type 1 & Type 2 DM) and Gestational Diabetes Mellitus (GDM). Complete clinical data including diabetic profile were documented. Routine fetal autopsy procedure was performed and the major systemic organs involved in metabolism like Liver, kidney, pancreas and lungs were weighed and analyzed for histomorphological changes**.**

Results: The study analyzed 25 cases which showed 5 cases each in Type 1 & Type 2 DM and 10 cases in GDM. Renal changes in fetuses were prominent in GDM compared to other groups. Histomorphological changes in the form degenerative features in liver, pancreas and lungs were more in common in GDM

Conclusion: Gestational Diabetes mellitus stays as a rampant condition leading to major cause for still birth compared to Type 1 & 2 DM. It had been evident that GDM is not an homogenous set of disease and a subset of conditions especially pre-existing but left undiagnosed could be a potential risk for growing fetal malformations with subsequent organ failure and stillbirth

Keywords: Fetal autopsy; Diabetes mellitus; Histomorphology; Still birth.

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Introduction

In the modern fraternity of medicine with many innovative interventional procedures for various disease conditions, fetal death still remains rampant and a formidable condition to deal for both Clinician and patients as well.[1,2] Fetal death is defined as 'a death that occurs before complete expulsion or medical interventional extraction of products of conception which is independent of gestational period and it is marked by no evidence signs of breathing, heartbeat, or signs physical mobilization of muscular movement.[3]

The incidence of fetal mortality is still on higher margin and it is denoted by[4]

$$\text{Fetal deaths} = \frac{\text{Number of fetal deaths encountered} \times 1000}{\text{Sum of live births and fetal deaths in a given number of population}}$$

Neonates and fetuses in India are highly vulnerable and it had been estimated that nearly one quarter of overall global deaths occurs in India which is highest among worldwide ratio constituting a sum of 0.80 million deaths per year.[5,6]

While many morbidities contribute to this high incidence, toxemic pregnancies is among the leading cause mostly attributed to maternal factors. Perinatal mortality is one among the consequent and it is applied as a tool to measure as the indicator of heath care status as a quanta due to the existing paucity of framework and guidelines in estimation of still births.[7]

World Health Organization (WHO) states still birth as 'loss of fetus that occurs post 20 weeks of gestational period subject to restriction to mothers with documentary evidence of biochemical confirmation of Gestational diabetes mellitus or condition of diabetes in pregnancy'.[1,8] There are several identifiable contributory factors for stillbirth which includes increased suboptimal glycemic index either in form of Gestational diabetes mellitus (GDM) or diabetes mothers in pregnancy (DIP); Maternal obesity, maternal smoking habits, gestational hypertension and subsequent pre-eclampsia, teratogenic medications (pre-conception) etc.[9,10]

Among the known factors GDM tops the table as a potential etiology for still birth in adjunction with other risks like lethal malformations, twin pregnancy and its associated morbidities, macrosomia, intrapartum hypoxia, intrauterine growth retardation, chromosomal abnormalities, maternal infections, low for gestational age, bad obstetric history and fetal medical conditions.[11,12]

Diabetes mellitus is defined as a spectrum of 'metabolic disorder characterized by high blood glucose levels owing to lack of adequate production or peripheral action of insulin in the body.[13,14] Gestational diabetes mellitus being the most commonly encountered medical related complication of pregnancy, WHO defines GDM as 'any grade of glucose intolerance which had been primarily recognized and proved by laboratory tests during time of pregnancy.[15,16] The prevalence of pre-existing DM in pregnancy (DIP) is just 1–1.5% whereas GDM accounts for a massive alarming figure of 9–25% of pregnancies in in India.[17,18]

Hyperglycemic state in utero in early pregnancy state is known to adversely impair organogenesis like renal, liver and pancreatic development.[18] Though radiological investigations are available to measure the organ damage, histopathological examination of organs of fetal autopsy stays as standard method of documenting the systemic organ damage occurred due to GDM.[19] A systemic analysis to work on the causes of still birth in GDM mothers identified systemic impairment of organs as major cause for still birth and its morbidities.[8,20]

Still birth and neonatal death seems to represent extremes of spectrum of morbidities, autopsy examination still remains as a nodal procedure of examination for integration of medical knowledge.[21,22] Various data available on GDM focusses only on clinical parameters and outcomes whereas in Indian context very sparse studies were carried out to analyze risks of GDM associated still birth in general population.[23,24] Systemic organs like liver, kidney, pancreas and lungs are known to be active metabolic and it is directly in association with DM related changes.[25] Hence the present study was conducted with a novel aim to analyze the histomorphological changes of renal, liver and pancreas on fetal autopsy in still birth from GDM mothers and propose guidelines on preventive measures and counselling to parents for subsequent pregnancies.

Materials and Methods

The study was conducted at Mahatma Gandhi medical college & Research Institute and all fetal autopsies performed during May 2012 to January 2020, was included for the study data collection. The study enrolled only cases which were directed to fetal autopsy at parents request after obtaining clear written consent and Institute Ethical clearance was obtained to collect data from medical records.

Inclusion criteria

Cases referred to routine fetal autopsy due to still birth from mothers having Diabetes/GDM at parents request to identify the underlying pathology

Exclusion criteria:

Intrauterine fetal death.

Data collection: Clinical and laboratory data collected was prescribed proforma which maternal

and pregnancy clinical details. Diabetes mellitus and Gestational diabetes was defined as per WHO guidelines and diabetic characteristic included type of diabetes (Type 1 Type 2); which were labelled as 'diabetes in pregnancy (DIP) and Gestational diabetes mellitus (GDM); HbA1c levels (preconception, early and late pregnancy levels), duration of diabetes, medication history and maternal smoking status. Still birth was defined as per WHO criteria and contributory (if any) were also documented.

All the procedures were carried out according to standard operating protocol. Anthropometric measurement was recorded by external examination. An 'I' incision was taken and en bloc dissection was done followed by internal examination of gross analysis of systemic organs. The organs were weighed, sectioned for further histopathological examination. The subjected tissue was processed by automated tissue processor, tissue blocks were prepared by paraffin embedded tissue blocks and stained with hematoxylin and eosin to analyze the microscopic features.

All the routine organs were analyzed as a routine evaluation and microscopical features of systemic organs like kidney, liver, pancreas and lungs which have major association and impact due maternal diabetes were documented in formatted proforma. The observed data were analyzed using descriptive statistics and the results were represented in terms of mean ± SD. In specifications, *p*-value was calculated and values <0.005 was taken to be significant

Results

A total of 25 cases of fetal autopsy which were referred to fetal autopsy by Clinicians at parents request were studied during the 7 years study which satisfied the inclusion criteria of still birth with GDM.

Most of the maternal age ranged between 23 to 27 among Type 1 & Type 2 DM whereas GDM majority of patients were elderly primigravida. HbA1c levels were reasonable under control in Type-2 DM compared to Type 1 DM in all the 3 trimesters. Whereas in case of GDM, HbA1C was in poor control in early pregnancy and was in control during later stages of pregnancies. As evident Type 1 DM were on insulin whereas Type-majority of cases (n = 4) were on oral medications. Still birth took place very early in case of Type 1 DM as early as 26 weeks and little later in Type 2 DM around 29 weeks of gestation. GDM still birth took place around 32 weeks of gestation. The general maternal clinical parameters and Diabetic characteristics were analyzed and the results were depicted in (Table 1).

Table 1: Analysis of clinical characteristics and Diabetic profile of the study parameters

Maternal parameters	Diabetes in Pregnancy (Type 1) (n = 5)	Diabetes in Pregnancy (Type 2) (n = 5)	GDM (n = 15)
Age (in years)	23 ± 3	25 ± 4	32 ± 2
Gravid status			
(i) Primigravida	04	03	08
(ii) Multigravida	01	02	06
Duration of diabetes	15 ± 3 years	5 ± 3 years	–
HbA1c levels			
(i) Pre-pregnancy	10 ± 2.2	6.3 ± 1.2	NA
(ii) Early pregnancy	8.2 ± 3.6	6.2 ± 1.6	8.1 ± 1.2
(ii) 3rd trimester	7.7 ± 2.7	5.7 ± 1.7	6.3 ± 1.6
Medication history			
(i) Insulin	07	01	–
(ii) Oral hypoglycemic drugs	–	04	
Gestational age at time of still birth	26 ± 3 weeks	29 ± 3 weeks	32 ± 4 weeks

Systemic organs were routinely evaluated under light microscopic observations for histopathological analysis. Renal changes was more commoner in GDM cases whereas equally common in Type 1 & 2 DM. similar findings were noted in systemic organs like liver, lungs and pancreas. Organs like kidney, liver pancreas and lungs were documented for histomorphological changes according to each diabetic category as shown in (Table 2).

Table 2: Histomorphological changes of systemic organs according to diabetic profile

Histomorphology of systemic organs	Type 1 DM (*n* = 5)	Type 2 DM (*n* = 5)	GDM (*n* = 15)
Kidney			
Glomerular changes-shrunken	02	01	08
Vacuolar degeneration	01	01	03
Hyalinization	–	01	03
Liver			
Distortion of architecture	01	01	07
Centrilobular necrosis	–	01	05
Lung			
Dilated alveoli & airspaces	01	01	07
Atelectasis	–	01	02
Fibrosis	–	–	04
Pancreas			
Decreased beta cells	01	01	07
Atrophied islet cells	–	01	04

In context to anthropometric measurements, kidney, liver and pancreas showed decreased in weight from their average expected weight in reference to gestational age as shown in (Table 3).

Table 3: Anthropometric values of systemic organs-weight (in grams)

Gestational age (in weeks)	Kidney weight (grams)			Liver weight (grams)			Pancreas weight (in grams)		
	DM 1	DM 2	GDM	DM 1	DM 2	GDM	DM 1	DM 2	GDM
26 ± 3 weeks	90 ± 10	120 ± 20	100 ± 20	120 ± 10	115 ± 20	110 ± 20	1.2. ± 0.2	1.1 ± 0.2	0.9 ± 0.02
29 ± 3 weeks	100 ± 15	125 ± 25	110 ± 20	130 ± 15	135 ± 25	115 ± 20	0.9 ± 0.3	1.2 ± 0.3	1.1 ± 0.02
32 ± 4 weeks	110 ± 15	130 ± 10	110 ± 15	140 ± 15	135 ± 10	115 ± 15	1.1 ± 0.2	1.4 ± 0.2	1.3 ± 0.2

Placenta being the nutrient supplying tissue to the growing fetus, placenta villi are more commonly affected with degenerative changes indicating hypoxia and its sequelae of morbidities. Various placental lesions noted in diabetic pregnancies are shown in (Table 4).

Table 4: Degenerative Changes in Placental &Villi on Histomorphology

Villous Lesions	Type 1 DM (*n* = 05)	Type 2 DM (*n* = 5)	GDM (*n* = 15)
Syncytial Knots	03	02	09
Villous Stromal Fibrosis	02	02	10
Fibrinoid Necrosis	02	03	11
Intervillous Hemorrhage	–	01	10
Membrane-Chorioamnionitis	02	03	11

Discussion

Autopsy being a dissection procedure, it still remains as focal point in imparting medical knowledge and providing critical parameters for quality assurance and effective implementation.[1,2] Therefore, medical knowledge of the gamut on underlying etiology of stillbirth in Indian demographical perspective is essential since it ensures appropriate facilities and guidelines to enhance the survival of growing fetus.[2,3]

The term 'Forensic Gynecology' refers mainly to medical cases and with regard to diagnostic aspects fetal autopsy for various indications serves as a major stay to identify underlying etiopathogenesis for fetal death, especially in case of still birth followed by Intrauterine deaths.[4] In recent times majority of parents opt themselves

for subjecting still birth fetus for autopsy studies for getting acknowledged with cause of death and get awareness and counselling for subsequent conceptions.[5,6]

The association between diabetes and its impact on pregnancy was first described Sir. Vincent in the year 1987 by conducting a case control studies.[7] After few decades, the incidence of stillbirth and congenial deformities heaped up to 4–6 times in diabetic associated pregnancies in Indian population.[7,8] In our hospital, the incidence of GDM and its associated morbidities was marginally higher compared to other domains.

Several studies had been commissioned to analyze the etiopathogenesis for higher incidence of GDM complications and most of the studies documented placental lesions followed by systemic organ dysfunction was the predominant cause for the alarming rate.[9] Interestingly, the rate of malformations was lower compared to rate of unexplained still births, thereby warranting need for additional studies in analyzing systemic organ pathology. In modern era after advent of many innovations, there was no decline in the rate of stillbirth in Diabetic cohort and it was still consistence in prevalence both in aspect of incidence and causes as well.[10,11]

The major reason of all abnormalities noted in diabetes in pregnancies (DIP) being sub-optimal glycemic control, HbA1c is considered as gold standard for assessing average blood glucose control in the preceding 5–11 weeks.[12] In recent times it had become as routine examinations irrespective of signs or history, that all antenatal women should undergo HbA1c tests especially in early to mid-gestation period.[13] In the present study, GDM cases showed poor control compared to Type 1 & 2 DM. The reason attributed is delayed presentation for undergoing blood tests and unawareness of the sequelae of complications. The observations are in concordance with prior studies done in the same geographic domain.[8]

In the present study, the anthropometric measurements in terms of weight showed that slight marginal increase in the weight than the expected average. The observations are in concordance with prior studies which postulates that existence of renal hypertrophy and hyper function as a compensatory mechanism. Since maternal hyperglycemic status triggers fetal hyperinsulinemia that eventually leads to enhanced glucose utilization, increased fat deposition and aminoacids production leading to hypertrophy of tissues. Recent studies have proposed that chemical mediators like insulin-like growth factors and fibroblasts growth factors may contribute for organomegaly in growing fetus of GDM.[14,15]

Histomorphological studies of kidney showed abnormal glomerular structural changes [atrophied glomeruli] as evidenced by gradient tubules to glomerular ratio, indicating retarded renal function of the growing fetus (Fig. 1).

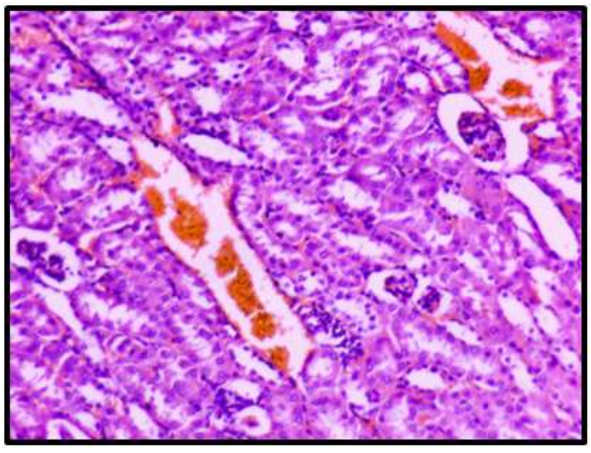

Fig. 1: Histomorphology of kidney showing shrunken glomeruli and decreased glomerular structures with congested vessels, H&E, 40X.

The glomeruli are shrunken in 8 cases (n = 15) pertaining to GDM fetuses followed by 2 cases in Type 1 & one case in Type 2 DM (n = 5 cases each). The observations are in concordance with previous studies.[15,16] The kidneys were also observed to be exposed to degenerative changes like vacuolation and hyalinization of the stroma and tubules (Fig. 2) with high incidence in GDM

followed by DIP concurring with prior studies done by Naik et al.[16] It was evident from the present study that renal pathology is more pronounced in fetuses of among GDM mothers compared to DIP. Eventually diabetic embryopathy affects other developing organs especially urinary tract system leading to congenital renal malformations, hydronephrosis and ureteric lesions. The reason attributed to high incidence of renal abnormalities in GDM is due to sub-optimal blood glucose level despite treatment modalities which led to loss of inadequate circulation of nephrons structure owing to the cause that renal blood vessels shrink with turbulent blood supply leading to glomerular shrinkage.[17,18] In 2 cases, tubular hypertrophy was observed which is explained by the fact that 'compensatory and adaptive 'mechanism. Thus renal pathology is a major concern in GDM as well as DIP with more alarming rate in former cases.

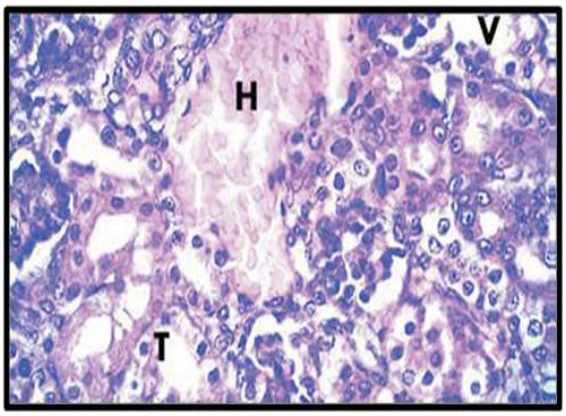

Fig. 2: Histomorphology of Kidney showing degenerative hyalinization (H), vacuolation (V), atrophic tubules (T), H& E, 40X.

Liver being a primary metabolic organ, it was subjected to many degenerative changes with high margin in fetus of GDM mother (12 cases, *n* = 15) compared to DIP. The pathological changes were denoted in the form of distortion of lobular architecture and necrosis indicating loss of blood supply (Fig. 3). Eventually all the metabolic activities are altered leading to systemic organ failure.[19,20] The observations were in concordance with previous Researchers that the mechanisms of reducing glucose output by liver, augments glucose uptake in the peripheral tissue since majority of GDM mothers were under Metformin treatment.[20,21]

Lungs being a major organ in pulmonary system, lung lesions were noted in the form of atelectasis and fibrosis more in GDM (13 out of 15 cases) followed by DIP leading to evidence of respiratory distress The reason for distress being inadequate circulation, prematurity and hypoplasia in the form decreased alveolar counts concurring with prior studies.[22] Microscopically, features showed irregularly dilated alveoli with septal fibrosis into the alveolar lumen (Fig. 4).

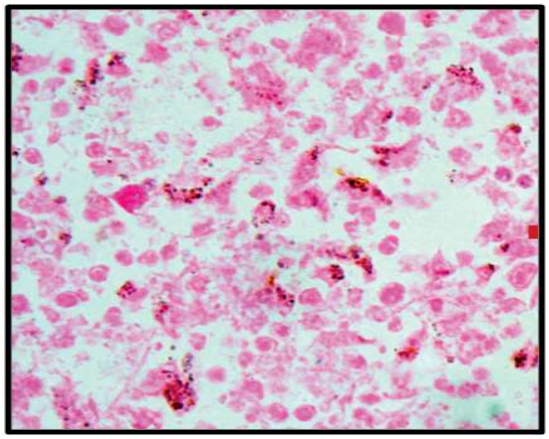

Fig. 3: Histomorphology of Liver Showing Complete Distortion of Architecture With Necrosis, H&E, 40X.

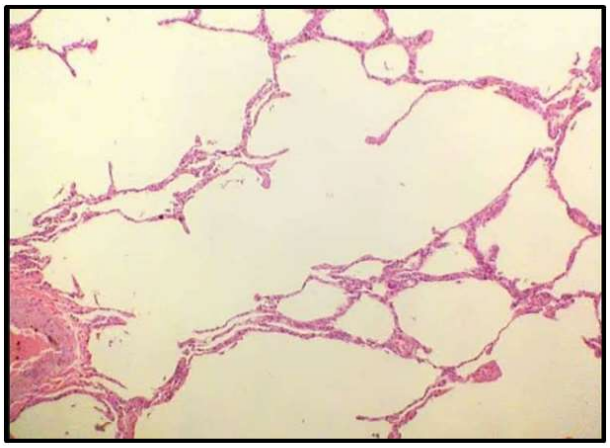

Fig. 4: Histomorphology of lung showing septations of alveoli and irregularly dilated alveolar spaces with evidence of atelactasis, H&E,4 0X.

Pancreas being an endocrine organ with primary function of secreting insulin from beta cells, our results showed decrease in the counts of beta cells and islet cells in the form of atrophy. The production of insulin denovo in fetuses in decreased more in GDM compared to DIP concurring with prior Research analysis.[23,24]

Placental being the dynamic gestational organ, it showed various degenerative changes in the forms of villous fibrosis, syncytial knots and hemorrhage. The gross weight of placenta was increased relatively to normal expected weight, Chorioamnionitis was predominantly noted in majority of cases in GDM & DIP indicating high prevalence of infections in diabetic pregnancies (Fig. 5).

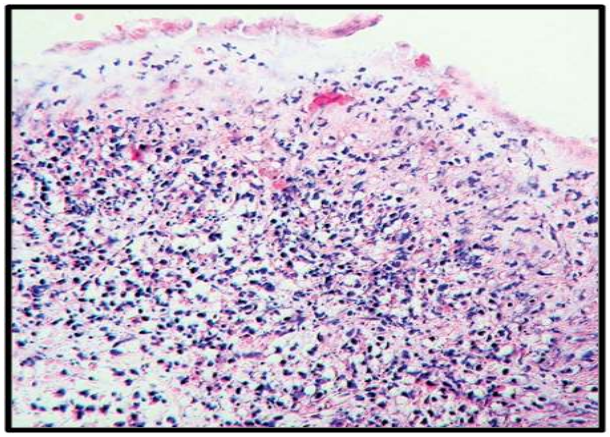

Fig. 5: Histomorphology of Acute chorioamnionitis with focal necrosis with dense neutrophilic infiltrates & cell debris with disrupted syncytial lining, H&E, 10X.

HbA1c

Hb1c being a gold standard method of assessing average glycemic control in diabetic patients for the preceding 70–110 days, it had been recommended that to do HbA1c tests at the time of conception and during the course of gestation as a follow up.[25] In the present study, HbA1c is sub-optimal among the GDM patients followed by Type1 cases and then Type 2 cases. The reason attributed for the spike in GDM is delayed presentation since majority of females do check their blood glucose as prima facie during early pregnancy only leading to difficulties in controlling in later period of gestation. Researchers had postulated that since most of the critical organogenesis would have elapsed by the time GDM or diabetes is detected, thus having an impact on growing fetus.[24,25] Recent studies had shown that, even tight control of glycemic index especially during pregnancy could have a role in

reducing risk of malformations though systemic morbidities occur in varying proportions.[25]

Critical appraisal of the study

Diabetic in pregnancy is mostly characterized by insulin resistance and also decreased secretion of insulin from pancreas and it stays as a major concern in causing congenital anomalies and fetal deaths especially with risk for still births. Diabetes remains as major factor for systemic organ failure. It had been evident that GDM is not an homogenous set of disease and a subset of conditions especially pre-existing but left undiagnosed could be a potential risk for growing fetal malformations with subsequent organ failure and still birth. The only limitation encountered in the study is lack of inadequate source for karyotyping and genetic analysis since the study was conducted in resource limited area.

Conclusion

Forensic Pathology being a nodal point of focus in picking up systemic organ failures which was left undiagnosed mortally. Fetal autopsy is a significant procedure in the domain of Forensic Gynaecology often picking up the cause of fetal death in still birth conditions. Diabetic pregnancies manifest as a serious and alarming challenge globally since the growing fetus is exposed to multiple morbidities like still birth due systemic organ failures, anomalies as evidenced in the present study. Fetal autopsy in adjunction with Histomorphology analysis of systemic organs aids the Obstetricians and Pathologists to arrive at a definite diagnosis for the cause of still birth. Feat death being an unfortunate event for the parents, Histomorphological analysis paves directions for genetic counselling and to entrust awareness among the parents for future planning of pregnancies.

Conflicts of Interests: None

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Original Article

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Arm Span to Estimate Stature among the South Indian Population State of Telangana

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Abstract

Background: Stature estimation provides relevant data for personal identification, in the events of murders, accidents or natural disasters, which results in highly decomposed, fragmentary and mutilated human remains.

Aim and Objective: To determine body stature of both sexes using arm span and find the relationship between stature and arm span.

Place of Study: The present study was carried out in the department of Forensic Medicine and Toxicology at Kamineni Institute of Medical Sciences and Research Center, Nalgonda District of State Telangana.

Type of Study: Descriptive cross sectional study with analytical and comparative components

Material and Method: Arm span length was measured using a calibrated steel tape to the nearest millimeter in bare feet on a level flat surface with peer backs and buttocks, heel against the wall giving the support.

Observation and Discussion: observation among study subjects $n = 150$, where 85 (56.7%) were males and 65 (43.3%) were girls. Height and arm span in boys (164.7 ± 10.92 cm and 162.38 ± 8.02 cm respectively) was significantly ($p < 0.000$) more than girls (157.1 ± 9.1 cm and 156.8 ± 6.5 cm respectively). Height to Arm span ration HAR of boys and girls according to age of the subjects are shown and overall mean Height to Arm span ration was 0.9961 ± 0.0183. In the present study the correlation between stature and arm span showed a strong positive correlation ($r = 0.8651$, $p < 0.000$). This result is an support to the widely accepted positive correlation between height and arm span in adults.

Conclusion: Using regression equation for estimation of stature is more acceptable, and result of this study and regression equations may be considered in clinical practice and in medico legal cases for estimation of stature from arm span in south Indian population of Nalgonda District of Telangana.

Keywords: Stature; Arm Span; Regression equations.

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Introduction

In scientific literature the well known factor is measurement of body height is important in many settings, it has an important measure of body size as well gives an assessment regarding nutritional status. The main aim of anthropometry is to establishment of Identity of unknown and to supplement the law enforcement agencies. Limitations are with routine methods especially in highly mutilated bodies where identification is difficult. Stature estimation becomes equally important in such forensic investigation along with

other identification parameters like age, race sex etc.[1-3]

Stature estimation provides relevant data for personal identification, in the events of murders, accidents or natural disasters, which results in highly decomposed, fragmentary and mutilated human remains.[4] One of the most important elements of Identification in individual is its stature, it is very essential in cases when only fragmentary remains of human body found at the scene of crime.[5] The maximum distance measured from the point where heel touches the floor to the highest point of the head in an erect position of person is termed as stature.[6]

Stature estimation question may arise in scenarios like from mass disasters i.e. bomb blasts, airplane crash, stampede, tsunami, earthquake, flood, cyclones, Terrorist attack, close compartment fire, wars, public vehicle (train, bus, ship, plane etc) accidents etc. Possibility of Mutilation of the body could be by humans, animals or by a natural process of decomposition. It is possible that hand print and foot print left at the crime scene, identification and exclusion of a person involved in a crime can be made.[7]

Human body represents a certain relationship with length of certain bones and appendages in the form of proportion to height.[8] After having completed the skeletal maturity the proportion does not alter with age, quantitative or qualitative measurement of personality is Height.[9] However in some scenario it is not possible to measure the person stature because of deformities in limbs or the person who have undergone amputations or in an unknown cadavers where limbs, trunk is either absent or mutilated. In such scenarios stature need to be estimated using other body parameters[10] lime foot length, hand length, sitting height, knee height, length of vertebral column, sternum, length of scapula cranial sutures as well arm span.[11]

Correlation between stature and arm span in comparison to other all body parameters was found to be very reliable[12] maximum distance between the tip of longest fingers of both hands is termed as Arm span while the person extends both arms at the level of shoulders.[13] Different ethnic and racial groups vary arm span and body weight.[14] It was Torres et al. who applied Bland Altman analysis and observed a poor agreement between height and arm span although these correlate good. It shows that arm span measurements are an inappropriate proxy for stature estimation in certain group of population. In forensic anthropology measurements of height and arm span relationship between them had applied a clear significance as well in plastic and cosmetic surgery and other allied clinical sciences.[15] The present study aim and objective is to determine body stature of both sexes using arm span and find the relationship between stature and arm span.

Materials and Methods

The present study was carried out in the department of Forensic Medicine and Toxicology at Kamineni Institute of Medical Sciences and Research Center, Nalgonda District of State Telangana. In the present research, stature and arm span measurements of 150 volunteers (85 male & 65 female) of ages 18–25 years were done. All of them belonged to Nalgonda district of Telangana state. As such subjects were selected irrespective of their caste, religion, dietary habits and socio-economic status. The study was a predominantly descriptive cross sectional study with analytical and comparative components. Sufficient permissions and consents were procured before the measurements of the students taken and clearance from the Institutional Ethical committee was obtained in advance.

Stature Measurements

Using the stadio-meter, the subject was made to stand barefoot in the standard standing position on its baseboard. Both feet are in close contact with each other and head oriented in Frankfurt's plane. The height was then recorded in centimeter from the standing surface to the vertex in the weight bearing position of foot.

Arm Span Measurements

Arm span length was measured using a calibrated steel tape to the nearest millimeter in bare feet on a level flat surface with peer backs and buttocks, heel against the wall giving the support. The subjects head was in the Frankfort horizontal plane and the arms outstretched at right angles to the body with palms facing forwards. Measurements were taken from one middle fingertip to the other middle finger tip with the help of measuring tape passing. To avoid diurnal variations measurements were taken twice and an average of the both reading was calculated.

Exclusion Criterion

Volunteers morphologically showing the congenital malformations, Dwarfism/Achondroplasia, features of nutritional deficiencies and injuries

to extremities, using medication thought to alter growth, neuromuscular weakness or abnormal tone or with any other major medical illnesses or growth disturbance were excluded from the study.

Statistical Part

Data divided into 2 group male and female. The basic statistics like mean, mean ± SD etc. of stature (In cm) and arm span length (In cm) of body of male, female and combined was done. We observed the relationship between stature (In cm) and arm span length (In cm) by scatter diagram. All associations are positively exist. The arm span lengths (In cm) of male, female & combined group are positively correlated with stature. Therefore, the simple regression of stature on arm span length (In cm) was calculated by mathematically, also we calculated the stature value on the arm span length (In cm). Compared the actual value and predicted value of stature by using *t*-test and observed the significance at 5% level of significance. The complete statistics was doing in MS-Excel.

Results

The simple regression equation of stature on arm spam length (In cm) of male, female and combined group are as given bellow.

Male Stature (In cm) = 24.92 + 0.841* Arm span length (In cm)

Female Stature (In cm) = 26.99 + 0.827* Arm spam length (In cm)

Combined Stature (In cm) = 25.2 + 0.839* Arm span length

In our study the observation among study subjects n = 150, where 85 (56.7%) were males and 65 (43.3%) were girls. Height and arm span in boys (164.7 ± 10.92 cm and 162.38 ± 8.02 cm respectively) was significantly (p < 0.000) more than girls (157.1 ± 9.1 cm and 156.8 ± 6.5 cm respectively). Height to Arm span ration HAR of boys and girls according to age of the subjects are shown and overall mean Height to Arm span ration was 0.9961 ± 0.0183. This ratio was used to calculate expected height from the arm span data for residual analysis.

Group wise data was tested by Pearson correlation (r), the findings in all the groups showed statistically significant positive correlation between height (cm) and arm span (cm). In study the Age group wise correlation coefficients between height and arm span. Fig. 1 shows the linear regression scatter plot of height and arm span in boys. The correlation coefficient showed a strong positive

Table 1: Descriptive Statistics of stature and arm span

Variables	Stature		Arm Span	
	Mean	Mean ± SD	Mean	Mean ± SD
Male	164.7	164.7 ± 10.92	163.5	163.5 ± 9.53
Female	157.1	157.1 ± 9.1	156.9	156. ± 7.9
Combined	161.4	161.4 ± 10.8	160.6	160.6 ± 9.4

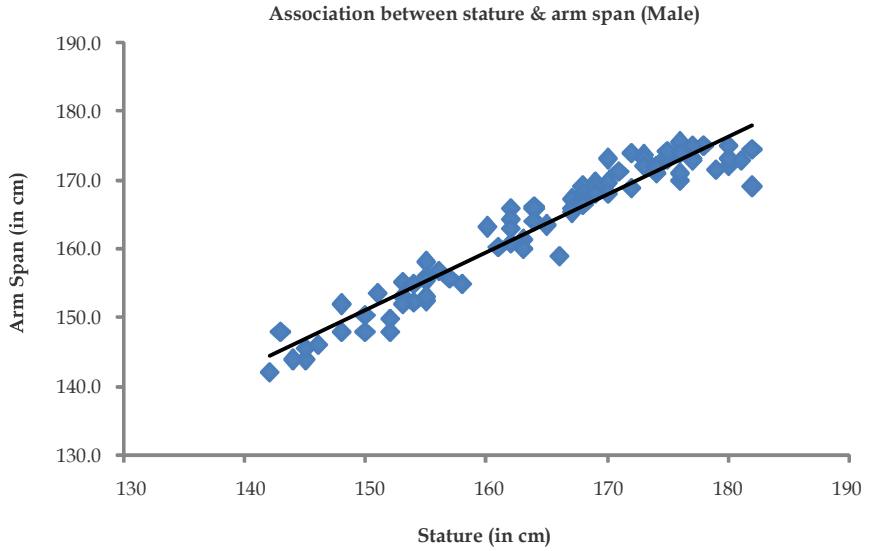

Fig. 1: Scatter diagram showing relation between Stature and Arm span in Males.

correlation (r = 0.8640, p < 0.000). The regression equation was Y = 24.92 + 0.841* Arm span length (In cm). Which may be interpreted as Height (cm) = 0.841* arm span (cm) + 24.92.

Fig. 2 shows the linear regression plot of height and arm span in girls. The correlation coefficient also showed a strong positive correlation, (r = 0.8534, p < 0.000). The regression equation was Y = 26.99 + 0.827* Arm spam length (In cm). When the height and arm span data of boys and girls were taken combined, and correlation and regression analysis were carried out, it showed a positive correlation coefficient (r = 0.8651, p < 0.000). The regression equation was Y = 25.2 + 0.839* Arm span length (In cm). This equation was used to obtain estimated height from the arm span data for residual analysis. When residual analysis was carried out between

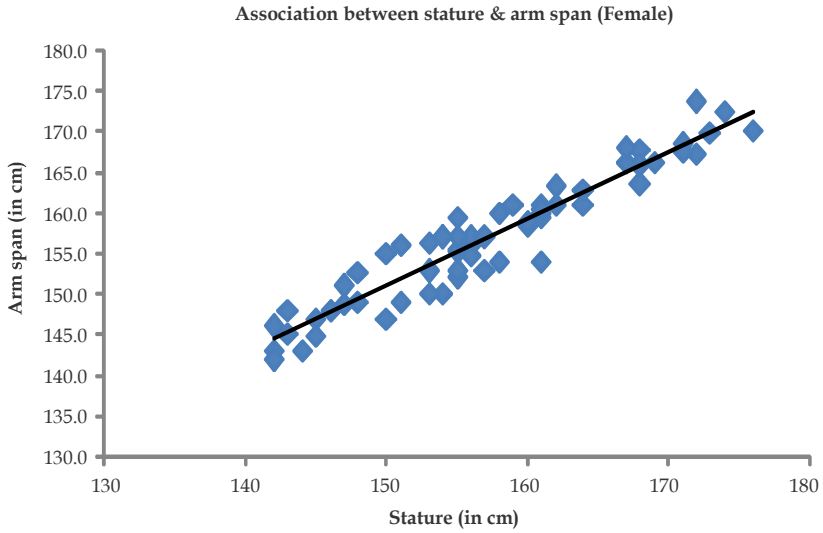

Fig. 2: Scatter diagram showing relation between Stature and Arm span in Females.

Table 2: Correlation between stature and arm span

Variables	Correlation (r)	t-test	P-Value	Significance
Male	0.8640	15.6	0.0000	All are highly significant
Female	0.8534	13.0	0.0000	
Combined	0.8651	21.0	0.0000	

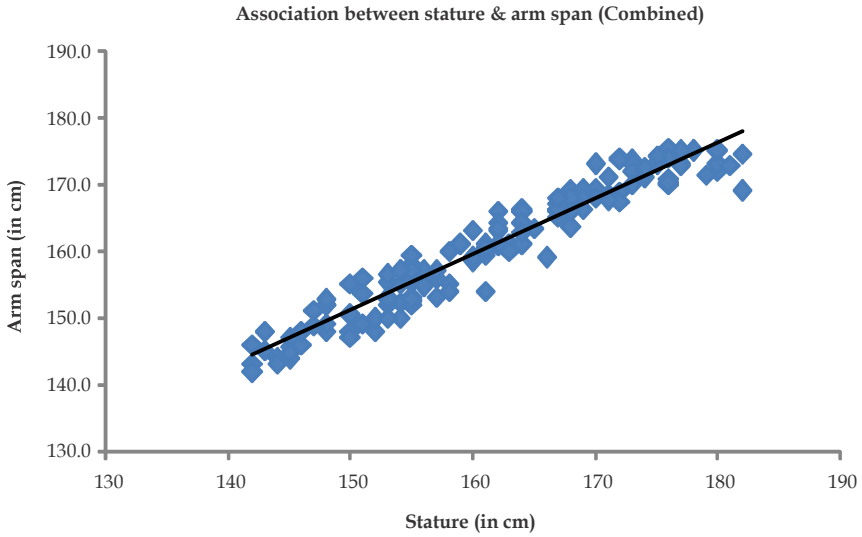

Fig. 3: Scatter diagram showing relation between Stature and Arm span (Combined).

Table 3: Comparison between actual and calculated values

Variables		Actual Stature	Calculated Stature	*P*-Value	Significance
Male	Mean	164.66	162.38	0.1233	All are not significant
	Mean ± SD	164.7 ± 10.92	162.38 ± 8.02		
Female	Mean	157.10	156.80	0.8332	
	Mean ± SD	157.1 ± 9.1	156.8 ± 6.5		
Combined	Mean	161.40	159.96	0.2000	
	Mean ± SD	161.4 ± 10.8	159.96 ± 7.88		

arm span and residuals calculated from regression equation (i.e., difference between actual height and estimated height from the regression equation), it showed practically a zero slope, it indicates no interdependence between variables.

Discussion

Even in mutilated and dismembered bodies it is possible to estimate stature as well in fragmentary remains, arm span length can be used for estimation of stature in living subjects and also in those it is not possible to measure the stature due to deformities.

In our study the result showed that in majority of study subject arm span was relatively more than the stature. Our study is supports findings made by Dorjee B et al. in west bengal state India[16] as well with the study made by Esomonu UG et al. in Nigeria[20] also in other studies like[17,18–21] all showed from India that arm span is more than the height.

In the present study, a total of 150 (85 males and 65 females) subjects between the age of 18 and 25 years were enrolled. Since maximum height of an individual is attained between 18 and 25 years, these individuals were selected for the study. In other studies like Agnihotri AK et al., Rajkumar CM and Krishna K[23–25] they too enrolled subjects of same age group. A study from Thailand[26] has made the findings that the decrease in the correlation between arm span and stature with increasing age, as stature decreases with age and Arm span does not, even though earlier study[22] found contribution of age is insignificant in estimation of stature, we considered age and regression equations are derived for different age groups.

In the present study the correlation between stature and arm span showed a strong positive correlation (r = 0.8651, p < 0.000). This result is an support to the widely accepted positive correlation between height and arm span in adults. Dorjee B et al. found more strong correlation (male r = 0.978, female r = 0.972) than the result of this study.[16] However, they took a larger sample (n = 240) while this study was conducted out on a smaller sample size (n = 150). There is a possibility that difference between sample size and sample age range may be the contributing factors behind the difference in the results.

Regression equations were established for male and female separately. Overall regression equation was Y = 25.2 + 0.839* Arm span length in cm. This equation was used to estimate height from arm span data and compared with the actual height.

Regression equations for stature estimation from other anthropometric parameters are widely available for adult population. Tandon R et al., used foot length to estimate height in adult population from the established regression equation in their study.[27] Similarly Mondal MK et al., came up with regression equation for estimation of height from ulnar length in adult population.[28]

These all above stated studies were carried out on adult population. In an study made by Chowdavarapu RR et al., observed that head length can be used to estimate height in 8–12 years children.[29] It was Bardale RV et al., and Sen J et al., observed that height can be estimated from index and ring fingers in adult population.[30,31]

On the contrary it is true that appropriate measurement of smaller segments of the body like finger length, foot length, and head length needs calipers and intra-observer and inter-observer variation may give a proportionate error in height estimation.[32-41] Whereas arm span can be measured with simple measuring tape. Arm span is almost similar to stature in length; hence, chances of error in estimation would be comparatively less for estimated height from arm span.

Conclusion

Stature can be estimated from measured arm span using regression equations. Using regression equation for estimation of stature is more

acceptable, and result of this study and regression equations may be considered in clinical practice and in medico legal cases for estimation of stature from arm span in south Indian population of Nalgonda District of Telangana.

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Stature Estimation by Per-Cutaneous Tibial Length amongst People of Nellore District State Andhra Pradesh

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Abstract

Background: Stature estimation plays a crucial role in medico legal cases in identification of unknown bodies and in skeletal remains. A strong relationship exists between stature and various dimensions of different body parts for estimation of stature in forensic investigation.

Aim and objective: To estimate stature from per-cutaneous Tibial length measurements in people of Nellore district State Andhra Pradesh South India.

Type of Study: Descriptive cross sectional study with analytical and comparative components.

Place of Study: Department of forensic medicine and Toxicology Narayana Medical College, Nellore District of Andhra Pradesh State.

Material and Method: Stature: using the stadio-meter, the subject was made to stand barefoot in the standard standing position on its baseboard. For Tibial Length, Top point was the medial most point on the upper border of medial condyle of tibia and the lower point was tip of medial malleolus of the tibia, distance between these two points was measured by using spreading caliper to determine Per-cutaneous Tibial Length.

Observation and Discussion: The regression formulae derived for male was Height (y) = 87.38 + 1.92 * PCTL (x) and for females it was Height (y) = 62.93 + 2.45 * PCTL (x). Our study regression equations provided greater reliability in estimated stature and we derived regression formula. Kaore et al. reported in his study and commented that the regression formulae are more dependable than multiplication factor for stature estimation.

Conclusion: We conclude that the regression equations presented here can be used to estimate ante-mortem stature, with reasonable accuracy, of unknown mutilated or dismembered human lower limb remains from per-cutaneous lengths of tibia and fibula in medico-legal cases, particularly from Nellore district of State Andhra Pradesh.

Keywords: Per-cutaneous Tibial Length; Regression; Stature.

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Introduction

A challenging task for a Forensic Pathologist during post mortem examination of the deceased is to establish the Identity and as a result of increase of incidence of terrorism and advancement of transportation facility, aircraft crashes and mass disasters, mutilated dismembered and skeletonized materials become very common. In such scenario forensic anthropologist is required to assist for partial identification by compiling a biological profile as the possibility of identification *f* individual is narrowed.[1]

Most of the time, parts of human body are available for identification, as being an individual characteristic stature becomes one of the important parameters for personal identification. Stature estimation hence plays an crucial role in medico legal cases in identification of unknown bodies and in skeletal remains. A strong relationship exists between stature and various dimensions of different body parts for estimation of stature in forensic investigation.[32–36] The long bones lengths of lower limb provide better estimates of stature in comparison to the long bones of upper limb.[7]

Long bones and stature relationship is influenced by ethnicity and gender of an individual and there are no universal formulae for estimation of stature from the length of long bones.[8] Various studies had significantly reported the differences in proportion of limb dimensions due to hereditary ethnic, environmental and dietary factors which influence the stature of a person.[9–11] Hence there is a string need for population specific formulae foe stature estimation in medico legal cases.[12–14] Even though there are some difficulties in developing population specific formulae for stature estimation from long bones. Problem with this is unavailability of documented skeletal collections with accurate ante mortem stature record for various different Indian populations[15,16] however even in the absence of documented skeletal collections the regression equations can be developed from per-cutaneous bone measurements in a living populations, even though this may not be very idealistic solutions but it has an advantage of avoiding serious errors that could result due to the use of formulae developed for the another geographical location and population.[17]

Comparatively very fewer studies had been done for estimation of stature from lower limb bones for population of Nellore in State of Andhra Pradesh India, in view of the paucity of information we made an attempt to present a linear regression models to predict stature on the basis of per-cutaneous length of Tibia in a population from Nellore. In this present cross sectional prospective study we aim to estimate stature from per-cutaneous Tibial length measurements in people of Nellore district State Andhra Pradesh South India.

Materials and Methods

In the present study was conducted at Narayana Medical College, Chinthareddy Palem, Nellore State Andhra Pradesh by the Department of forensic medicine and Toxicology on the Consenting volunteers of Nellore District of State Andhra Pradesh. The research was with the aim of estimation of stature from per cutaneous Tibial Length measurements collected in 300 adult volunteers with age of 18 to 40 years.

The subjects were confirmed to be descent from Nellore district and were specifically selected with residence of Nellore district only, irrespective of their caste, religion, dietary habits and socio-economic status. The study was a predominantly descriptive cross sectional study with analytical and comparative components. Sufficient permissions and consents are procured before the measurements of the volunteers are taken and clearance from the Institutional Ethical committee is obtained in advance. Measurements taken by single investigator and with the same instrument to avoid any technical or inter observer error and to maintain reproducibility and measurements were taken thrice and their men value were considered for stature estimation.

Stature: Using the stadio-meter, the subject was made to stand barefoot in the standard standing position on its baseboard. Both feet are in close contact with each other and head oriented in Frankfurt's plane. The height was then recorded in centimeter from the standing surface to the vertex in the weight bearing position of foot.

Tibial Length: Measurement of Per cutaneous Tibial Length subject was asked to stand and keep his/her foot on a table to maintain the angle between the flexor surface of leg and that of the thigh at 90° and both points were surfaced mark by using sketch pen. Top point was the medial most point on the upper border of medial condyle of tibia and the lower point was tip of medial malleolus of the tibia, distance between these two points was measured by using spreading caliper to determine Per cutaneous Tibial Length.

Exclusion Criterion: Those with any apparent disease, orthopedic deformity, morphologically showing the congenital malformations, Dwarfism/Achondroplasia, features of nutritional deficiencies and injuries to extremities, using medication thought to alter growth, neuromuscular weakness or abnormal tone or with any other major medical illnesses or growth disturbance were excluded from the study.

Statistical Analysis: Descriptive statistics like range, mean, standard deviation, standard error, coefficient of variation etc. of height and length of right Tibia was done. Comparing the stature and

Tibial length between male and female, Association between Stature and Tibial length were present by scatter diagram. Association between Stature and Tibial length were positively correlated, also checking the significance of correlation by using t-test for correlation. So, on the basis of that we calculate the simple regression equations of Stature on Tibial length, by using regression equation we can predict the Stature value by using independent variable Tibial length. We evaluated the significance at 5% level of significance. The complete statistics was done by MS-Excel.

Fig. 1: Measurement of per-cutaneous tibial length by spreading caliper.

Results

Per cutaneous Tibial length statistics of Right side of tibia in both male and female is as per (Table 1) and showed bilateral symmetry in length of tibia in both male and female, the mean per cutaneous Tibial Length for male 39.73 cam and for females it was 37.95 cam and combined for both male and female it was 38.84 cm.

Table 1: Descriptive statistics of height and Tibial length

Characteristics	Male		Female		Combined	
	Height	PCTL	Height	PCTL	Height	PCTL
Range	144.8–178.4 cm	33.8–44.1 cm	140–176 cm	32.8–43.9 cm	140–178.4 cm	32.8–44.1 cm
Mean	163.62	39.73	155.84	37.95	159.73	38.84
St. Deviation	9.40	2.91	10.11	3.01	10.49	3.09
Std. Error	0.77	0.24	0.83	0.25	0.61	0.18
Coefficient of Variation (CV)	5.74	7.33	6.49	7.93	6.57	7.95

As per (Table 2) our observation revealed that the standing stature of many subjects were same but on the contrary their per cutaneous Tibial Length differed, means that contribution of Tibial length to the stature of a person differed from person to person, keeping this point in view mean of stature and per cutaneous Tibial length was taken into consideration and data was analyzed as shown in Table 2, the observed mean stature was 163.62 ± 9.4 and 155.84 ± 10.11 and mean per cutaneous Tibial length was 39.73 ± 2.91 and 37.95 ± 3.01 for male and females respectively which was highly significant ($p < 0.0001$) for both gender.

Table 2: Comparison of height and PCTL between male and female.

Variables	Male	Female	Mean Difference	*t*-test	*p*-value	Significance
	Mean ± SD	Mean ± SD				
Height	163.62 ± 9.4	155.84 ± 10.11	7.8 ± 3.09	6.91	0.000001	Highly Significant
PCTL	39.73 ± 2.91	37.95 ± 3.01	1.8 ± 3.03	5.21	0.000001	

As per (Table 3 & 4) Correlation Coefficient (r) of stature and per cutaneous Tibial Length for male and female was 0.5946 and 0.7287 respectively and it was statistically significant. As there was a high correlation between the stature and per cutaneous Tibial length, we derived a simple regression analysis between males and females and a simple regression formula was derived to predict stature from per cutaneous Tibial length. The regression formulae derived for male was Height (y) = 87.38 + 1.92 * PCTL (x) and for females it was Height (y) = 62.93 + 2.45 * PCTL (x). As well the predicted stature so derived was acceptable within a range of error and was in close approximation with that of the observed stature.

Table 3: Association between height and PCTL of male and female.

Variables	Correlation (r) between Height & PCTL	t-test	p - value	Significance
Male	0.5946	8.996	0.00001	
Female	0.7287	12.9447	0.00001	Highly Significant
Combined	0.6985	16.84993	0.000001	

Table 4: Regression analysis of height on PCTL of both sex.

Regression analysis of Tibia	Male (Average Height = 163.62)	Female (Average Height = 155.84)	Combined (Average Height = 159.73)
Independent Variable (x) = PCTL	39.73	37.95	38.84
Intercept	87.38	62.93	67.513
Regression coefficient	1.92	2.45	2.375
Correlation Coefficient (r)	0.5946	0.7287	0.6985
Coefficient determination (R^2)	0.3491	0.5278	0.4862
Std. error of estimate (SEE)	7.58	6.9472	7.52
Significance (p)	0.000001	0.00001	0.000001
Regression Formula	Height (y) = 87.38 + 1.92 * PCTL (x)	Height (y) = 62.93 + 2.45 * PCTL (x)	Height (y) = 67.513 + 2.375 * PCTL (x)
Predicted average height (y)	163.66	155.91	159.76

The positive correlation of Length of Tibia (mean = 39.73 ± 2.91 cm) on X-axis and Height of male subjects (mean =163.62 ± 9.4) on y–axis as per Fig. 2 indicates that increase in length of tibia leads to increase in total stature of male subject (r = 0.5946, p < 0.0001). The significant correlation was further interpreted by linear regression. Similarly as per Fig. 3, the positive correlation of Length of Tibia (mean = 37.95 ± 3.01 cm) on X-axis and Stature of female subjects (mean = 155.84 ± 10.11 cm) on y–axis, indicates that increase in length of tibia leads to increase in total height of female subject (r = 0.7287, p < 0.0001). The significant correlation was further interpreted by linear regression.

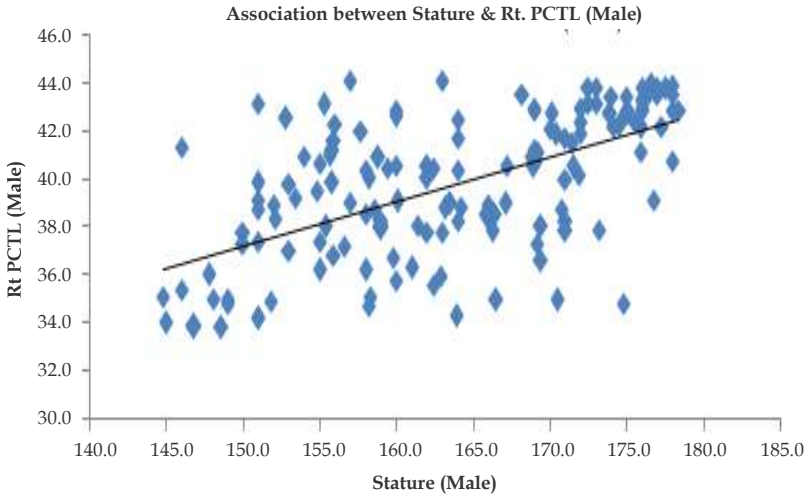

Fig. 2: Scatter plot of Stature and Right PCTL of male.

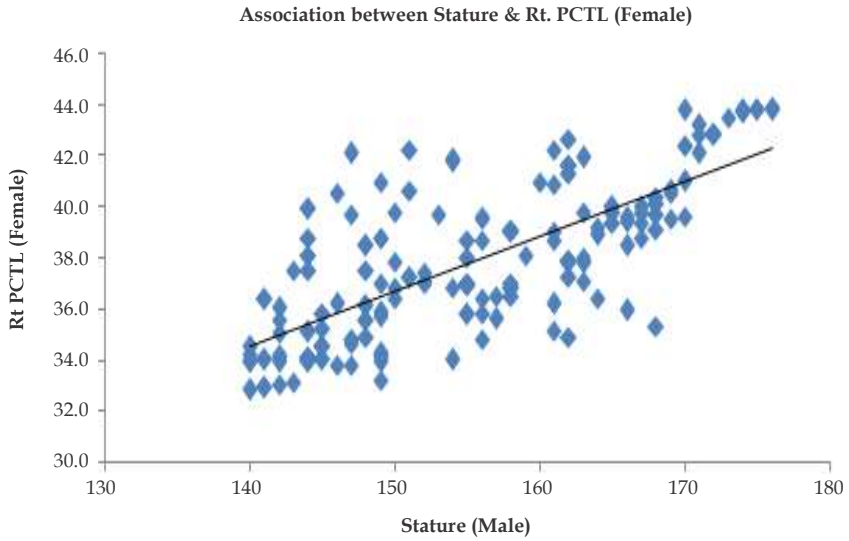

Fig. 3: Scatter plot of Stature and Right PCTL of female.

Discussion

The stature estimation is one of the essential part in forensic anthropology wherin the rising frequency of mass disasters causes bony fragments and dismembered human remains, external examination done before autopsy include the measurements that help the regression equation to be used in estimating living stature.[27-31] Regression equations as being postulated for stature estimation are population and sex specific, necessitates the researches to be done on a regional foundation. Hence we had undertaken this study to derive equations for estimation of stature of Nellore male and female populations in state of Andhra pradesh.

It was in (1952) Trotter and Gleser[19] concluded that increase in stature after 18 years is insignificant and there is no statistical significant alteration after age 18. For the same reason the current study was done on persons aged ≥18 years. To remove the impact of the epiphyseal growth element in regression equations construction, it is preferred to select the individual aged more than 21. Observations of El-Meligy et al.[20] were conducted on both male and female Egyptian and Indian students aged from of 19–21 years and 18–24 years, respectively. In our study the mean of the measured stature and per cutaneous tibial length showed significant increase in males than in females of the same age and population group. It can be based on the fact of epiphyseal union occurs earlier in female than male comparatively. Hence males have a chance for bony growth of about two years than females which was conveyed as surpass of the somatometric measurements of the adult male.[21]

In our study regression equations provided greater reliability in estimated stature and we derived regression formula. It was Kaore et al.[22] who reported in his study and commented that the regression formulae are more dependable than multiplication factor for stature estimation. Kate and Muzumdar[23] also compared the derived regression equation in Maharashtrian and Punjabis with that of Pearson's regression formulae which was derived from English bone and stated that Pearson's regression equation does not give exact results on Indian population, even Kore et al.[22] also had a similar view and suggested that the regression formula derived by Albrook.[24] for stature estimation in British population is also not suitable to estimate stature in Indian population.

On completion of union of epiphysis and the diaphysis the individual stature stop growing which usually occur by the age of 18 to 20 years hence all the individuals considered for the purpose of this study was either at or above 18 years of age. In this study, the mean height for male was 163.62 ± 9.4cm and for female was 155.84 ± 10.11 cm; and the mean PCTL for male was 39.73 ± 2.91 which was significantly ($p < 0.0001$) greater than the female which was 37.95 ± 3.01 cm. Our findings are similar to that of Chavan et al.[25] and many others, who observed that there was no statistically significant difference in the length of tibia in both males and females. It was Mukta Rani[26] who compared the bilateral per-cutaneous measurement of tibia and expressed that left tibia is longer than the right tibia in both gender. Similarly Allbrook[24] in 1961, compared both estimated stature derived from length of dried tibia and from the average per-

cutaneous tibial length. He stated that there was no difference in stature estimated from two different sets of tibia. The average stature was 170.06 cm for British male population. As well Chavan et al.[25] estimated the mean height of male and female to be 167.89 cm ± 6.21 cm and 151.41 cm ± 5.04 cm respectively. Mean PCTL was 37.32 cm ± 2.18 cm for male and 34.44 cm ± 2.10 cm for female.

Conclusion

In both genders stature estimated by regression formulae for per-cutaneous Tibial length of people of Nellore district was similar to average measured stature with an error of less than 1 cm which was statistically insignificant $p > 0.05$. We conclude that the regression equations presented here can be used to estimate ante-mortem stature, with reasonable accuracy, of unknown mutilated or dismembered human lower limb remains from per-cutaneous lengths of tibia and fibula in medico-legal cases, particularly from Nellore district of State Andhra Pradesh. However the formulae derived cannot be generalized to all population groups, hence it is necessary to derive regression equations which are region wise and population specific. Thus the data of this study are recommended in anthropological studies for stature estimation amongst the ethnic group under study

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Original Article

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Forensic Evaluation of Frontal Sinus, Nasal Bone, Nasal Septum Pattern and Piriform Aperture Using Postero-anterior Cephalogram

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Abstract

Background: Personal Identification with the help of radiographic examination of Skull is a potentially useful method in cases where fragments of skull persist with no likelihood of identification. Frontal sinus Nasal bone, piriform aperture and Nasal septum show racial and geographical variations and their shape can be used as one of the classic indicators of sexual dimorphism. The purpose of this study was to evaluate and classify the variations in the pattern of frontal sinus and nasal septum, the dimensions, size and the shape of the piriform aperture and their sexual dimorphism.

Material and methods: Postero-anterior cephalometric radiograph of 180 healthy individuals aged 20-70 years were traced for the morphology of frontal sinus and piriform aperture, pattern of nasal bone, nasal septum pattern using various classification systems.

Results: The most predominant pattern of frontal sinus seen in the study sample was the left dominant asymmetry 56.1% and the least predominant was symmetry 3.9%. The mean height of frontal sinus on right side in males was greater than in females and was statistically significant. The most predominant pattern of nasal bone was Type A (56.7%) and least predominant was Type C 2.8%. The most predominant pattern of nasal septum in males and females was found to be straight 62.2% and 63.3% respectively and rare type 1.1%. The proportions of pattern of nasal septum were not statistically different among males and females. The mean height and mean area of the piriform aperture was found to be greater in males as compared to females which was statistically significant ($p < 0.05$).

Conclusion: The frontal sinus, nasal bone, nasal septum and piriform aperture can be useful aids for forensic identification.

Keywords: Frontal sinus; Nasal bone; Nasal septum; Piroform aperture, Forensic; Postero-anterior cephalometric radiograph.

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Introduction

Human identification in forensic scientific discipline has played a key role in identification of living, decomposed or deceased human remains.[1,2] Though most challenging tasks faced by mankind, it has always been considered paramount importance to the society for personal, social and legal purposes.[1,3,4] The utility of such identification methods can also resolve issues during natural disasters, medical breakthroughs, criminal investigations and insurance settlements.[2–4]

Various morphometric and anthropometric methods have been employed till date. Amongst them, radiographic identification methods are efficient, comparatively easy, economical, more precise, accurate and reproducible.[5] The skeleton survives both natural and unnatural abuse or violence and is almost always available for identification. The skull is the second-best region for identification after the pelvis. It is sexually dimorphic and aids in identification with an accuracy of up to 92%. It has various structures that aid in identification such as the dentition, cranial suture patterns, vascular groove patterns, sella turcica area of sphenoid, frontal sinuses, mastoid pneumatic air cells, and sinuses.[6]

In establishing the identity of an individual from a defleshed skull, lateral cephalograms and postero-anterior (PA) radiograph assume a predominate role. Evidence based reports suggest that the use of frontal sinus, piriform aperture, nasal bone and nasal septum pattern aid in personal identification and sex determination.[1,3,7,8] Configuration of frontal sinus and nasal septal pattern is also said to be controlled by various environmental factors, although gender, race, and disease are known to affect its development.[8–10]

The morphometric assessment of these anatomical radiographic landmarks seen on the PA cephalogram, could be used as one of the aids for personal identification. Moreover, these methods are simple, less time consuming and can be easily employed by a general dentist, as it doesn't require expertise. Since there is a paucity of literature related to anthropometry, this study is aimed to report the characteristics of the frontal sinus patterns, nasal bone, nasal septum and the piriform aperture, anticipating that they would be further useful as essential tool to the researchers, clinicians and forensic experts related to this field.

Materials and Methods

An observational study was conducted after obtaining ethical approval from the Institutional review committee. Digital postero-anterior cephalometric radiograph of 180 (90 Males & 90 Females) apparently healthy individuals aged 20–70 years who were advised advised PA cephalogram were made utilizing PLANMECA apparatus using the Caldwell technique on Kodak radiographic film. (Size 18 × 24 cm) Individuals with facial asymmetries, history of trauma or surgery in mid facial region, history or clinical characteristics of any type of systemic disorders, bone diseases, nutritional and endocrinal diseases affecting the head and neck, acute/chronic rhinitis, sinusitis, deviated nasal septum (DNS) and pregnant women were excluded from the study.

The radiographs were then traced using tracing paper, pencil and film illuminator with magnifying lens for the morphology of frontal sinus.[11] The Classification of frontal sinus pattern was done Taniguchi M et al.[12] 2003 and morphology of piriform aperture as given by Hwang et al. 2005[13] (Fig. 1,2,3). In order to define the types of the nasal bone, shapes of the nasal bone were classified into five types given by (Fig. 4). Nasal septum patterns were classified according to Taniguchi et al. (Fig. 5) 2003.[12]

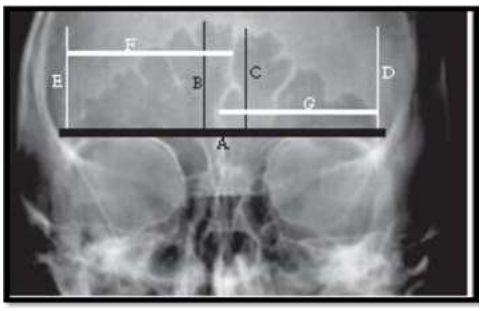


Fig. 1: Diagram of Caldwell radiograph showing demarcations of frontal sinus and identification of the measurements. A denotes reference baseline; B, C denote greatest height of the frontal sinus on left and right side respectively; D,E denote lateral most points on right and left side of frontal sinus. F,G denote largest width of frontal sinus.[11]

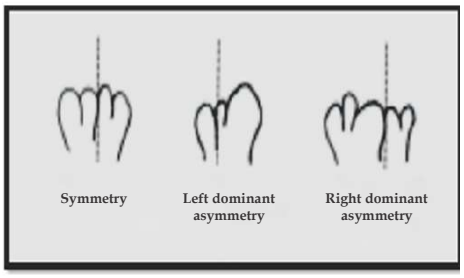


Fig. 2: Classification of frontal sinus pattern according to Taniguchi et al.[12]

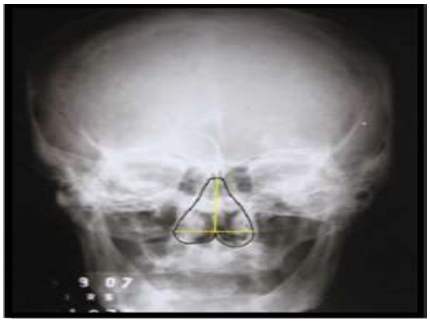


Fig. 3: Morphometry of piriform aperture on PA cephalometric radiograph according to Hwang et al.[13]

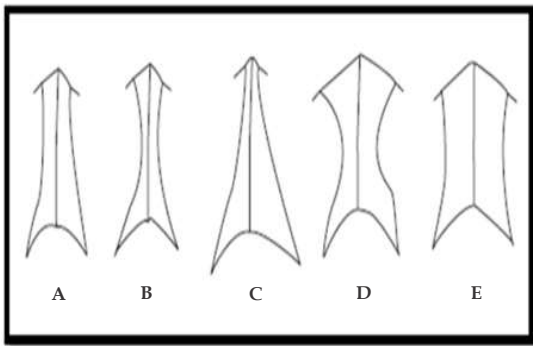


Fig. 4: Classification of Nasal bone pattern according to Hwang et al. (2005).

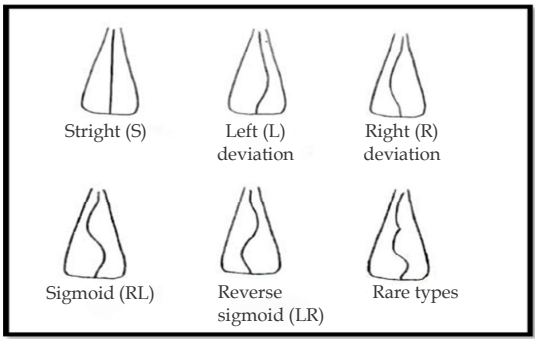


Fig. 5: Classification of nasal septum pattern.[12]

Statistical analysis

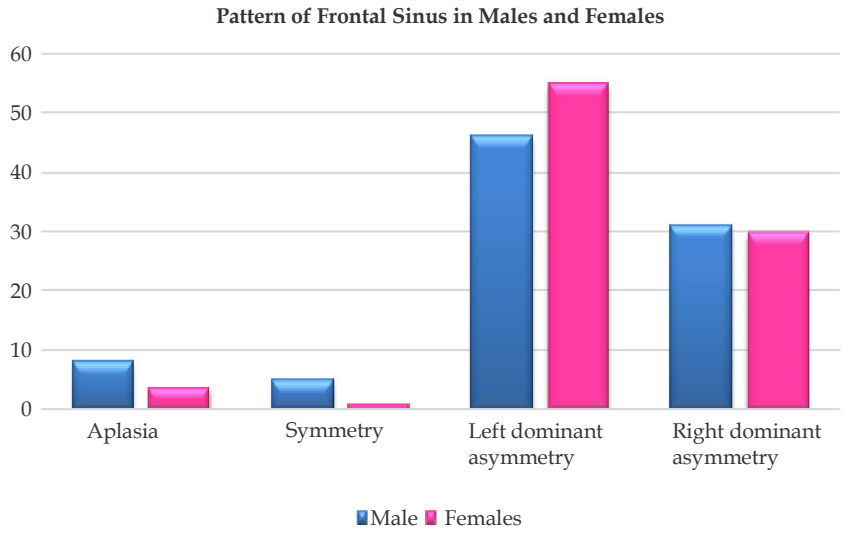
Quantitative characteristics (dimensions of the frontal sinus, height, width and area of pyriform aperture) were compared between males and females using Mann-Whitney U test. Association of qualitative characteristics (pattern of frontal sinus, Pattern of nasal septum, pattern of nasal bone between gender were done using Fishers exact test.

Results

The mean age of the population assessed was 45.53 years (±14.77). The most predominant pattern of frontal sinus seen in the study sample was the left dominant asymmetry 56.1% and the least predominant was symmetry 3.9% (Table 1).

The most predominant pattern of frontal sinus in males and females was left dominant asymmetry in 51.1% and 61.1% and least predominant was symmetry in 5.6% and 1.1% respectively (Graph 1).

The association between most predominant pattern of frontal sinus in males and females with advancing age was not statistically significant (Table 1).



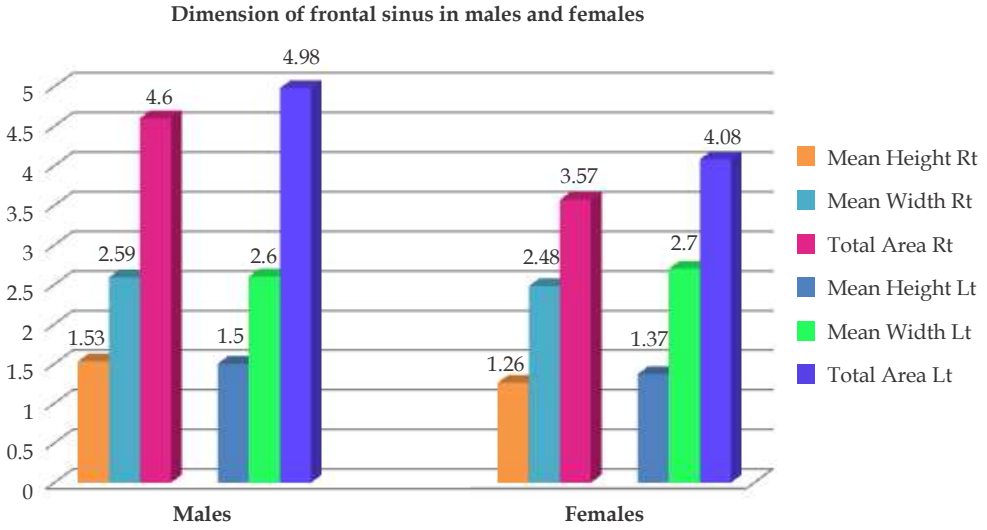
Graph 1: Frequency of most predominant pattern of frontal sinus in males and females.

Table 1: Most predominant pattern of frontal sinus in males and females with advancing age

	Aplasia		Symmetry		LDA		RDA		Total
	M	*F*	*M*	*F*	*M*	*F*	*M*	*F*	
21–25		1 (11.1%)	–	–	7 (77.8%)	5 (55.6%)	2 (22.2%)	3 (33.3%)	18
26–30		–	–	–	7 (77.8%)	6 (66.7%)	2 (22.2%)	3 (33.3%)	18
31–35		–	–	–	5 (55.6%)	7 (77.8%)	4 (44.4%)	2 (22.2%)	18
36–40		–	2 (22.2%)	–	5 (55.6%)	7 (77.8%)	2 (22.2%)	2 (22.2%)	18

	Aplasia		Symmetry		LDA		RDA		Total
	M	*F*	*M*	*F*	*M*	*F*	*M*	*F*	
41–45	2 (22.2%)	–	–	–	4 (44.4%)	6 (66.7%)	5 (55.6%)	3 (33.3%)	18
46–50	2 (22.2%)	–	–	–	3 (33.3%)	3 (33.3%)	4 (44.4%)	6 (66.7%)	18
51–55	1 (11.1%)	1 (11.1%)	–	–	4 (44.4%)	5 (55.6%)	3 (33.3%)	3 (33.3%)	18
56–60	2 (22.2%)	1 (11.1%)	2 (22.2%)	1 (11.1%)	2 (22.2%)	4 (44.4%)	4 (44.4%)	3 (33.3%)	18
61–65	1 (11.1%)	1 (11.1%)	1 (11.1%)	–	2 (22.2%)	5 (55.6%)	4 (44.4%)	3 (33.3%)	18
66–70	8		–	–	7 (77.8%)	7 (77.8%)	1 (11.1%)	2 (22.2%)	18
Total	3.86	4	5	1	46	55	31	30	180
Fishers exact test	0.93		1.66		2.99		3.1		
p-value			>0.99		0.97		0.98		

The mean height of frontal sinus on right side in males was greater than in females and was statistically significant. On the left side mean height and total area of frontal sinus were statistically significantly greater in males than in females (Table 2, Graph 2).



Graph 2: Mean dimensions of frontal sinus on right and left side in males and females.

Table 2: Dimensions of frontal sinus in males and females

	Right			Left		
	Mean Ht ± sd	Mean Wt ± sd	Mean Total area ± sd	Mean Ht ± sd	Mean Wt ± sd	Mean Total area ± sd
Males	1.53 ± 0.87	2.58 ± 1.09	4.6 ± 3.21	1.58 ± 0.88	2.6 ± 1.13	4.98 ± 3.32
Females	1.26 ± 0.69	2.48 ± 0.94	3.58 ± 2.38	1.37 ± 0.69	2.7 ± 0.89	4.08 ± 2.71
Mann–Whitney U	3247	3723.5	3375.5	3254	3810.5	3321.5
Asymp. Sig. (2–tailed)	0.021*	0.35	0.054	0.023*	0.492	0.037*

*statistically significant

The most predominant pattern of nasal bone was Type A (56.7%) and least predominant was Type C 2.8% which was not statistically significant (Table 3).

Table 3: Frequency of pattern of nasal bone in males and females

Pattern of nasal bone	Males	Females
Type A	48 (53.3%)	55 (61.1%)
Type B	4 (4.4%)	6 (6.7%)
Type C	2 (2.2%)	3 (3.3%)
Type D	17 (18.9%)	17 (18.9%)
Type E	19 (21.1%)	9 (10%)
	Fishers exact test 3.73	
	p-value 0.44	

The most predominant pattern of nasal septum in males and females was found to be straight 62.2% and 63.3% respectively and rare type 1.1%. The proportions of pattern of nasal septum were not statistically different among males and females (Table 4).

Table 4: Predominant pattern of nasal septum in males and females

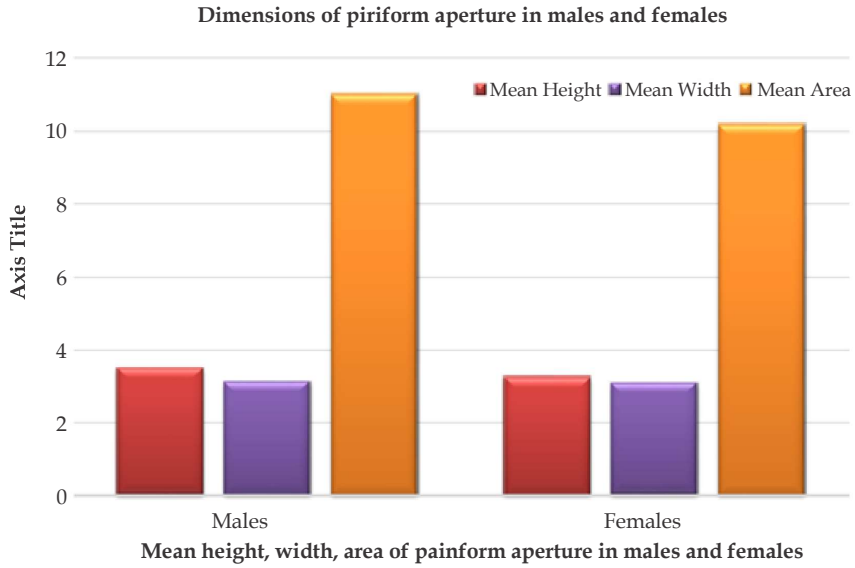
Type of nasal septum	Straight	Right deviation	Left deviation	Sigmoid	Reverse sigmoid	Rare types
Males	56 (62.2%)	14 (15.6%)	11 (12.2%)	6 (6.7%)	2 (2.2%)	1 (1.1%)
Females	57 (63.3%)	10 (11.1%)	15 (16.7%)	1 (1.1%)	6 (6.7%)	1 (1.1%)
		Fishers exact test 6.839				
		p-value 0.21				

The mean height and mean area of the piriform aperture was found to be greater in males as compared to females which was statistically significant ($p < 0.05$) [Table 5, Graph 3].

Table 5: Mean height, width and area of piriform aperture in males and females

	Mean Height ± sd	Mean Width ± sd	Mean area ± sd
Males	3.5 ± 0.39	3.14 ± 0.34	10.99 ± 1.78
Females	3.3 ± 0.41	3.12 ± 0.34	10.2 ± 1.76
Mann–Whitney U	2861	3858	2954
Asymp. Sig. (2–tailed)	0.001**	0.581	0.002**

**statistically highly significant



Graph 3. Mean dimensions of piriform aperture in males and females.

Discussion

Radiographs have become an invaluable tool in forensic sciences since they capture distinct anatomical features. The accuracy for gender differentiation is about 80–100% and radiographs form a standardized technique for morphometric analysis.[2, 14] In the present study PA Cephalogram was utilised to study the different parameters for personal identification that could be assessed with minimal distortion from a single radiograph. A total of 180 healthy individuals (90 males and 90 females) with a mean age of 45.53 years (± 14.77) were included.

Frontal sinus patterns have been evaluated as a parameter to establish post-mortem identity, and empirical data suggest that their configuration is mostly characteristic to each individual.[5] Radiographically, frontal sinuses normally appear by the 2nd or 3rd year of life. They rapidly develop in puberty and complete their definitive configuration at about 20th year of life.[7,15,16] In the present study individuals above 20 years were included to exclude the possibility of incomplete growth leading to false results. The selection of age was conformed to earlier studies.[3,5,9,12,17] (McLaughlin RB et al. 2001 and Tatlisumak E et al. 2008 have stated that as the age increases the frontal sinus tends to expand until the age of 40 years, due to hormonal and mechanical stresses of mastication and osseous resorption.[15,16] In the present study statistically significant association of age was not seen with dimensions of frontal sinus.

A statistically significant sexual dimorphism was found in relation to frontal sinus in the present study, while in literature though males showed larger frontal sinus diameters than females it was not statistically significant.[5,11,16,18–21] In a study by Porbonikova et al. 1974 and Ponde et al. 2008, it was reported that females have proportionally larger antero-posterior diameter frontal sinuses than males, when compared to the sagittal diameter.[7,22]

The frequency of bilateral and unilateral agenesis of the frontal sinus is known to differ in most ethnic populations, with the highest being in the Eskimo population where it is considered to be an adaptation to the cold climatic conditions.[23] In the previous studies bilateral and unilateral aplasia was found to be ranging between 1–18% and 1–9% which is in accordance with the present study.[3,12,19,20,24] In our study, bilateral aplasia was found more on right side (21.1%) as compared to left side (11.1%). The variable difference by each research can be attributed to the influence of environmental and genetic factors on the frontal sinus. Three systemic factors that is the craniofacial configuration, the thickness of the frontal bone and growth hormone levels influence the frontal sinus morphology within each population.[25,26]

The pattern of frontal sinus in the present study population was based upon the classification given by Taniguchi M et al. 2003 as it is easy and less time consuming.[12] Schuller A and Asherson N stated that frontal sinus pattern of no two individuals are alike.[20, 24] Yoshino et al.[19] proposed the classification of frontal sinus pattern of a given individual, which assesses several parameters and requires expertise. In the present study, symmetry was found in (3.3%), left dominant asymmetry was found in (56.1%) and right dominant asymmetry in (33.9%), which was in accordance to the previous studies.[9,12]

The numbers of septa on right and left side were from 0-8 (0.6%). The most prevalent number on right and left was 2(26.7%) and 1 (31.7%) respectively. The numbers of lobulations and septa on the left and right side were: 1–6 each in the symmetrical type, 1–4 in the left and 0–4 in the right, respectively in the left dominant asymmetrical type, and 0–5 in the left and 1–4 in the right, respectively, in the right dominant asymmetrical type. The tendency of number of lobulation in males was found to be greater than in females but the difference was not statistically significant.

The pattern of nasal septum found in the present study, predominantly was straight (62%) which was slightly lesser than that reported by Reddy S et al.[9] (92.3%) and more than Verma P et al.[17] (40.9%). The nasal septum reported to be more prevalent in previous studies was Left deviation by Taniguchi M et al.[12] (37.6%) and Talaiepour et al.[25] (31.5%) respectively. In the present study however, no significant association was found between gender and nasal septum pattern which was in accordance with the previous studies.[3,12]

The morphological variations of the piriform aperture and nasal bone can be used in Forensic sciences, because its knowledge may be applied to the sexual and ethnic differentiation. However, quantitative data on the piriform aperture remains rare.[27]

Anthropological studies suggest that climate influences the breadth and height of the piriform aperture and for this reason, it is speculated that the shape of the piriform aperture is adapted to the

environment in a way that reflects geographical variations.[28,29,30,31] Reported findings indicate that the piriform aperture continues to develop even after 20 years of age. The width of the piriform aperture increases twice from childhood to adulthood.[29,31,32]

In the present study, statistically significant correlation was found between mean height of piriform aperture and gender ($p < 0.05$) which is in accordance with the previous studies.[12,26,27,31,33] The mean height of piriform aperture in males 3.5cm was in accordance with the study conducted by Hwang et al. on Korean population.[30] The mean width of the piriform aperture in our population is 3.1cm which was higher as compared to the study conducted in North Indian population by Asghar A & Dixit A[27]. Also, in the present study, statistically significant correlation was found in the mean area of piriform aperture and the gender.

The shape and the size of the nasal bone vary in different races, ethnic groups and climates. Various studies have been reported on type of nasal bone in the literature.[27,34,35] In the present study, the most predominant pattern of nasal bone is Type A in 56.7% followed by Type D 18.9%, Type E 16.1%, Type B 5.6% and Type C 2.8%. The most predominant pattern of nasal bone found in the present study was Type A in 56.7% is in accordance with the studies conducted by Lang and Baumeister et al.[32] on German population (68.3%), Prado et al.[28] on Brazilian population (28.6%) and Adil Asghar et al.[27] (45%) on Indian population respectively.

Conclusion

The need to establish a reliable, low-cost, and easily reproducible method for human identification prompted the elaboration of technical, precise, and accessible parameters, such as the evaluation of the pattern, area, asymmetry, and shape of the frontal sinus, nasal bone, nasal septum and piriform aperture. As stated, genetic and environmental factors control the configuration of all these mentioned anatomic structures within each population. Thus, no single parameter can prove to be most accurate in sex determination and a need for the use of combination of various parameters arises. A further research with larger sample size and modified methods with higher calibrations are to be proposed. Thus, the combined use of all the above-mentioned parameters can prove to be a useful, reliable, economic and extremely simple tool for gender identification.

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Original Article

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Magnetic Resonance Imaging Measurement of Ligamentum Flavum Thickness and its Relations with Age, Sex and Asymmetry

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Abstract

Background: Ligamentum flavum (LF) when thickens can contribute to spinal canal stenosis and nerve roots compression.

Objective: To Assess the relationship of Ligamentum flavum with age, sex and side

Patients and Method: This was a cross-sectional study conducted at MRI unit in Al-Hilla teaching hospital. Included 60 patients aged 20–80 years with low back pain and/or radiculopathy. Patients with a history of previous lumbar surgery or radiotherapy, congenital anomalies, scoliosis, spondylolisthesis, cardiac pacemakers, aneurysms, clips and metallic implants and joint replacements were excluded.

Results: The mean LF thickness at left side was 3.50 ± 0.6 mm in males and 3.72 ± 0.69 mm in females. In right side the values were not much different where the mean LF thickness in males and females was 3.30 ± 0.64 and 3.52 ± 0.66, respectively. Female had thicker LF than male but the difference did not reach the statistical significance.

It had been found that the mean LF thickness in both sides increased with advancing age, ($p < 0.05$). According to the level, it had been significantly found that in both sides the LF was thicker at the L4–L5 level than other two levels, and no statistically significant differences had been found between both sides when compared at each level

Conclusion: Advanced age and female gender were found to be independently raise the risk of LF thickness, The study suggest that LF measurement should be interpreted in conjunction with patients' variables specially age and gender.

Keywords: Ligamentum flavum (LF); Magnetic Resonance Imaging (MRI).

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Introduction

Low back pain (LBP) is a common medical condition and the associated disability and medical cost have a significant impact on the community.[1–3] With the increasing longevity of our population and the resulting increasing proportion of middle-aged and elderly persons, the problem of low back pain is becoming a significant health care issue. Given the potentially devastating effects of this

medical condition, early diagnosis and treatment are essential for positive outcomes.[4]

Lumbosacral pain may occurs as result of several causes, including degenerative and congenital spinal stenosis, neoplasm, infection, trauma, and inflammatory or arthritic processes, with degenerative joint and disk disease accounting for the vast majority of cases.[5]

The relation between low-back pain and abnormalities in the lumbar spine is controversial as abnormal findings are often seen in asymptomatic patients on plain radiographs, CT studies and MRI studies. Degenerative changes in the disc are already seen in one-third of healthy persons between 21 and 40 years old.[6]

Hypertrophy of the ligamnetum flavum (LF) represent important causative factor in the compression of the dural sac and roots.[7] And significantly contributes to lower back pain and radiculopathy[8,9] even in the absence of a bulging annulus fibrosus, herniated nucleus pulposus, or osseous spurs. A cut of 4 mm has been fixed as lower normal for LF.[10,11]

The reasons for LF thickening are not completely understood, but they are probably related to mechanical instability and asymmetrical stresses on the facets.[12,13]

Materials and Methods

This was a cross-sectional study conducted at MRI Unit in Al Hilla teaching hospital in Babylon governorate, Iraq during the period; January to September 2019.

Included (60) patients (32 female and 28 male) aged 20–80 years who were referred to the MRI unit for lumbosacral evaluation due to low back pain and/or radiculopathy. Patient was excluded if he/she had a history of previous lumbar surgery, radiotherapy, congenital anomalies, scoliosis, spondylolisthesis and cardiac pacemakers, aneurysms, clips and metallic implants, joint replacements and when the MRI examination does not included any of L3/4, L4/5 & L5/S1 level were excluded. MRI of the lumbar spine is performed in both sagittal and axial planes.

Any abnormality on sagittal views should be confirmed on axial views and vice versa. On T1-weighted images, ligamentum flavum reflects intermediate- to low-signal intensity T2-weighted images optimize contrast between disk, bone, and CSF. All examination were performed by the same MRI system using MRI sequences for lumbosacral evaluation with the followings imaging parameters:

Sagittal T1 WI. TSE TE = 8 ms TR = 500 ms

Sagittal T2 WI. TSE TE = 100 ms TR = 4000 ms

Axial T2 WI TE = 100 ms TR = 4000 ms

Data were collected including the demographic and clinical variables. Radiological data and evaluation of axial (T2W) & sagittal (T1W & T2W) MRI images and measurement of the ligamentum flavum were performed or supervised by expert specialist radiologists additionally, any ancillary degenerative findings like facet joint hypertrophy were assessed.

Statistical Analysis: was performed using the statistical package for social sciences (SPSS) version 25. Data were managed and analyzed according to the type of variables and appropriate statistical tests and procedures were applied accordingly.

Results

A total of 60 patients were included in the study their age ranged 20–80 years. They were equally distributed into three age groups with 20 years interval. They were 28 males and 32 females with a female to male ratio of 1.14:1, (Table 1). The comparisons of mean LF thickness according to age, sex, levels and sides are shown in (Table 2); According to age it had been found that, in both sides, the mean LF thickness increased with advancing age, where the higher thickness reported among patients aged 61–80 years, and lower thickness was found in those aged 20–40 years, further more, curve estimation for the correlation between age and LF thickness revealed a direct (positive) correlation, ($p < 0.05$) in both sides. (Fig. 1, 2 and 3). The comparison according to sex revealed that LF was thicker in females than males, however, the difference did not reach the statistical significance. According to the level, it had been significantly found that in both sides the LF was thicker at the L4–L5 level than other two levels, ($p < 0.05$).

Table 1: Age and sex distribution of the studied group (*N* = 60)

Variable		No.	%
Age (year)	20–40	20	33.3
	41–60	20	33.3
	61–80	20	33.3
	Mean (SD)	52.1 (15.2)	
	Range	25–78	
Sex	Male	28	46.7
	Female	32	53.3

SD: Standard deviation

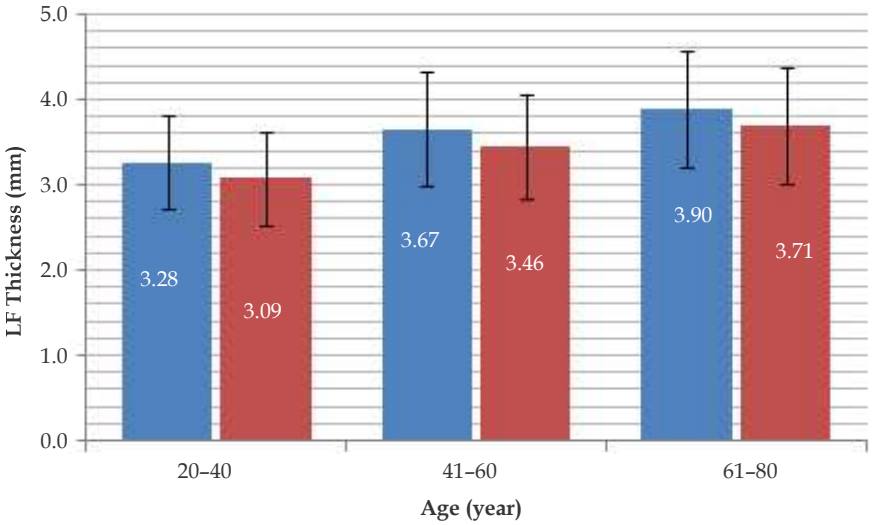

Fig. 1: Graphical comparison of the mean left and right LF thickness according to age groups.

Table 2: Comparison of mean LF thickness according to age, gender and side

Variable		Number of cases	LF thickness				*p*-value (*t*-test) Between sides
		Left		Right			
		Mean	SD	Mean	SD		
Age	20–40	20	3.28	0.55	3.09	0.55	0.285 ns
	41–60	20	3.67	0.66	3.46	0.61	0.300 ns
	61–80	20	3.90	0.69	3.71	0.68	0.394 ns
***p*-value (ANOVA) Between age groups**			0.001 sig		0.001 sig		
Gender	Male	28	3.50	0.64	3.30	0.64	0.268 ns
	Female	32	3.72	0.69	3.52	0.66	0.249 ns
***p*-value (*t*-test) between genders**			0.209 ns		0.204 ns		
Level	L3–L4	16	3.30	0.63	3.11	0.60	0.391 ns
	L4–L5	25	3.87	0.53	3.67	0.50	0.172 ns
	L5–S1	19	3.54	0.78	3.35	0.77	0.454 ns
***p*-value (ANOVA) Between levels**			0.023 sig		0.022 sig		

SD: standard deviation, ns: not significant, ANOVA: analysis of variances, SD: standard deviation, sig: significant, ns: not significant

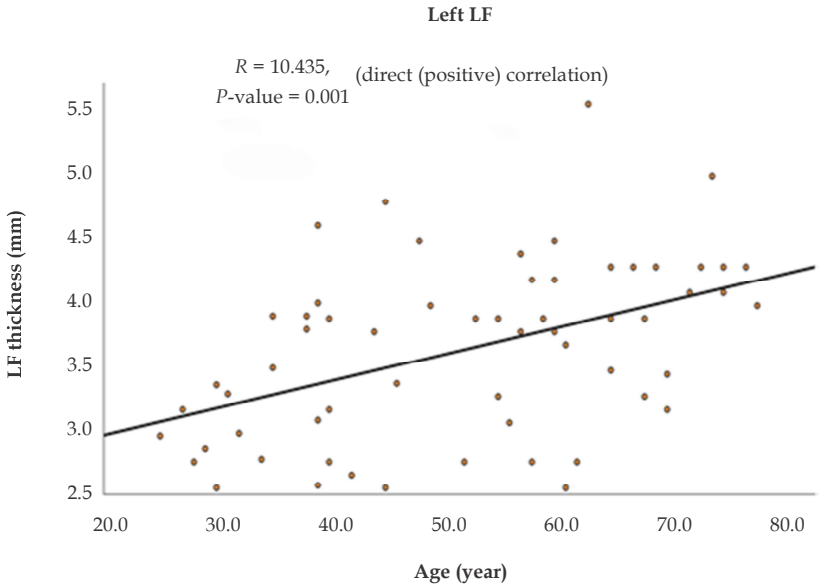

Fig. 2: Curve estimation showing a direct (positive) significant correlation between left LF thickness and age of the studied group.

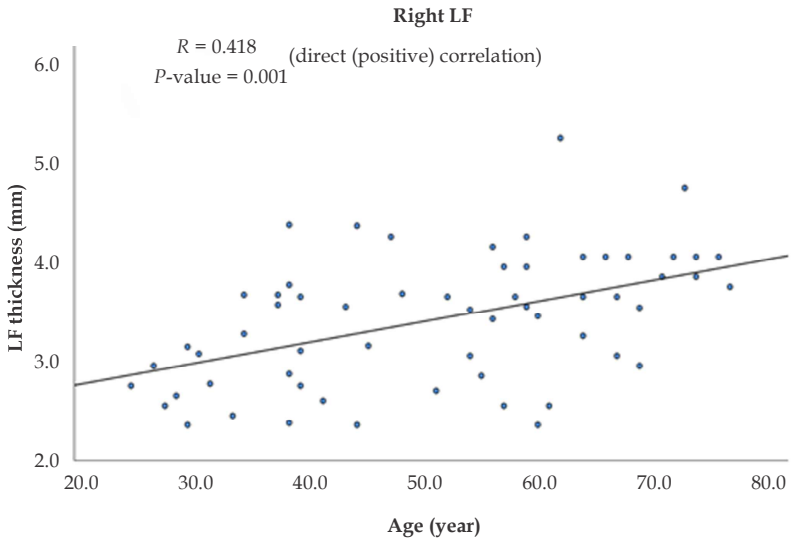

Fig. 3: Curve estimation showing a direct (positive) significant correlation between right LF thickness and age of the studied group.

Discussion

Regarding effects of age on LF; the findings of the present study were in concordance with most of previous studies of LF (Akreyi et al.,[8] Kolte et al.,[14] Okuda et al.,[9] Abbas et al.[15] and Altinkaya et al.[16] Twomey and Taylor[17]) that suggested the LF thickness is an age-dependent phenomenon. In all these studies, significant changes in LF thickness were seen at the L4–L5 and L5–S1 spinal levels as age increased.

On the contrary; Safak et al.[10] and Fukuyama et al.[18] found that there was no association between LFT and increasing age. Safak et al.[10] suggested that mechanical stress and degeneration seemed to be more important factors in LF hypertrophy than age and gender.

In this study, we found that females were having thicker LF than that in males at the three studied lumber levels; this is in agreement with Akreyi et al.[8] and they attributed that to the nature of the Iraqi women's work. Interestingly; in these two Iraqi

studies (our study and Akreyi et al.[8] study), females found to have more LF thickening compared to Iraqi males. Up to our Knowledge, we don't found a similar result in the previous articles concerning LFT. On the contrary, Safak et al.[10] and Abbas et al.[15] found that there is no statistically significant difference between male and females regarding the LFT.

In this study don't found statistically significant differences in LFT with respect to the side (right or left) when measured at the same level and this is true at all studied levels. This is in agreement with Kolte et al.[14] and Chokshi et al.[19] but in disagreement with Abbas et al.[15] who found that the right sided LF is thicker than left LF while Safak et al.[10] who found that the left sided LF is thicker than right LF.

Abbas et al.[15] explained that it could be attributed to the right thoracic built in rotation in non-scoliotic spine at the mid and lower thoracic vertebrae. They assumed that there would be a compensatory rotation to the left of the lumbar spine that increases the tension forces in the right spine complex leading, in time, to a greater thickening of the right LF.

Conclusion

1. LFT is more in females than males but without statistical significance.
2. LFT increased with advancing age Therefore, interpreting LF thickening should be done without considering patient's age else over- or underestimation may result.
3. Among lower lumbar levels, LF was thicker at L4/5 LF than at L3/4 & L5/S1 levels.
4. There was no significant difference in LFT regarding the side.
5. When each of all aforementioned variables taken independently, the advanced age was the stronger predictor of thicker LF, followed by spinal level L4/L5, and female gender

Ethical Clearance: The study protocol was approved by the Scientific council of the college of Medicine, Babylon university and the department of Radiology. Signed informed consent was obtained from each patient before examination and enrollment in the study, all data were kept confidentially and collected in accordance with the World Medical Association Declaration of Helsinki Ethical Principles For Medical Research Involving Human Subjects.

Conflict of Interest: Authors declared none

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Pattern of Head Injuries in Road Traffic Accidents Cases Brought to Post Mortem Center

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Abstract

Road traffic accidents are one of the major causes of morbidity & mortality especially in developing countries including India. Craniocerebral injuries are the most common injuries found in fatal road traffic accidents. The objective of our study was to analyze the pattern of craniocerebral injuries in these types of fatal accidents. The study was conducted at the Department of Forensic Medicine, Government Medical College, Kota during January 2017 to December 2018. During this period 290 victims of fatal road traffic accident were autopsied. In the present study the male ratio was more compared to female. Most of the victims in the present study belonged to the age group of 21 to 30 years. Mechanized two wheelers were the commonest off ending vehicle. Most of the death occurred in the winter season. Most common intracranial hemorrhage was Subdural hemorrhage with combination and fracture of vault was the commonest fracture found.

Keywords: Accident; Craniocerebral injuries; Intracranial Hemorrhage.

Introduction

Road traffic injuries are the leading cause of death globally, and the leading cause of death for young people aged 15–29 years. More than a million people die each year on the world's roads, and the cost of dealing with the consequences of these road traffic crashes runs to billions of rupees. Current trends suggest that by 2030 road traffic deaths will become the fifth leading cause of death unless urgent action is taken. Only 28 countries, covering 7% of the world's population, have comprehensive road safety laws on all five key risk factors: drinking and driving, speeding, and failing to use helmets, seat-belts, and child restraints as per the global status report on Road Safety 2013 by World Health Organization[1]. India is undergoing major economic and demographic transition coupled with increasing urbanization and motorization. Injuries on roads, at homes, and in the workplace have increased due to lack of safety-related policies and programs. The health sector bears the maximum brunt in terms of provision of acute care, and short-term and long-term rehabilitation service. Some of the factors that increase the risk of road crashes in India are unsafe traffic environment, poor road infrastructure and encroachments that restrict safe areas for pedestrians; lack of safety engineering measures; traffic mix and an increasing number of motorized vehicles; unsafe driving behavior and lack of valid or fake driving licenses. Craniofacial injury, a common term which actually means craniocerebral damage and injury to face, has been recognized since ages. As found in medico-legal practice blunt craniofacial injuries are most frequently caused by traffic accidents, fall from

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height, assault, train accidents etc. and road traffic accidents are the main component, followed by fall from height and railway accidents. World Health Organization defined accidents as '' an unexpected, unplanned occurrence which may involve injury''.[1]

The present study has been carried out regarding the various epidemiological and medico legal aspects of vehicular accidents. An attempt was made to analyze various risk factors, distribution and pattern of head injuries with respect to skull fracture and different intracranial hemorrhages.

Materials and Methods

This study has been carried out in the mortuary of the Department of Forensic Medicine and Toxicology, Government Medical college, Kota; Rajasthan during the period of 1st January 2017 to 31st December 2018. During this period; fatal craniocerebral injury cases numbered at 290. All these 290 cases selected for the study were due to craniocerebral injuries. Pre-designed and pre-tested questionnaire were prepared and information or data was collected from the following sources.

(1) Inquest reports

(2) History taken from the relatives

(3) Hospital records

(4) Post–mortem examination findings.

Detail post mortem examination of the cases were done and the findings were recorded in a master chart prepared then appropriate statistical analysis using percentage and proportions was done for data analysis.

Results

Out of these cases a total 290 cases were due to road traffic accidents which constituted and that have been charted are represented in the form of diagrams which are as follows: Seasonal wise variation are as depicted in the Table 1 shows more deaths occurred in winter and least were in Rainy season. The peak incidence was observed in the age group of 21–30 years in both sex male as well as female. Individuals in the age group of more than 80 years were least affected, in female age group of 0–10 years shows least affected individuals. In table no 2 it is shown that female were the less affected individual than males with gender ratio of male to female 2.41:1. Table 3 shown that vehicle which was involved during incidence, it is observed that Motor cycle involved in highest number of cases with 104 cases and next one is pedestrian. 13.78% deceased showed only head injuries without any other detectable body injuries on rest of body, followed by head, neck face injuries 33.82% (Table 4). Distribution of types of vault fracture is summarized in the Table 5 which shows 31.72% cases fissured fracture of vault was observed, in about 18.62% cases fissured fracture of both vault and base seen. Only in 4.13% cases surgical intervention was seen. However death occurred in 10% cases, due to internal damages to brain without any fracture of skull. Lesion to brain due to trauma was observed in 17 cases which were about 5.86 percentages. Subdural hemorrhage and subarachnoid hemorrhage both observed in 44.13 cases and extradural hemorrhage was observed lonely in 1 case.

Table 1: Weather

Weather	Winter	Summer	Rainy	Total
No of cases	130	85	75	290

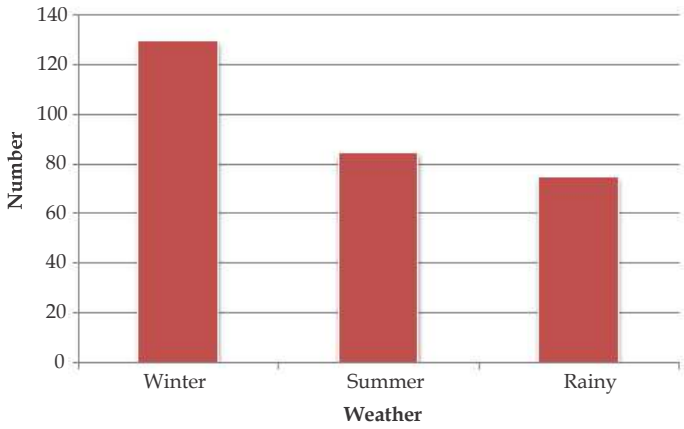

Fig. 1: Weather

Table 2: Age wise distribution

Age groups	0–10	11–20	21–30	31–40	41–50	51–60	61–70	71–80	More than 80	Total
Male	5	15	84	39	26	16	11	8	1	205
Female	1	11	31	16	12	6	5	2	1	85

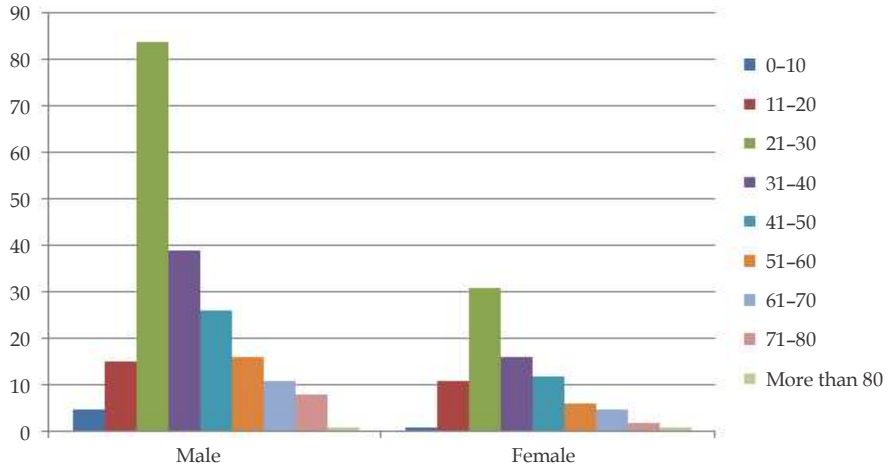

Fig. 2: Age wise distribution

Table 3: Vehicle wise distribution

	Pedestrian	Four wheeler driver	Four wheeler Occupant	Motor cycle	Pillion rider	Bicycle rider	Rickshaw puller	Other	Total
No of deceased	96	38	26	104	18	4	2	2	290

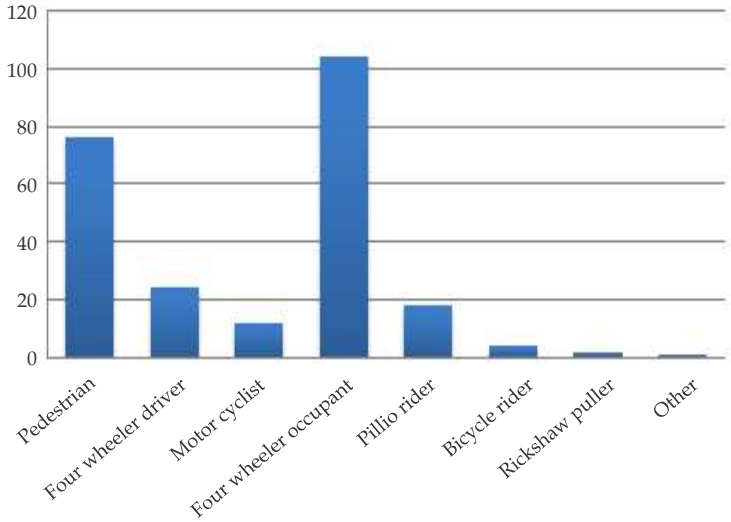

Fig. 3: Vehicle wise distribution

Table 4: Distribution of injuries

Type of injury	No of cases	Percentages
Head injury	40	13.78
Head, neck, face injuries	101	33.82
Head injury + Other body injuries	149	51.37
Total	290	100.00

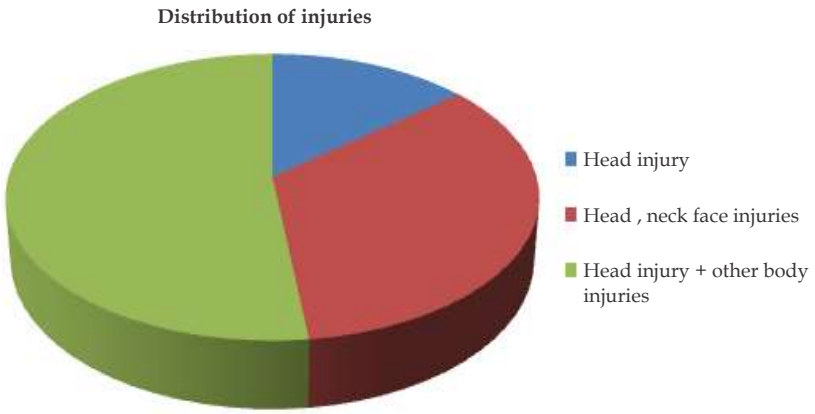

Fig. 4: Distribution of injuries

Table 5: Distribution according to fracture of vault in head injury cases

Fracture of vault	Frequency	Percentages
None	29	10.00
Fissured fracture of vault	92	31.72
Fissured fracture of base	12	4.13
Depressed	10	3.44
Comminuted	14	4.82
Fissured+depressed	19	6.55
Fissured fracture of vault and base	54	18.62
Fissured+depressed+comminuted	17	5.86
Depressed+comminuted	11	3.79
Crush	20	6.89
Craniotomy/burr holes/drain/ other surgical procedures	12	4.13
Total	290	100.00

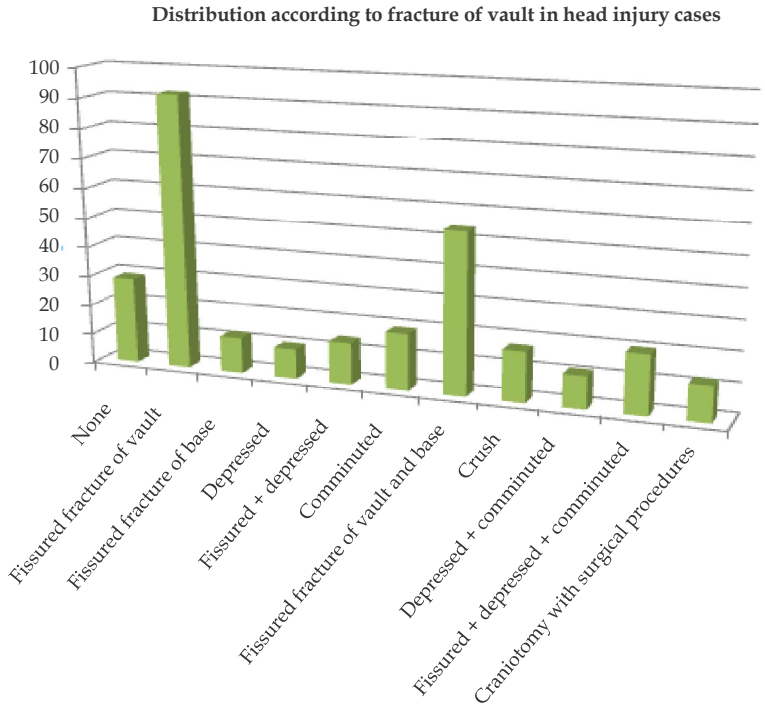

Fig. 5: Distribution according to fracture of vault in head injury cases

Table 6: Distribution of types of intracranial hemorrhages in head injury cases

Intracranial hemorrhages	Frequency	Percentages
SAH	33	11.37
EDH	1	0.34
SDH	37	12.75
EDH+SDH	08	2.75
SDH + SAH	128	44.13
EDH + SDH + SAH	9	3.10
ICH	4	1.37
Other combination	41	14.13
SDH + SAH + ICH	12	4.13
Absent	17	5.86
Total	290	100.00

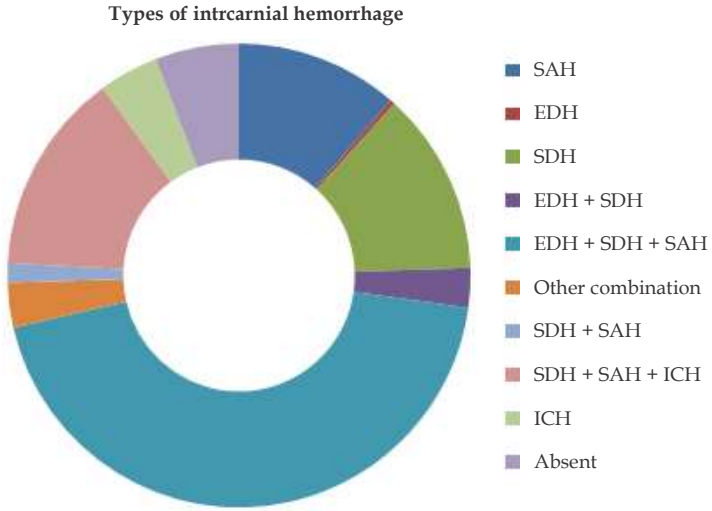

Fig. 6: Distribution of types of intracranial hemorrhages in head injury cases

Discussion

India is developing country where poverty and unemployment in rural areas increases as time progresses day by day, it leads peoples rapidly move towards urbanized cities. As the development associates with rapid and unplanned urbanization. Incomplete traffic system, unplanned roads and highway, violation of traffic rules by drivers and pedestrian, over crowding of peoples and vehicles, unlicensed rickshaw, reckless driving etc are responsible for highest rate of road traffic accidents. In this study season was divided into three categories like summer season (March to June), Rainy season (July to October) and winter season (November to February). It was found from data analysis that maximum craniofacial injury cases occurred during the winter months with a total number of 130 cases. In summer season 85 cases and in rainy season 75 cases occurred. The findings of the study are similar to those conducted by Kumar A et al. (2001–2005) and Patil et al. (2014).[2,6] These findings are similar to the studies conducted by Kaul A et al.[3] It was seen that maximum fatal craniocerebral injuries in RTA were sustained by those who were in between 21 years to 30 years of age comprising a total 115 cases. 84 males who belonged to 21–30 years age group sustained fatal craniocerebral injuries while 31 females who belonged to 21–30 years age group sustained such injuries in RTAs. These findings are similar to the studies conducted by Momonchand A and Fimate L.[4] For the purpose of study the victims were divided into following categories- Pedestrian, Driver, Occupant, Motor cyclist, Pillion rider, bicycle rider and rickshaw puller. Analyses of the data revealed that majority of the victims were motor cyclist with total number of 104 cases who are followed by the pedestrian with 76 cases. Pillion riders were involved in 18 cases and

occupants of the 4 wheelers in 24 cases. Kumar L et al. and Kremer C et al. do agree in accompanying injuries, in majority of cases (149: 51.37%) deceased head injury was associated with some other bodily injuries.[2,3] Only 13.78% cases only head injury seen without any other injuries. Scalp Injury with skull fracture was the most common presentation of head injury. Linear fracture of skull was the commonest type of skull fracture other researchers Thube HR et al. & Shivakumar BC et al. found the homologous findings.[7,8] Commonest intracranial hemorrhage is subarachnoid hemorrhage with combination of subdural hemorrhage followed by other combinations. Most of other researchers Ahmad et al., Tandle RM et al. and Soni SK et al. founds that subdural hemorrhages as a commonest type.[9–11] This study has shown that traumatic brain injury is one of the important major causes of mortality and morbidity in road traffic accidents.

Conclusion

Maximum head injury cases occurred during the winter months. most commonly affected victims were the motorcyclist. Road traffic accidents have become significantly responsible for loss of life, economic and social resources even in our city. With the sudden rise in the number of vehicles in the past ten years the incidences of traffic accidents also has risen. It is high time to better define the specific characteristics of the problem in a uniform manner so that preventive measures can be implemented accordingly. Primarily safety measures should focus upon three main factors viz. infrastructure, human behavior and vehicle design. It is required from concern government authority to take appropriate and immediate actions to reduce these kinds of accidents. As far as concern the same time, people should be educated for taking preventive actions to protect themselves like using helmets, speedlimitation while driving, lane systems in schools and public places.

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Conflict of Interest: None declared

Ethical Approval: Not needed.

Abbreviation

SAH- Subarachnoid hemorrhage
EDH- Extradural hemorrhage
SDH- Subdural hemorrhage
ICH- Intracranial hemorrhage

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Original Article

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Morphological Spectrum of Renal Lesions: An Autopsy Study

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Abstract

Context: Renal diseases are responsible for a great deal of morbidity and mortality. The autopsy study throws immense light on pathogenesis of disease, reveals hazardous effects of violence on various organs and lastly often reveals the cause of death.

Aims: To study the histomorphological spectrum of renal lesions in autopsies and an attempt is made to establish the cause of death.

Design: Observational type of study

Materials and Methods: A prospective study was conducted from July 2016 to June 2018 in the department of pathology. A total of 210 kidneys of adult medico legal autopsies performed during the period were included in our study. The stained microscopic sections were examined by two histopathologists independently.

Statistical Analysis: Descriptive analysis using IBM SPSS Statistics for Windows, Version 22.0.

Results: The age ranged from 4 to 80 years. Majority of the cases were in the age group of 21–30 years with a mean age of 33.40 years and the M:F ratio was 1.8:1. Out of 210 cases, 103 cases (49.1%) showed tubulo-interstitial and vascular lesions, 92 cases (43.81%) showed near normal histology of kidney and 15 cases (7.1%) showed glomerular lesions.

Conclusions: The tubulo-interstitial lesions were more common than glomerular lesions in medicolegal autopsies. The incidental finding in this study highlights the importance of gross and microscopy examination of each organ in detail from each autopsy irrespective of the cause of death.

Keywords: Autopsy; Histomorphology; Renal lesions.

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Introduction

Autopsy provides normal as well as diseased human tissue for morphologic studies. It provides the opportunity to discover new diseases, to evaluate toxic effects of drugs and therapies.

Renal diseases are responsible for a great deal of morbidity and mortality. Chronic kidney disease (CKD) is now recognized as a major global public health problem and is an independent risk factor for cardiovascular disease.[1,2] CKD can lead to progressive loss of renal function, and may terminate in End Stage Renal Disease.[3,4]

Although glomerulonephritis is the most important cause of chronic renal insufficiency, vascular diseases and tubulointerstitial diseases are also seem to be the leading causes.[5,6] The most common cause for acute kidney injury in violent death is ischemic acute tubular injury.[7,8]

In view of the above and with limited data on autopsy studies related to renal system, this study was undertaken to detect the renal system findings in all adult autopsy cases.

Materials and Methods

A prospective study conducted from July 2016 to June 2018 (2 years) in the department of pathology of a tertiary care hospital, Kalaburagi. A total of 210 kidneys of adult medico legal autopsies performed during the period were included in the study. Clinical data were recorded as per the proforma. Virchows technique of en block dissection was carried out. The kidneys were removed by blunt dissection in the plane between the renal capsule and the perinephric fat. Then weight of the kidneys and detailed external gross assessment was done.

The kidneys were then bisected and the cortex, medullary pyramids and pelvis were examined. Tissues were fixed in 10% formalin by dissecting into thin (3–5 mm) bread-loaf slices. The formalin fixed tissues were sampled from cortico-medullary region and were further processed by automatic processor. The section of 3 microns were obtained from paraffin embedded tissue samples and were stained with haematoxylin and eosin. The special stains were done as and when required. The microscopic sections were studied and special stains carried out when required.

Results

The age ranged between 4 and 80 years. Majority of cases were seen in the age group of 21–30 years (67 cases, 32.0%) with mean age being 33.40 ± 12.81 years and the male to female ratio was 1.8:1 (Table 1).

Table 1: Age and sex distribution of medicolegal autopsies

Age in years	Males	Females	Total	Percentage (%)
1–10	04	02	06	2.8
11–20	12	10	22	10.5
21–30	45	22	67	32.0
31–40	28	29	57	27.1
41–50	38	05	43	20.5
51–60	05	05	10	4.7
61–70	02	01	03	1.4
71–80	02	–	02	1.0
Total	136 (64.8%)	74 (35.2%)	210	100.00

Among 210 cases, 92 cases (43.8%) showed near normal histology and 118 cases (56.2%) showed pathological changes; out of which 103 cases (49.1%) showed non-glomerular lesions which were more common than the glomerular lesions (15 cases, 7.1%) (Table 2). In the present study incidental findings were seen among which one case was of adult polycystic kidney disease with chronic pyelonephritis (Fig. 1) and the other case was renal aspergillosis (Fig.2).

Table 2: Distribution of renal lesions in medicolegal autopsies

Sl. No	Microscopic findings	No of cases	Percentage (%)
1.	Glomerular lesions	15	07.1
2.	Tubular & interstitial lesions	95	45.2
3.	Vascular lesions	07	3.4
4.	Adult polycystic kidney disease	01	0.5
5.	Normal histology	92	43.8
	Total	210	100.00

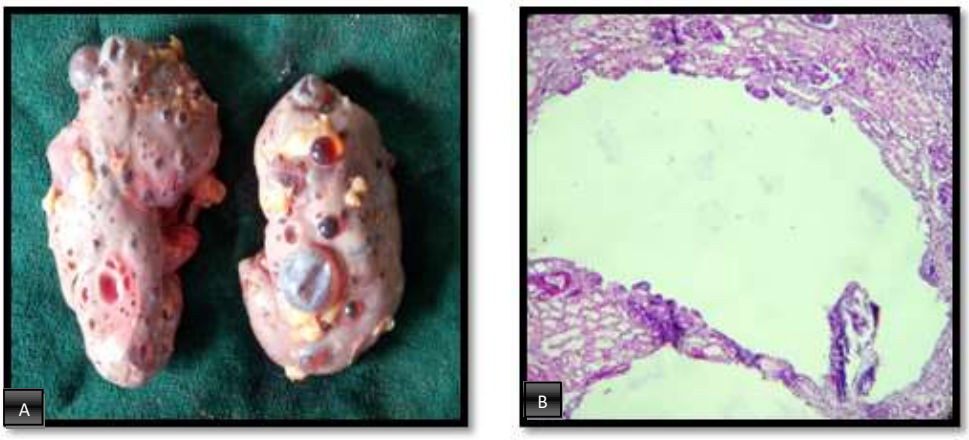

Fig. 1: Adult polycystic kidney disease (A) Bilateral enlarged kidneys with varying sized cysts, (B) cysts lined by flat epithelium (H&E 10X).

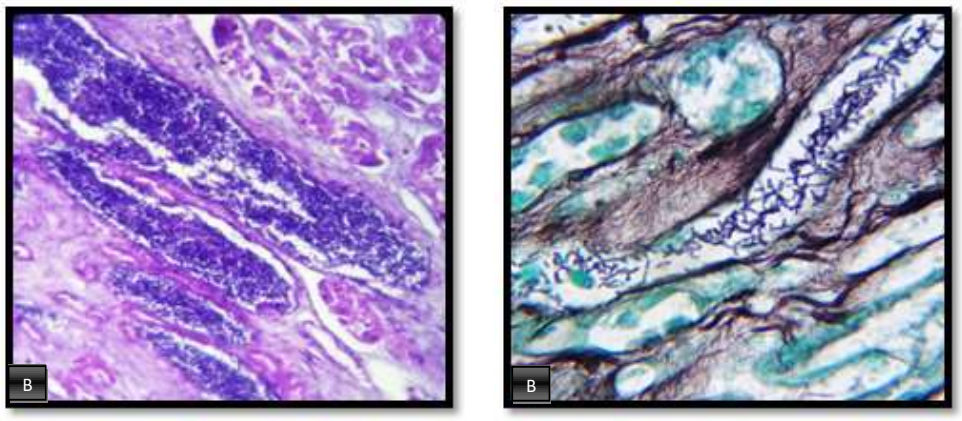

Fig. 2: Renal aspergillosis. (A) Tubules and vascular spaces filled with fungal hyphae (H&E 40X), (B) Fungal hyphae stained black (GMS 40X).

The spectrum of glomerular lesions seen were glomerular congestion (9 cases, 4.3%), peri-glomerular fibrosis (4 cases, 1.9%) and focal global glomerulosclerosis (2 cases, 0.9%). The non-glomerular lesions included tubule-interstitial and vascular lesions of kidney; among which acute tubular necrosis (Fig. 3) (79 cases, 37.7%) was seen in the majority of cases followed by chronic interstitial nephritis (Fig. 4A) (12 cases, 5.7%) and benign arteriosclerosis (Fig. 4B) (7 cases, 3.3%) (Table 3).

Table 3: Distribution of non-glomerular (Tubulo-interstitial vascular) lesions

Sl. No	Lesions	No of cases	Percentage (%)
1.	Acute tubular necrosis (Ischemic)	59	57.8
2.	Acute tubular necrosis (Toxic)	20	19.7
3.	Tubulointerstitial nephritis	03	2.9
4.	Chronic Interstitial nephritis	12	11.8
5.	Renal aspergillosis	01	0.9
6.	Benign arteriosclerosis	07	6.9
	Total	102	100.00

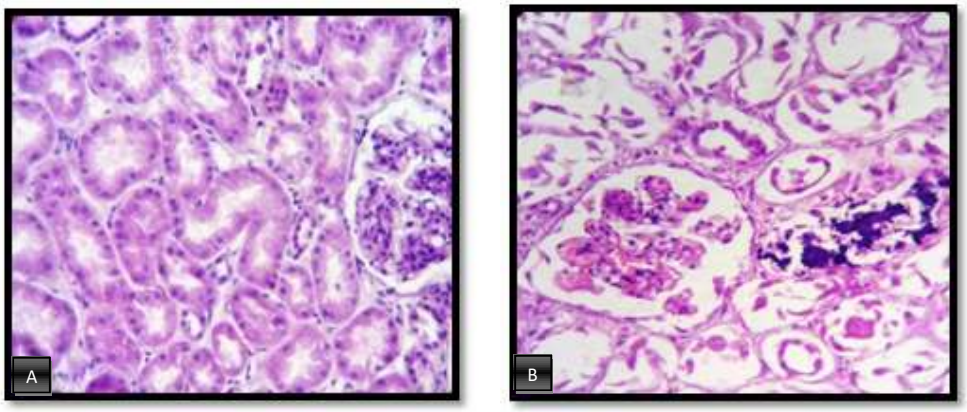

Fig. 3: Acute tubular necrosis (ATN) (A) Ischemic: diffuse necrosis of tubular epithelium (H&E 40X), (B) Toxic nephrosis: Desquamation of tubular epithelial cells and microcalcification (H&E 40X).

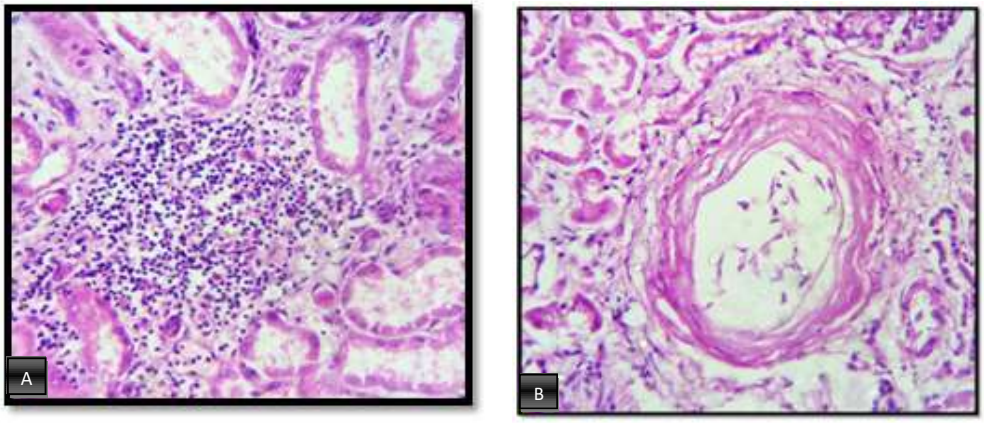

Fig. 4(A): Chronic interstitial nephritis- chronic inflammatory infiltrates in the interstitium with tubular atrophy (H&E 40X), (B) Benign arteriosclerosis- shows thickened and hyalinized vessel wall (H&E 40X).

The acute tubular necrosis (ATN) was divided into two types as ischemic and toxic. However, forty four cases (55.7%) of ischemic ATN were seen in burns cases and majority of the toxic ATN (18 cases, 22.8%) were seen in poisoning cases (Table 4).

Table 4: Distribution of cases of Acute tubular necrosis

Mode of death	Ischemic	Toxic	Total	Percentage (%)
Burns	44	–	44	55.7
Poisoning	–	18	18	22.8
Snake bite	–	02	02	02.5
Hanging	01	–	01	01.3
Road traffic accident	11	–	11	14.0
Post operative death	02	–	02	02.5
Death during sleep	01	–	01	01.2
Total	59 (74.6%)	20 (25.4%)	79	100.00

Discussion

Autopsy provides normal as well as diseased human tissue for morphologic studies. It provides the opportunity to discover new diseases, to evaluate toxic effects of drugs and therapies. Further it plays an important role in establishment of diagnosis and whenever possible determines the possible cause of the death.

The kidneys are often affected by chronic inflammatory lesions, neoplasms, toxic effects of various drugs and metabolic disorders. Pathologic examination of renal tissue in autopsy throws light on renal histologic changes in the general population and might provide useful information for preventing chronic renal diseases that tend to be asymptomatic which may often go undiagnosed.

In present study, the spectrum of renal lesions were analysed. However, the distribution of renal lesions varies with geographic area, age, gender, environmental, nutritional and genetic factors and socioeconomic status of the population.

In present study, the microscopic findings in 43.8% of cases were close to normal histology which correlates with the study conducted by Usta et al.[10] (41.8%). However, the glomerular lesions accounted in present study (7.1%) were less when compared to Usta et al.[10] (41.8%) and Sandhu et al.[11] (16.6%) which could be attributed due to the assessment of histopathological changes with histochemical methods without the guidance of immunofluorenscence microscopy.

The non-glomerular (tubulo-interstitial and vascular) lesions (48.6%) were more common than glomerular lesions (7.1%) in present study which correlates with the study by Berinde et al.[9] (6.5%) and Sandhu et al.[11] (34.1%). Among the non-glomerular lesions, tubulo-interstitial lesions were the commonest accounting for 95 cases (45.2%) which was comparable with Sandhu et al.[11] (34.1%).

The present study revealed acute tubular necrosis (ATN) to be the commonest renal lesion accounting for 37.6% which could be explained by large number of burns cases, poisoning and snake bite.

The main disease which determines renal vascular lesions is arterial hypertension, whose prevalence increases with age.[12] Diabetes is another cause of arteriolar renal lesions. However, the clinical data regarding history of diabetes and hypertension for this study were not available. In the present study the vascular lesions accounted for only 3.4% which may be because majority of the cases were in the age group of 21–30 years.

In the present study incidental findings were seen among which one case was of adult polycystic kidney disease with chronic pyelonephritis. In a study conducted by Berinde et al.[9] also found 3 cases of polycystic kidney disease as an incidental finding. Another incidental finding was one case of renal aspergillosis.

The present study provided satisfactory data in respect to morphological spectrum of various renal lesions in an autopsy study. However, it does not reflect the actual incidence of renal lesions in a population.

Conclusion

The present study emphasizes the importance of autopsy which throws immense light on pathogenesis of disease, reveals hazardous effects of violence on various organs and lastly often reveals the cause of death.

The incidental findings in this study highlights the importance of gross and microscopical examination of each organ in detail from each autopsy irrespective of the cause of death.

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Cheiloscopy: A Deterministic and Non Invasive Tool for Personal Identification

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Abstract

Aim: To establish the uniqueness of lip prints for personal identification & to find the reference of the technique in family inheritance.

Objective: Use & reliability of lip prints in personal identification and family inheritance.

Hypothesis: Not applicable observational study.

Material and Method: The research will be conducted on around 100 students (50 males and 50 females) in Dr. Vitthalrao Vikhe Patil Foundation's medical college. The people with congenital lesions, lip surgery or hypersensitivity to lipsticks will be excluded. The method of making lip prints will be noninvasive using simple materials like dark colored lipsticks, cellotapes and a magnifying glass.

Result: The uniqueness of lip prints as personal identification tool is proved by statistically analysing the data obtained from all the lip types some evidences of family inheritance can also be proven.

Conclusion: The inference of the study is lip prints are unique and permanent for an individual. Also lip prints have different patterns based on the grooves. Hence Cheiloscopy can be deterministic tool in personal identification

Keywords: Cheilosocpy; Identity; Crime.

Introduction

With subsequent increase in potential minded crimes and perfectly executed robbery, there is need to increase forensic techniques to rule out and find the true culprit the possibilities. It is very difficult and tedious job for a forensic expert to search for the criminal with no or false evidences. Various highly efficient identification techniques include DNA finger printing, dactyloscopy (finger printing), anthropometry, sex determination, age estimation, blood grouping etc

Cheiloscopy (Greek cheilos is lips) (e skopien is to see) is the study of lip prints by analyzing the sulci and grooves present on the labial mucosa of the lips.[1,1] The folds on the mucosa are permanent and unchangeable. They are unique for every individual except monozygotic twins. Also, the lip prints does not change after 3 months or according to seasons.[2]

The first ever evidence of use of lip prints was discovered by anthropologist Fischer R. In 1970,

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Suzuki and Tsuchihashi discovered that wrinkles an grooves present on the lip show some pattern and designated it as ”sulci labiorum rubroum''.[14] This led to new classification of lip prints. According to various studies lip prints are unique to every individual. By this fact, Suzuki and Tsuchihashi solved two cases where lip prints proved useful in criminal identification. The first case lip prints were identified on envelope while in the second case they were noted on undergarments in 1987, FBI identified a male robber dressed in female disguise using his lip prints

Aim: To prove the uniqueness, reliability of lip prints in personal identification, sex determination and family inheritance

Objective

1. To prove uniqueness of lip prints in individual and its reliability in identification using adobe Photoshop software
2. To check inheritance by analyzing similar grooves and pattern among individual in a family
3. To find the reference of this technique in sex determination

Materials and Methods

The study was conducted among hundred (50 males and 50 females)undergraduate students of age 17–24 after obtaining clearance from institutional ethical committee with their written informed consent. For the inheritance studies, lip print of 5 families which included father, mother, Child A, Child B (Child C if present) that is 22 people with their consent were studied.

Inclusion Criteria

- Participants having full dentition were included(eruption of third molar was ignored)
- Students consenting to give prints
- with age group 17 to 24 years
- For families, a nuclear family with random age was selected who were willing to give consent

Exclusion Criteria

- Participants with malformations, deformity, inflammation, trauma and surgical scars (eg. operation for cleft palate), active lesion of lips and other abnormalities of lip were excluded.
- Gross deformity of lips such as cleft lip, lip pits, ulcers, traumatic injuries on lip, angular chelitis, chelitis glandularis and chelitis granulonatosa
- Participants allergic to lipsticks.
- Participants unwilling to apply lipstick
- Participants with any other pathologic condition

Study Material

Lipstick: Eyetex dazzler lipstick shade 627 red, cellophane tape (2 inches), white paper, cotton swabs, scissors, lipstick brush, adobe Photoshop 0.7 software

Study type: Descriptive, cross sectional study

Duration of study: 9 august 2019 to 15 October 2019

Study site: Department of Forensic medicine and Toxicology, Dr. Vithalrao Vikhe Patil's Medical College and Hospital, Ahmednagar, Maharashtra, India.

Number of samples: 100 (50 males and 50 females).

Methodology

According to the procedure mentioned in Rashmi venkatesh study type (1), the following procedure was done. With the willingness of the participants, the lips were cleaned with cotton swab. Lipstick was applies to both the lips covering all edges in a single stroke with the lipstick applicator brush. The participants were asked to rub lips on each other to evenly spread lipstick. The participants were asked to keep the lips in relaxed position. Then, the cellophane tape's glued portion was placed on the resting position of lips. While making lip prints, subsequently less pressure was applied. The strip was removed gently and placed on white paper A4 sized for further analysis. (Each print numbered serially was studied under adobe Photoshop 0.7 software). Each impression was studies thoroughly and the data was complied.

The lip print was divided into four quadrants system based on the classification of Suzuki and Tsuchihashi. The right upper, The left upper, the left lower, the rights lower as Quadrant I, Quadrant II, Quadrant III, Quadrant IV respectively. If there were 2 dominant types in same quadrant, the most

dominant one was considered. The types were considered as in Fig. 1

Variable	Measurement scale	Measurement method
Age	Ratio	Interview
Gender	Nominal	Observation
Types of print	Ordinal	Examination of prints
Family type	Ordinal	Interview

Type I	Clear-cut grooves running verically across the flip
Type I'	The grooves are striaight but disappear half-way instead of coverig the entire breadth of the lip
Type II	The grooves fork in their course
Type III	The grooves intersect
Type IV	The grooves are reticulate
Type V	The grooves do not fall into any of the Type I-IV and coanot be differented morphologically

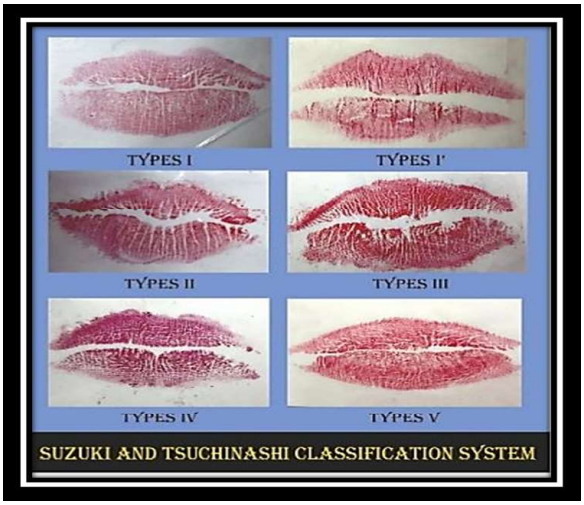
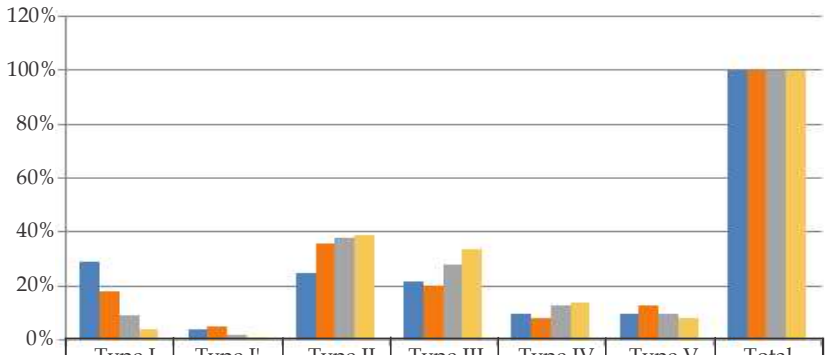


Fig. 1: Suzuki and Tsuchihashi classification of lip prints (1)

Results

According to Suzuki and tsuchihashi's classification for cheiloscopy, six different types of prints were correctly identified among 100 individuals of age 17–24 years

1. All the prints were different and distinct. According to this study, Type II (33.6%) was the most predominant pattern seen followed by Type III (25%), I (14.6%), IV (13.4%) respectively. Type V and Type I was the least seen patterns among individual participated in this study.
2. Type II was 42% in male and 28% in female; followed by Type III 26% in male and 26% in female (equal). It was not possible to find the differentiation of type/pattern between genders in this study.
3. All the lip prints are unique as The Images were superimposed on each other and no two prints were found to match which prove the uniqueness of lip prints to an individual. The superimposition was done using the Adobe Photoshop software 0.7 version. This proves the uniqueness of lip prints.
4. In the family inheritance study although there were some patterns similar in the child and parents but the prints were not found to be same. The child has some unquiet combinations of pattern for himself but also shared some similar grooves like his parents. This suggests that there is correlation between family inheritances despite the child having his individuality.



	Type I	Type I'	Type II	Type III	Type IV	Type V	Total
Quadrant 1	29	4	25	22	10	10	100
Quadrant 2	18	5	36	20	8	13	100
Quadrant 3	9	2	38	28	13	10	100
Quadrant 4	4	1	39	34	14	8	100

Fig. 2: Distribution of different types in 4 quadrants according to Suzuki and Tsuchihashi classification.

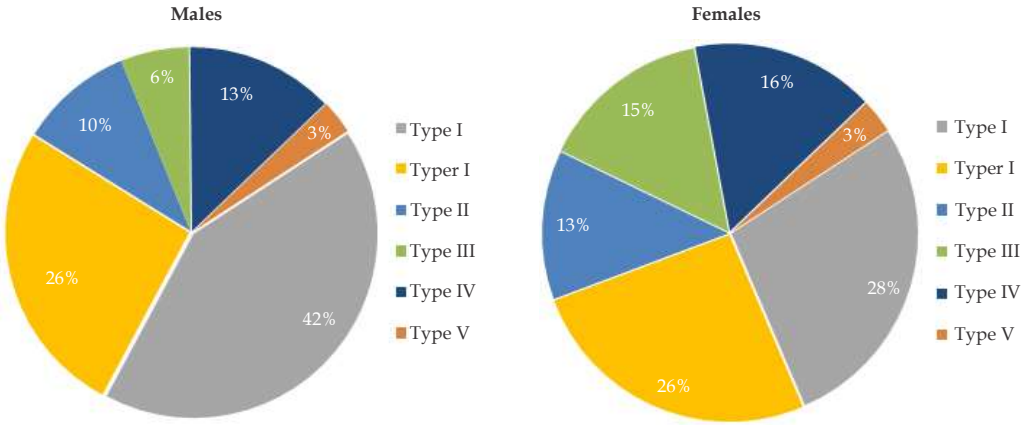


Fig. 3: Sex distribution

Discussion

With the increase in crime rates, it has become crucial for law personnel to relate the evidences attained at the crime site to the perpetrator. Lip prints are nothing but the normal lines and fissures in the form of wrinkles/grooves present in the zone of transition of human lip between the inner labial mucosa and outer skin.[1] The sebaceous and secretory glands of the labial mucosa release a secretory and sticky fluid. According to Locards principle of exchange of materials of contact, lip prints are formed when the lips touch some objects. Lip prints are found on cutlery, crockery items, on window/ door glass panes, Photographs, letters especially love letters, wine glasses, paintings, plastic bags, cigarette ends etc.[6] The prints also appear side by side with bite marks on the food items. In the cases of kidnapping lip prints are most certainly found on the tape used to cover the victim's mouth. In case of pushing the person on the wall there is chance that lip prints may remain on the wall. Three different types of lip prints are found in the crime scene; Visible, latent and 3D or plastic. These prints can be perceived as discernible prints by using Sudan black, Lysochrome, carbonate powder, and Nile red

Lip print patterns in all 100 individuals were found to be unique as they were non superimposable on the adobe Photoshop software. This implies that lip print is unique and can be used to aid personal identification in non-invasive ways.

In this study Type II was the most common type found in all the quadrants. This results match with the conclusion of Govindhkar et al.,[3] Naik et al., Rashmi Venkastesh et al.,[1] Vat J et al.[13]. But contradicts other studies like Sharma et al.[8] where Type IV is more common; In Vahanwala studies Type I and I' Were more common.[6,7] The results did not match with Randhawa et al.[11], Singh et al.[2]

Among the 50 male patterns, Type II was most common with 42% followed by Type III. The least common were Type IV (10%), V (6%) I'(3%). Govindhkar et al. also found Type II as most prevalent Type In males.[3] But in Vahanwala –Parekh studies, it was suggested that certain pattern tends were prevalent in either sex. Type I and I' were dominant in the females in 3rd and fourth quadrant and Type II in the second quadrant of Males in 50 females pattern,[6,7] Type II (28%) was most common followed by Type III (26%) the least common was Type I' with 3%. The results entirely match with Peter kiran, Shweta murthy showing Type II followed by Type III in both males and females. Unlike other studies, it was not possible to differentiate between the genders by using the types of grooves on lip prints. Augustine et al. found that the lip prints varied equally between the males and females and varied among age groups.[12] In studying the lip prints obtained from the families it was seen that the lip print of the child has some similar grooves resembling the parents present at different location but still the lip print was distinct showing individuality. Thus, further use of cheiloscopy should be done in solving family disputes, inheritance cases, posthumous child, etc.,

However there are few cons of cheiloscopy that doubt its uses as primary source of personal identification. It is not possible to detect the lip pattern in the pathological condition like chelitis, angular chelitis, cleft lip, scars or other deformity. Inflammation can change the lip print temporarily but the original pattern is retains after inflammation is reduced. Lip prints may vary on how was the position of lips whether the mouth was open or closed in open mouth the grooves are relatively ill defined and difficult to interpret. The

clarity may also depend on the pressure applied to the recording material, depending on the surface on which the print may be located etc. Where the lip prints can be lifted from body surface, clothes, inanimate object, or surroundings inanimate objects and can be matched to the victim or suspect and can lead to conviction

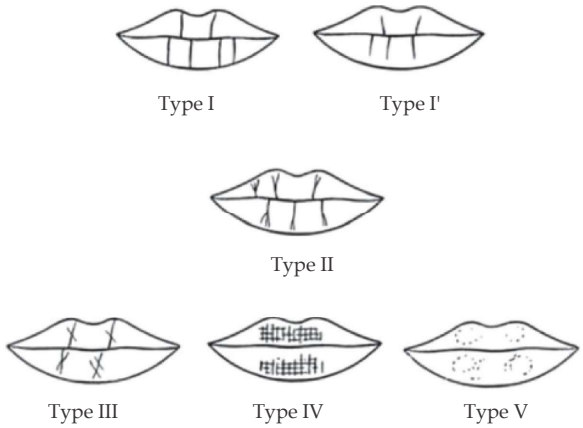


Fig. 4: Suzuki and Tsuchihashi classification of lip prints (pictorial representation)

Conclusion

Forensic sciences plays important role in criminal identification and crime solving. With the help of many ante mortem techniques like iris scan, fingerprinting, cheiloscopy is the most interesting and non-invasively cheap option.

On the basis of the data collected and analyzed in this study, the uniqueness of lip print in identification was proved. We could also find evidences of inheritance through the lip prints which can prove coordinating to family disputes cases. Also some studies show the use of cheiloscopy in gender determination. But the wide and enormous discussion of cheiloscopy must be extended by studying population of different states, races, geographical areas, families, twins. Also study must be conducted on the technique of taking lip prints to find universal technique used in practical purpose.

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Original Article

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Umbilical Cord Abnormalities in Fetal Autopsies: A Six Year Study

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Abstract

Introduction: The role of umbilical cord abnormalities has seldom received attention as a cause of intrauterine fetal demise (IUFD). Umbilical cord anomalies are of various types ranging from clinically inconsequential anomalies to those which can result in fetal demise. There can be numerical abnormalities or non-numerical abnormalities or both within the same cord. In this study, we attempted to focus on the abnormalities of the umbilical cord. *Aim of the study:* To study the various types of abnormalities in umbilical cords in fetal autopsy specimens.

Materials and Methods: This was a prospective study done in the department of Pathology at Kamineni Academy of Medical Sciences and Research Centre, Hyderabad, India, over a period of six years. A total of 83 fetal autopsy specimens were received and studied grossly and microscopically. Autopsies were performed as per standard protocol and included complete anthropometry, external examination, gross and microscopic evaluation of different organs and placenta. Both numerical and non-numerical abnormalities were recorded.

Observations and Results: There were total 83 fetal autopsy specimens with umbilical cords. Primigravida accounted for 53% cases. MTP accounted for 45.7% cases and 54.2% cases were intrauterine deaths. Numerical abnormality of umbilical cord vessels was seen in 16.8% cases and all had single or multiple developmental anomalies. There were 20.4% cases of cord having normal or abnormal number of vessels along with additional other abnormalities. There were 18% cases with numerically normal vessels but with other abnormalities. The commonest numerical abnormality was of two vessels; single umbilical artery and single vein. Hypercoiling of cord and stenosis of cord were the common non-numerical abnormalities.

Conclusion: Ultrasound examination is recommended in all antenatal cases and definite guidelines are required for reporting cord abnormalities on ultrasound. In cases of MTP and/or IUD, a complete autopsy study should be done to detect cord anomalies. Irrespective of pregnancy outcome, examination of all umbilical cords from the labour room or operation theater will be helpful in determining whether further evaluation of the neonates is required or not.

Key Words: Cord abnormalities; Cord accidents; Fetal autopsy; Ultrasound of umbilical cords.

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Introduction

The role of umbilical cord abnormalities has seldom received attention as a cause of intrauterine fetal demise (IUFD). There are many studies on fetal autopsies but literature on cord anomalies is sparse. This may be due to the fact that intact entire cords are rarely received in Pathology for examination. More than 80% of all abortions occur in the first trimester, and 53% of these are attributable to chromosomal

abnormalities.[1] The etiology of fetal loss in 45% of cases is unknown. Similarly, the exact cause of abortions in the early second trimester is often unknown.Umbilical cord anomalies are of various types ranging from clinically inconsequential anomalies to those that can result in fetal demise. Due to advances in prenatal ultrasound, many such anomalies can be detected in utero in present days. However, in low resource settings or in predominantly rural population where specialist services of a sonologist may not be available, or where population in general lacks awareness about antenatal care, such problems may go undetected. Cord anomalies can result in fetal loss and intrauterine deaths (IUD). Many such cases will go unnoticed due to resistance on the part of the couple for fetal autopsy due to various factors. If fetal autopsy is performed in all such cases, more information can be brought to light regarding the association between cord anomalies and fetal demise.

In the present paper we have attempted to study the prevalence of various cord anomalies in fetal autopsies in our local population. All the cord anomalies were noted only during fetal autopsy, and were not reported on antenatal ultrasound scan.

Aim of the Study

To study various types of abnormalities in umbilical cords in fetal autopsy specimens.

Materials and Methods

The present study was a prospective study carried out in the department of Pathology at Kamineni Academy of Medical Sciences and Research Centre, Hyderabad, India, over a period of six years from January 2013 to December 2018. A total of 83 fetal autopsies were done in this period. The clinical details were collected from the request forms which included demographics, obstetrics history, history of consanguinity, gestational age of fetus, nature of fetal death i.e., whether it was a medical termination of pregnancy (MTP), spontaneous abortion, missed abortion, intrauterine death or stillbirth. All the cases had prenatal ultrasound scan reports done at varying stages of gestation and these reports accompanied the pathology requests for fetal autopsy.

After fixation of the fetal specimen in 10% neutral buffered formalin, autopsy was carried out in the following order:

(a) external examination,
(b) anthropometric measurements
(c) presence of effusions
(d) in situ examination of organs
(e) en bloc dissection, and
(f) examination of individual organs.

Whether the location of the organs was normal or abnormal and whether they were of appropriate size for the gestational age was noted. The placenta, membranes and umbilical cord were examined in detail.

On gross examination the following points were looked for in the umbilical cord: the length of the cord, presence of true or false knots, the adequacy of Whartons jelly, presence of any strictures or stenosis, hypercoiling of the cord, evidence of funisitis, and type of insertion of cord into the placenta, number of vessels on cut surface of cord, presence of any cystic areas.

For microscopic examination, all the fetal organs were sampled. The cord was sampled as transverse bits at two different levels in all cases and additional tissue bits were taken from areas suspected of having some abnormality. The tissue bits were submitted for routine histopathological processing. The sections were cut at five micron thickness, stained with hematoxylin and eosin staining, and were examined under light microscope.

Results

In the present study there were 81 women, 83 fetal autopsies and 83 umbilical cords. Of the 81 cases, there were 2 cases of twin pregnancies, both having single placenta. Placenta was received in 58 (71.6%) cases only (58 of 81 pregnancies, as two twin gestation cases had single placenta).

Of the 81 cases, 27 (33.3%) cases were referral cases which came from outside peripheral smaller hospitals and 54 (66.6%) cases from our own hospital. Ours is a tertiary care centre with fully equipped department of Obstetrics and Gynecology and department of Radiodiagnosis. As fetal echocardiography and fetal Doppler studies are available with us, most of the cases detected as abnormal TIFFA scans in smaller hospitals are referred to us for second opinion and if any abnormality is detected the parents are given thorough counselling after which they decide on the option of medical termination of pregnancy (MTP).

Table 1: Parity of patients (*n* = 81)

Parity	No. of cases	Percentage (%)
Primipara	43	53.0
Gravida 2	25	30.8
Gravida 3	11	13.5
Gravida 4	01	1.2
Gravida 5	01	1.2

Spontaneous IUD versus MTP: Of the total 83 fetal autopsies, 38 (45.7%) were medical termination of pregnancies and 45 (54.2%) were intrauterine deaths, still births, spontaneous abortions or inevitable abortions.

Numerical abnormality of umbilical cord vessels was seen in 16.8% cases. There were 19 cases (20.4%) cases where the cord had normal or abnormal number of vessels and in addition also had some other abnormalities. There were 18% cases with numerically normal vessels but with other abnormalities.

The commonest numerical abnormality in cord vessels was of two vessels ie single umbilical artery and single vein. Hypercoiling of cord and stenosis of cord were the common non-numerical abnormalities.

Spontaneous IUD versus MTP in cases of cord abnormalities: Total cases with abnormal umbilical cords were 29. Some of the cords had more than one abnormality like numerical abnormality of cord vessels, with/without hypercoiling, stenosis or reduced quantity of Wharton's jelly. All the fetuses with cord abnormalities that had MTP had congenital malformations that were detected on ultrasound scan.

Table 2: Features of umbilical cord (*n* = 83)

Cord features	No. of cases	Percentage (%)
Normal vessels and normal cords	69	83.1
Numerical abnormality of vessels	14	16.8
*Numerically normal vessels but having other cord abnormalities	17	18.0
*Numerically abnormal vessels with other changes	02	2.4

*The above groups are not mutually exclusive

Table 3: Features of umbilical cord abnormalities* (*n* = 83)

Cord anomaly	No. of cases	Percentage (%)
Two vessels (single artery and single vein)	12	14.4
Two vessels (two arteries, no vein)	01	1.2
Four vessels (three arteries, one vein)	01	1.2
Twisting/Hypercoiling of cord	08	9.6
Stenosis of cord	05	6.0
True knots	01	1.2
False knots	01	1.2
Wharton's jelly cystic changes	01	1.2
Reduced Wharton's jelly	02	2.4
Velamentous insertion of cord	01	1.2

*The above groups are not mutually exclusive

All the 14 cases with vessel abnormalities had single or multiple developmental anomalies that were detected on prenatal ultrasound and were confirmed on autopsy. In all these cases, the vessel abnormalities were picked up on autopsy only and not on ultrasound.

Table 4: Autopsy findings of vessel abnormalities of cord and fetal anomalies (n = 14)

Vessel abnormality in cord	MTP/IUD	Fetal anomaly	No. of cases
One artery, one vein	MTP	Absent skull bones	1
One artery, one vein	IUD	Absent right middle finger	1
One artery, one vein	IUD	Multiple anomalies, Potter's sequence, Bilateral renal agenesis	1
One artery, one vein	MTP	Truncus arteriosus, VSD	1
One artery, one vein	MTP	Bilateral cystic kidneys, imperforate anus	1
One artery, one vein	IUD	Bilateral cystic kidneys, pericardial effusion	1
One artery, one vein	MTP	Fused kidneys, bilateral lower limbs absent, imperforate anus	1
One artery, one vein	MTP	Skull bones absent, defective anterior abdominal wall	1
One artery, one vein	MTP	Hydrops fetalis	1
One artery, one vein	MTP	SGA, Dilated brain ventricles	1
One artery, one vein	MTP	Multicystic kidney right side	1
One artery, one vein	MTP	Defective anterior abdominal wall, amniotic band syndrome	1
Two arteries, no vein	MTP	Atretic intestine, absent pancreas, imperforate anus	1
Three arteries, one vein	MTP	Bilateral polycystic kidneys, Hydrops, absent bladder	1
Total	MTP(11)/IUD(3)	–	14

MTP: medical termination of pregnancy, IUD: intrauterine death, SGA: small for gestational age, VSD: Venticular septal defect

Table 5: Other abnormalities in cord and fetal anomalies (n = 19)

Other cord anomalies	MTP/IUD	Fetal anomaly	No. of cases
True knots	IUD	SGA	1
False knots	IUD	Nil	1
Hypercoiling of cord	IUD	No anomalies	2
		IUGR	2
		Anomalies present	2
Hypercoiling of cord (with fetal anomalies)	MTP	Present	2
Cord stenosis	IUD	SGA	3
Cord stenosis (with fetal anomalies)	MTP	Present	2
Reduced Wharton's jelly	IUD	–	2
Cystic changes in Wharton's jelly	IUD	Absent distal gut and imperforate anus. Omphalomesenteric cyst	1
Velamentous insertion	IUD due to Antepartum hemorrhage	Nil	1
Total	MTP(4) / IUD(15)	–	19

Discussion

Detecting umbilical cord anomalies in first trimester is extremely difficult. However, second trimester scan can assess some of the characteristics of the umbilical cord like measurement of the cord area, number of vessels, placental site where the cord inserts, and coiling pattern.[2] The color Doppler examination can establish the umbilical blood flow patterns.

The length of the human umbilical cord varies from no cord (achordia) to 300 cm, with diameters up to 3 cm. Umbilical cords are helical in nature, with as many as 380 helices. An average umbilical

cord is 55 cm long, with a diameter of 1–2 cm and 11 helices.[3] 5% of cords are shorter than 35 cm, and another 5% are longer than 80 cm.[4]

Causes of differences in cord length are unknown. Shorter cords are more susceptible to abruptio placentae with antepartum hemorrhage, cord rupture and vaginal delivery is usually difficult.[5] On the other hand, extra long cords commonly cause fetal entanglement, true knots and thrombi.[3,6] Despite these associations, assessing cord length prenatally is not possible. Hyper or hypo-coiling of the cord detected on ultrasound is associated with an increased risk for preterm delivery, however the association is not strong enough to be clinically useful.[7, 8] Its important to note the cord length in cases of placental abruption, oligohydramnios, or breech presentation, as abnormal cord length suggests a long-term fetal condition. In our study, the total cord length could not be measured in all cases as in some cases the placenta with attached part of cord was not submitted for examination.

Numerical abnormalities of the cord vessels: In the present study, the prevalence of numerical abnormality of umbilical cord vessels was seen in 14 (16.8%) cases (Table 2).

Single umbilical artery: In our study, the most common abnormality seen was of single umbilical artery with single umbilical vein (14.4% cases).

Vesalius described the single umbilical artery for the first time in 1543.[9] The cord cross section shows only two vessels in such cases. Single umbilical artery syndrome is seen when the other umbilical artery undergoes atresia, aplasia or agenesis.[10] Single umbilical artery (SUA) is the most common abnormality of the umbilical cord. Among pregnancies with single umbilical artery associated with various malformations, twothirds of fetal deaths occur before birth. The remaining one third encounter postnatal death, fetal growth restriction and small sized placentae.[11] In absence of chromosomal or structural abnormalities in such fetuses, a single umbilical artery is defined as an 'isolated SUA (iSUA)'[12] and more than 90% of cases with SUA exhibit an isolated anomaly but without increased risk of chromosomal abnormalities.[13] Regarding adverse pregnancy outcomes and perinatal complications, studies show discordant results. A meta-analysis suggests that there is no significant association between iSUA and pregnancy outcomes.[14] Another study suggests that iSUA is associated with a significant increase in adverse perinatal outcomes.[15]

There are no specific fetal abnormalities associated with the single umbilical artery. However, the most common fetal anomalies associated with SUA are ventricular septal defects, renal anomalies, hydronephrosis, cleft lip, ventral wall defects, esophageal atresia, spina bifida, hydrocephaly, holoprosencephaly, diaphragmatic hernia, cystic hygromas, and polydactyly or syndactyly. Whenever concomitant anomalies are detected on ultrasound, fetal echocardiography and karyotype analysis are recommended. In our study, 5 out of 12 (41.6%) cases of single umbilical artery had renal system abnormalities on autopsy. (Table 4). Single umbilical artery occurs in less than 1% of cords in singletons and 5% of cords in at least one twin. Single umbilical artery also occurs more often in fetal demise than in live births,[16] and there appears to be an association between isolated single umbilical artery and an increased risk for small-for-gestational-age (SGA) infants and pregnancy-induced hypertension.[17] With single umbilical arteries, a 5–20% perinatal mortality rate has been reported,[18] although this includes fetuses with severe congenital anomalies and chromosomal defects. So it cannot be said with certainty how much exactly is the contribution of SUA in fetal deaths.

Not all single umbilical arteries lead to fetal demise and despite the SUA, a pregnancy can progress to full-term and have a healthy neonate with normal size and development. However, a complete detailed physical examination by a paediatrician is required to exclude any hidden anomalies. Ultrasound views of the heart can detect 66% of the heart malformations associated with single umbilical artery. The undiagnosed ones are minor and have a favorable outcome.[19] Hence, examination of the cut section of the umbilical cord should become a routine practice in the labour room itself.

In cases of non-isolated SUA, chromosomal microarray testing is recommended because the risk of syndromes and chromosomal anomalies is increased. Isolated SUA with a normal insertion of the cord does not require special precautions during labor. In these cases, the long-term outcome for children is the same as for children born with three vessels in the umbilical cord.[20] Also, 13% cases of single umbilical artery are associated with velamentous insertion.[16] In our study, we didn't find any velamentous insertion in cases with single umbilical artery.

Four-vessel umbilical cord: Four vesselsare seen in almost 5% of the cords and the extra vessel is usually

a persistent small vitelline artery.[21] Four vessels are frequently associated with major congenital anomalies. In our study also there was one case of four- vessels with three arteries and one vein which also had multiple other anomalies (Table 4).

Non-numerical abnormalities: In our study, there were 19 cases (20.4%) cases where the cord had normal or abnormal number of vessels and in addition also had some other abnormalities. There were 18% cases with numerically normal vessels that had other abnormalities which is quite a high percentage. None of these other abnormalities were reported on the ultrasound and were noted only during the autopsy examination. Hypercoiling of the cord, cord stenosis, reduced Wharton's jelly, cystic changes in Wharton's jelly, etc. (Table 5). Most of them were intrauterine deaths and the others were MTP due to presence of concomitant fetal anomalies.

Cysts are found in 0.4% of pregnancies.[22] Of cord cysts of any type, 20% are associated with structural or chromosomal anomalies. During fetal anatomy scans, the abdominal wall near the cord insertion is the most likely location to detect a cyst. Cysts can be visualized most easily with color Doppler studies during the first trimester, when the umbilical vessels are small.

Most often cysts in the cord are clinically insignificant and are remnants of the allantois or theomphalomesenteric duct. Such finding warrants further detailed sonographic evaluation and karyotype testing when IUGR or other anomalies are also found.[23] Most often first-trimester cysts are transient with normal pregnancy outcome. The prognosis of persistent cysts is similar to that of second-trimester cysts.

Umbilical cord cysts are classified as true cysts or pseudocysts. True cysts have an incidence of 3.4% in first trimester of pregnancy and have no clinical significance.[23] They are derived from the embryological remnants of either the allantois or the omphalomesenteric duct, are located typically toward the fetal insertion of the cord and range from 4 to 60 mm in size.[24] Increased hydrostatic pressure in the umbilical vessels is thought to give rise to such cysts. Morphologic features of cord cyst (single, multiple) correlate with fetal abnormalities of abdominal wall defects and patent urachus.

Pseudocysts are more common than true cysts and can be located anywhere along the cord; they are devoid of epithelial lining and represent localized edema and liquefaction of Wharton's jellyand are known as Wharton jelly cysts. Ultrasound cannot distinguish between true cysts and pseudocysts.[25] Anomalies can be seen in both type of cysts. Pseudocysts are more common than true cysts and they are strongly associated with chromosomal defects and other congenital anomalies, especially omphalocele, hydrops, and trisomy. Usually, ultrasonography monitoring is sufficient, invasive tests not being typically needed. A higher risk of fetal anomalies is associated with the following: detection of cysts in the second or third trimester, persistence after the first trimester, large size, and location near fetal or placental end. Also, trisomy 18, 13, and 21 are known to be associated, in such cases, chromosomal analysis may be warranted.[26] They might be associated with omphalocele, Meckel's diverticulum, patent urachus, and hydronephrosis. False cysts are most commonly found at the fetal end of the cord, do not have an epithelial lining and might be associated with omphalocele, patent urachus, and chromosomal anomalies. Twenty percent of cord cysts are associated with structural or chromosomal anomalies. When the umbilical cyst is detected antenatally, especially in second or third trimesters, it is recommended to have a detailed ultrasonographic examination of the fetus, and to look for any associated defects. In case of any suspicion, karyotyping study should be done.

Velamentous insertion: One percent of singletons have velamentous insertion. However, this condition occurs in almost 15% of monochorionic twins.[27] In our study, we observed one case (1.2%) of velamentous insertion that led to antepartum hemorrhage and IUD.

True and false knots: True knots and false knots can form in the umbilical cord. True knots occur in approximately 1% of pregnancies, with the highest rate occurring in monoamnionic twins. False knots are kinks in the umbilical cord vessels and are more common than true knots and have no known clinical significance. True knots arise from fetal movements and are more likely to develop during early pregnancy, when relatively more amniotic fluid is present and greater fetal movement occurs. True knots are also associated with advanced maternal age, multiparity, and long umbilical cords. In our study, there was one case each (1.2%) of true and false knots. True knots have been reported to lead to a 4-fold increase in fetal loss, presumably because of compression of the cord vessels when the knot tightens. Weiner et al.[5] noted that umbilical cord entanglements, true knots, and short cords were more common in emergent cesarean deliveries (ECDs) than in vaginal deliveries.

Cord Coiling: In our study, there were 8/83 (9.6%) cases of hypercoiling of cord. The normal cord shows 1 coil per 5 cm, and the coiling is established as early as 9 weeks of gestation. The generally accepted method of assessing the degree of the umbilical cord coiling is by calculation of the umbilical coiling index (UCI), defined as the number of complete coils per centimeter length of cord. The normal UCI is around 0.2 in the postpartum setting based on examination of the delivered placenta and umbilical cord (pUCI) and it is 0.4 on antenatal sonographic examination (aUCI). Hypercoiling may be associated with constriction and long cords. Frequently the hypercoiled cord becomes thin and whip-like, or sometimes the torsion is focal. Many studies have shown that hypercoiling can lead to adverse pregnancy outcome and/or fetal death.[28] Achirality is absence of the coiling of cord.

Cord stricture: Cord stricture is constriction or occlusion of the cord. This condition is found in 19% of fetal demises. Familial recurrence of umbilical cord strictures has been described.[29] Umbilical cord stricture is a recognized cause of fetal demise, but the exact etiology remains unknown. The risk of recurrence has generally been thought to be low. French et al[29] described demise of three of 4 fetuses of a single patient between 28 and 30 weeks of gestation. They recommended that patients with fetal demise attributed to umbilical cord stricture should be counseled and that the risk of recurrent cord stricture is undetermined. The etiology of umbilical cord stricture is unknown. There is a deficiency in Wharton jelly in the umbilical cord in the area of stricture, however this could be a postmorbid change.

This condition cannot be diagnosed prenatally. Most infants with cord stricture are stillborn.

Malformations among fetuses with single umbilical artery have been reported to be as high as 46%.[30] In a meta-analysis of 37 studies related to single umbilical artery, the mean association with structural anomalies was 27% in live-born, while in specimens obtained from early abortions, fetal deaths and autopsies it raised up to 66,3%.[16] The mechanism of death is postulated to be chronic ischemia superimposed by a catastrophic acute vascular event.[1]

Cord varix: Cord varix is a cystic dilatation that can occur in any portion of the umbilical vein. It is a rare entity and is of unknown etiology. Reports have documented poor fetal outcomes in the presence of varices and an association with fetal anomalies. Cord ulceration, cord hematoma, cord hemangioma, cord teratoma are other conditions. In our study, we did not observe any cord varix, cord ulceration or cord hematoma.

Usually there is a good correlation between prenatal ultrasound scanning and autopsy findings for congenital anomalies.[31] But same is not true for umbilical cord anomalies. In our study, none of the cysts or other cord abnormalities were reported antenatally. This could be due to difficulties encountered by the radiologist. Also, as antenatal cases have ultrasound examination carried out in different places with radiologists having variable degree of expertise, who may not be well-versed in reporting cord abnormalities. Especially where resources are low, antenatal ultrasound may not be done in the recommended period or it may not be done at all due to lack of access to health care.

Conclusion

Ultrasound examination is recommended in all antenatal cases, with definite guide lines for reporting cord abnormalities. Fetal autopsy and evaluation of placenta, membranes and cord are mandatory, and must be accompanied by cytogenetic studies, if required. Also, when documented on large scale, a database for cord abnormalities and associated fetal anomalies can be created for further scientific studies and research.

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Original Article

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Estimation of Stature from the Length of Cranial Sutures By Regression Analysis: A Cadaveric Study in South India

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Abstract

Introduction: Skull is more represented and reported to forensic experts for the identification of a person. Stature is an important biological profile to help to confirm the absolute identification of a person. The judicial authority still consider stature estimation to confirm the identity. Even though many studies are available from the long bones, the challenge arises when long bones are not available and the formulae derived from these were limited applicable to fragmentary skeletal remain. Hence, we have undertaken the study, for the estimation of stature from the length of cranial sutures.

Methodology: The study conducted at the tertiary health care institute in South India. This is a prospective observational study and includes 210 cases out of 229 autopsy cases conducted from December 2016 to December 2018. Out of 210 cases males were 160 (76.19%) and females were 50 (23.81%).

Result: The age of cases was ranging from 21 years to 60 years and their mean stature was 162.953 cm. The correlation coefficient (Pearson's correlation, *R*) of total samples for coronal suture length (CSL) and sagittal suture length (SSL) were 0.326 and 0.308 respectively with the stature of deceased (STAD). The results showed, the cranial sutures are weakly correlated with stature in males and the linear regression equation could not be derived for males. The coronal suture showed the moderate correlation with stature in females (R = 0.300) and the regression equation derived. The coronal and sagittal sutures showed a moderate correlation with stature in total samples and regression equations derived.

Conclusion: The formulae derived are limited to the South Indian population and applicable only when the sex is not identifiable or other long bones are not available. This study was helpful when the skull, head, and vault with cranial suture were available as a fragmentary bone.

Keywords: Coronal suture; Cranial suture; Linear regression; Sagittal suture; Stature.

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Introduction

Skull is one of the most indestructible and noticeable humans remain to persist during the processes of postmortem taphonomic. The skull can be recovered and reported to the forensic expert for the identity of the deceased. But still, there is difficulty in collecting the information from human remains for identification process due to certain reason like decomposition, mutilation and missing of certain parts of bones.[1–4] Age sex, race, and stature are the important biological profile that can be estimated from the skull.[5]

Stature is one of the foremost presumptive findings of identification that leads to other methods to confirm identity.[6] Few studies reported the stature from cranial measurements.[7,8] Krogman and Iscan performed the radiological study in a view of identification of mass disaster victims by observing the cranial capacity, sinus pattern, and shape of sphenoid including sella turcica.[9] Patil and Mody derived a formula for stature from the various skull measurements. They observed the various lengths of a skull by using a radiograph through a lateral cephalometric view. The authors concluded that measurements of a skull were a good reliable indicator for the estimation of stature.[10]

Kalia et al. had done the study by using a lateral cephalometric view of radiographs for estimating the stature from the mesiodistal crown width of the six maxillary anterior teeth. The author concluded that the study was more helpful for estimating the stature.[11] Introna et al. performed a study of estimation of stature from maximum anterior-posterior and lateral diameter of the skull in age between 17 and 27 years old male.[12] Even though many methods to confirm identity like facial reconstruction, superimposition techniques.[13]

The estimation of stature from cranial sutures is quick and easy at the scene of the crime; as compared with other methods.[14] Such studies are very rarely reported in the literature. Skull or head is recovered without the body. Stature estimation is important for identification. This study is helpful for the estimation of stature from cranial suture length. The main objective of the study was to estimate stature from cranial suture length and their correlation. We had derived the linear regression formula, particularly from the South Indian population.

Materials and Methods

The present study conducted at the tertiary health care institute, in South India. This is a prospective, observational study conducted at the mortuary of our institute during the period from December 2016 to December 2018. Ethical clearance has been taken from the Institutional Ethics Committee (JIP/IEC/2016/1035) before the onset of the study. The study sample includes a total of 210 medicolegal autopsy cases, out of 229 cases. Nineteen cases excluded due to the presence of diastatic fractures and craniotomy. Among these 160 males and 50 females of South Indian origin, aged between 21 to 60 years.

Consent obtained from the legally accepted representative of the deceased in their own language. Cadaver is kept in supine with knee and hip joints extended, and neck and feet in a neutral position. The body length of the cadaver is measured from the vertex to heel with a measuring tape to the nearest 0.1 cm in the supine position. The scalp incised in full-thickness by placing a bi-mastoid incision using a Bard-Parkers knife. The anterior flap reflected till 2 cm above supraorbital ridges, and the posterior flap reflected up tothe external occipital protuberance. The temporalis muscle on both sides is excised out. The length of coronal suture is measured with a measuring tape from left pterion to right pterion. The length of sagittal suture is measured from Bregma to the lambda with a measuring tape. All lengths measured in centimeters to the nearest 0.1 cm. Measurements noted in anonymous data collection proforma by one author to minimize the error. The data computed using the Statistical Package for Social Sciences version 19.0. The correlation between stature and the length of the coronal and sagittal suture carried out by using Pearson's correlation analysis and its significance tested by Pearson's chi-squared test (χ^2). The linear regression equation derived for the estimation of stature from the length of the coronal and sagittal suture.

Results

The total of 210 cases were analyzed of that 160 (76.19%) were males and 50 (23.81%) were females. The results of statistical descriptive for all cases were given in (Table 1) as per age-wise, the stature of deceased (STAD), coronal suture length (CSL), and sagittal suture length (SSL).

Table 1: The Statistical descriptive results for all cases

Variables	Minimum	Maximum	Mean	Std. Deviation
Age (years)	21.0	60.0	39.48	13.175
STAD (cm)	140.8	190.2	162.953	8.2997
CSL (cm)	20.1	28.6	23.713	1.5572
SSL (cm)	9.2	16.8	12.027	1.2748

A significant and positive correlation noted between STAD and CSL in females ($p < 0.05$) (Fig. 1). CSL showed less correlation with stature in males. The SSL showed less correlation with stature in both sexes. A significant and moderate positive correlation noted between STAD and CSL, SSL in total samples ($p < 0.05$) (Table 2, Fig. 2 & Fig. 3).

Table 2: Correlation of cranial sutures with STAD

Variables	Males		Females		Total samples	
	R-value	*p*-value	*R*-value	*p*-value	*R*-value	*p*-value
CSL	0.244	<0.05	0.300	<.005	0.326	<0.05
SSL	0.243	<0.05	0.244	<0.05	0.308	<0.05

R is correlation coefficient (Pearson Correlation)

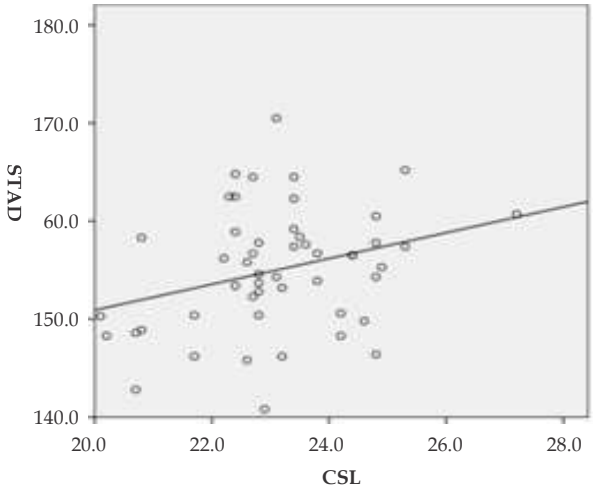

Fig. 1: The relationship between STAD and CSL in females.

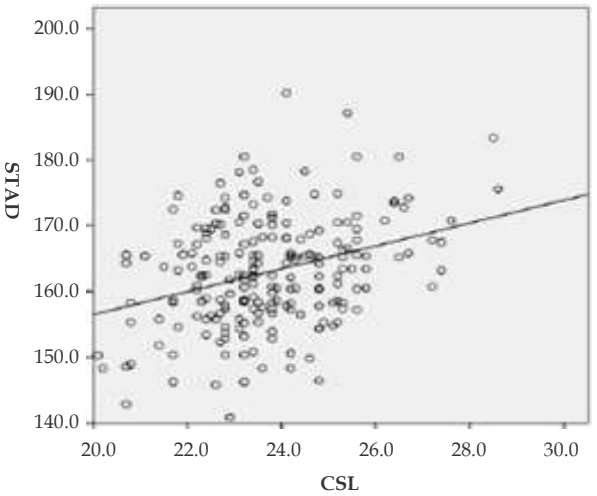

Fig. 2: The relationship between STAD and CSL in total samples.

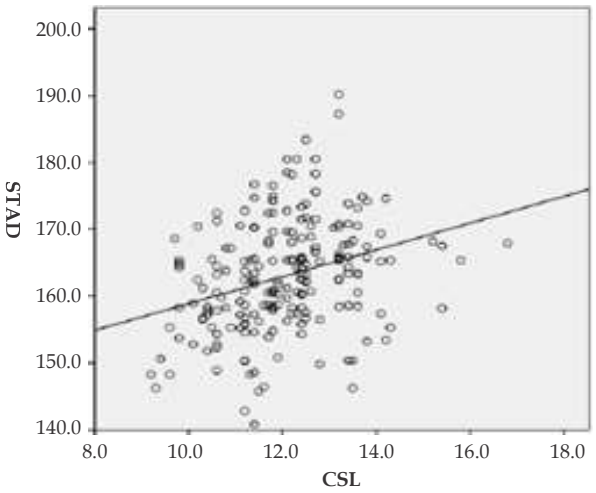

Fig. 3: The relationship between STAD and SSL in total samples.

The linear regression equations derived from CSL for the estimation of stature in Females. The linear regression equations from CSL and SSL in total samples are given in (Table 3). The linear regression equations from CSL and SSL for estimation of stature in males could not be derived due to the results were not statistically significant. The linear regression equations from SSL for estimation of stature in females could not be derived due to the results were not statistically significant.

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

Sample and variable	Linear Regression Equation	SE	R^2
Female			
X_1: CSL	$S = 124.614 + 1.315(X_1)$	6.0271	0.09
Total samples			
X_2: CSL	$S = 121.719 + 1.739\ (X_{2)}$	8.302	0.106
X_3: SSL	$S = 138.805 + 2.008\ (X_3)$	5.194	0.095

Linear regression equation ($S = \alpha + \beta X$)

"S" is stature, "α" is constant according to variables,

"β" is regression coefficient of variables, "X" is variables.

SE-standard error,

R^2- coefficient of determination.

The linear regression equations measured in centimeter

Discussion

Skeletal remains are more often reported to a forensic expert to find the identification of the person.[15] In cases of identification, stature usually estimated by using the regression equation from a length of bones. The main drawback of this method is very difficult and limited applicability to fragmentary skeletal remains.[16] The forensic expert also faces a challenge when long bones are not available and stature estimation from other than long bones should be considered. Amongst the skeletal remain, the skull is most commonly noticeable and reported for personal identity.[17] The judicial authority needs to confirm the identity of a person, they are still considered stature estimation even though the more specific method is available for personal identification. Hence, we undertaken the study, for the estimation of stature from the length of cranial sutures.

In the present study, there is more correlation coefficient between the stature and coronal sutures in females than males. In females, there is significant and more correlation coefficient between the stature and coronal suture length than sagittal suture length. In the present study, there is less correlation coefficient with STAD and cranial sutures in males. Rao et al. studied that, there is more correlation coefficient between the stature and coronal suture length in South Indian male population.[7] The analysis of total samples in our study showed that there is a positive and significant correlation coefficient between the STAD with CSL and SSL. Kolencherry et al. revealed that there is less correlation coefficient of stature with coronal suture (R = 0.015) and sagittal suture (R = 0.045) in the Central European population.[8]

Rao et al. study, derived the linear regression equation for stature estimation from the length of coronal suture in South Indian male population.[7]In this study, the linear regression equation for stature estimation from the length of cranial sutures could not be derived due to less correlation coefficient with stature in males. In females, the linear regression equation derived for stature estimation from the length of the coronal suture. But the linear regression equation could not be derived from the length of sagittal suture due to less correlation coefficient with stature in the female. On analysis of total samples, the linear regression equation derived for stature estimation from the length of the coronal suture and sagittal suture.

Conclusion

The present study showed a moderate correlation coefficient with stature and cranial sutures in total samples and high standard errors for stature estimation as compared to previous studies. The formulae derived are limited to the South Indian population and applicable only when the sex is not identifiable or other long bones are not available. This study is helpful when the skull, head, and vault are available with cranial suture as a fragmentary bone. In the males we cannot derive regression formula due to fewer samples. In future similar studies should be carried out on larger samples in other groups of the population to confirm these findings.

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Original Article

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Changing Trends of Poisoning at Salem, Tamilnadu: A Retrospective Study

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Abstract

Knowledge of profile of poisoning of a particular area and of particular time period is very important as it will help the health providers and policy-makers to plan & equip accordingly. Demographic profile of the patients and type of poisons consumed depends upon the availability of substances locally, their socioeconomic and cultural backgrounds. The present study was conducted at Annapoorna Medical College and Hospital, Salem, Tamilnadu in the year 2019. Data regarding age, sex, religion, occupation, locality (urban/rural), marital status & type of poison was collected in Pre-structured Proforma from two 3 yrs periods, 2007–2009 and 2016–2018. The variables from the two periods were compared to find out whether there were any changes. In the present study, the sex ratio, F:M changed from 1:1.6 to 1:1, there was increase in number of female cases in the later phase. With respect to age, there was almost doubling in number of cases in the age group of 11–20 yrs, from 26 cases (17.3%) to 54 cases (31.8%). Poisoning due to insecticides had decreased significantly in the later phase, from 99 cases (66.7%) to 43 cases (25.3%), whereas, there was increase in poisoning due to herbicides from 9 cases (6%) to 37 cases (21.8%), poisoning due to rat killers increased from 17 cases (11.33%) to 42 cases (24%) and household poisons from 3 cases (2%) to 13 cases (7.6%).

Keywords: Acute poisoning; Trends; Poisoning agents; Salem.

Introduction

Poisoning is one of the common medical emergencies encountered in our practice. It is the 4th most common cause of mortality in India.[1] Knowledge of profile of poisoning of a particular area and of particular time period is very important as it will help the health providers and policy-makers to plan & equip accordingly. Demographic profile of the patients and the type of poisons consumed depends upon the availability of substances locally, their socioeconomic and cultural backgrounds.

In developing countries, poisoning with Pesticides was found to be the most common and in urban areas drugs such as benzodiazepines and antipsychotics were being used.[2] India being an agricultural country, most common poisons consumed are insecticides.[3–6] In developed countries, it has been observed that poisoning deaths are mainly due to cleansing agents, detergents, paracetamol, carbon monoxide and other cosmetic products.[7]

In the present study, we want to study and analyze whether there are any changes in the demographic profile & type of poisoning due to urbanization, rapid industrialization, increased literacy, changing lifestyle, introduction of newer range of pesticides and drugs, etc.

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Materials and Methods

The present study was conducted at Annapoorna Medical College and Hospital, Salem, Tamilnadu in the year 2019. Data was collected from the hospital records of acute poisoning cases admitted to rural tertiary care centres at Salem, Tamilnadu Nadu and analysed with respect to age, sex, religion, occupation, locality (urban/rural), marital status & type of poison. The patients included in this study were those who were exposed to agricultural poisons, household poisons, plant poisons, drugs, bites and other miscellaneous poisons. Data regarding age, sex, religion, occupation, locality (urban/rural), marital status & type of poison was collected in Pre-structured Proforma from two 3 yrs periods, 2007–2009 and 2016–2018. The variables from the two periods were compared to find out whether there were any changes. Data was entered in Microsoft Excel and analysed. Descriptive statistics and frequencies were used for data presentation.

Results

In the present study which was done in two 3 yrs periods each, during 2007–2009 and 2016–2018 with an interval of 6 yrs, the total number of cases studied were 150 cases and 170 cases respectively. There was slight increase in the number of cases in the later phase. The sex ratio, F:M changed from 1:1.6 to 1:1; there was increase in number of female cases in the later phase (Table 1).

Table 1: Sex wise distribution of cases

Sex	2007–2009		2016–2018	
	No of cases	Percentage	No of cases	Percentage
F	58	38.7	84	49.4
M	92	61.3	86	50.6
Total	150	100.0	170	100.0

With respect to age, in the age group of 11–20 yrs, there was almost doubling in number of cases, from 26 cases (17.3%) to 54 cases (31.8%) (Table 2). The number of cases with respect to marital status remained the same in both the phases. With respect to locality, Urban to Rural ratio was 1:9.7 to 1:7.9; there was slight increase in the urban cases in the later phase.

Table 2: Age wise distribution of cases

Age in years	2007–2009		2016–2018	
	No of cases	Percentage	No of cases	Percentage
0–10	0	0.0	4	2.4
11–20	26	17.3	54	31.8
21–30	78	52.0	60	35.3
31–40	19	12.7	32	18.8
41–50	13	8.7	11	6.5
51+	14	9.3	9	5.3
Total	150	100.0	170	100.0

In the earlier phase, maximum number of cases were among Housewives were 42 cases (28%) and labourers 39 cases (26%). In the later phase other than farmer and housewives, there was increased incidence of poisoning among students, almost doubling, from 25 cases (16.7%) to 54 cases (31.8%) (Table 3)

Table 3: Distribution of cases according to occupation

Occupation	2007–2009		2016–2018	
	No of cases	Percentage	No of cases	Percentage
Business	9	6.0	5	2.9
Toddler	0	0.0	1	0.6

Occupation	2007–2009		2016–2018	
	No of cases	Percentage	No of cases	Percentage
Driver	13	8.7	1	0.6
Farmer	20	13.3	33	19.4
Housewife	42	28.0	56	32.9
Labourer	39	26.0	18	10.6
Retired	0	0.0	1	0.6
Student	25	16.7	54	31.8
Unemployed	2	1.3	1	0.6
Total	150	100.0	170	100.0

With respect to religion, maximum numbers of cases were Hindus in both the phases. Poisoning due to insecticides (organo-phosphorus compounds, organochlorines, carbamates, aluminium phosphide, ant powder, cowdung powder, imidacloprid, pyrethroids) had decreased significantly in the later phase, from 99 cases (66.7%) to 43 cases (25.3%), whereas there was increase in poisoning due to Herbicides (paraquat, cypermethrine, sodium acifluorfer), rat killers (3% yellow phosphorus, zinc phosphide), Household cleaning agents (phenol, Lysol, savlon) and drugs (alprazolam, clonazepam, metformin, paracetamol, antihypertensives, anticonvulsants and Thyroxine) (Table 4).

Table 4: Distribution of cases based on type of poisoning

Type of Poison	2007–2009		2016–2018	
	No of cases	Percentage	No of cases	Percentage
Insecticide	99	66	43	25.3
Herbicide	9	6	37	21.8
Cleaning agents	3	2	13	7.6
Rat killer	17	11.33	42	24.7
Plant poison	15	10	16	9.4
Drugs	6	4	10	5.9
Bites	1	0.7	04	2.4
Sulphuric Acid	0	0	01	0.6
Hair dye	0	0	02	1.2
Potash alum	0	0	01	0.6
Unknown	0	0	02	1.9
Total	150	100	170	100.0

Discussion

In the present study, there is slight increase in the number of female cases in the later phase, F:M ratio changed from 1:1.6 to 1:1, ratio is almost equal in recent times. Similar findings were observed in other studies.[8] This could be because of increase in the number of working women which leads to work and family stress, domestic violence, financial problems, etc. But in most of the studies males outnumbered females.[9] With respect to age, maximum number of cases is seen in the age group of 21-30 yrs in both the phases, the most active and productive phase of life. Similar findings were observed in other studies also.[9–11] But we noticed, slight decrease in the number of cases in the later phase, from 78 cases (52%) to 60 cases (35.3%) in this age group. But, there was doubling in the number of cases in the age group of 11–20 yrs, i.e., in adolescents, from 26 cases (17.3%) to 54 cases (31.8%). The reason for this increase was found to be failure in exams, failure in love affairs, impulsive behaviour, immaturity, difficulty in coping up with the competitive life style, etc. In the later phase paediatric cases in the age group of 0–10 yrs, 4 cases (2.4%) were also seen, among them three were accidental and one was homicidal. The number of

cases with respect to marital status remained the same in both the phases. With respect to locality, Urban to Rural ratio, there was slight increase in the urban cases, from 1:9.7 to 1:7.9 in the later phase. Despite India's predominantly rural character, urban preponderance of deaths by poisoning may reflect the role of more stressful life in urban areas. This is mainly due to rapid industrialization, work stress, modern life style, social stress etc.

In the earlier phase, maximum number of cases were among Housewives 42 cases (28%) and labourers 39 cases (26%). In the later phase other than farmer and housewives, there was increased incidence of poisoning among students, from 25 cases (16.7%) to 54 cases (31.8%). So the increasing number of self poisoning among student population seems to be one of the serious global health problems which needs attention, understanding and timely intervention to the problems which students are going through, by the parents, teachers and the law makers is the need of the hour.

With respect to religion maximum number of cases belonged to Hindus, as most of the population here are Hindus. Similar results were seen in other studies also.[9]

Trends of poisoning in a particular region depend mainly on availability of type of poisons. In the present study, poisoning due to insecticides has decreased significantly in the later phase, from 99 cases (66.7%) to 43 cases (25.3%), whereas there is increase in poisoning due to herbicides from 9 cases (6%) to 37 cases (21.8%). Self poisoning due to rat killers is commonly seen in North India.[12–14] But, in the present study we observed increase in the number of poisoning due to rat killers from 17 cases (11.33%) to 42 cases (24%). Household cleaning agents increased from 3 cases (2%) to 13 cases (7.6%) and also increased in usage of drugs for self poisoning. In addition to this, cases of poisoning with sulphuric acid, hair dye and potash alum was also seen in the later phases. There was not much change in the incidence of cases due to plant poisons. This change in the trends of poisoning, is due to increase in the number of urban cases, increased awareness of more toxic poisons through internet, media etc.

Conclusion

In the present study, we observed significant changes in the trends of poisoning at Salem, Tamilnadu. In the recent time, there is increase in the self poisoning by females, student population and in urban areas. Acute self poisoning using pesticides have decreased over the time and there is increase in poisoning by herbicides, rat killers, drugs and cleaning agents. Miscellaneous poisons like Sulphuric acid, Potash alum and hair dye was seen in the recent time.

Reducing the morbidity and mortality due to self poisoning, requires identifying the target groups and timely intervention by the family members, friends and the society. There is need to create awareness regarding the hazards of these toxic substances, highlighting the safe practices of proper labelling, preservation and sale. Setting up of helpline and counselling centres in educational institutions, working place, hospitals, etc., might help to reduce cases of self poisoning.

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Pivotal Role of Fine Needle Aspiration Cytology in the Diagnosis of Head and Neck Lesions: Our Hospital Experience

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Abstract

Background: Head and neck swellings are the commonest clinical findings affecting all the age groups. FNAC is of great value in early diagnosis and differentiation of wide plethora of infective, benign and malignant lesions, in head and neck region. Prior cytodiagnosis by FNAC helps in delineating the heterogenous lesions occurring in head and neck region which serves as an aid in the evaluation and planning of necessary management.

Objectives of the study: To study the cytomorphological features and classify various head & neck lesions. To evaluate the role of FNAC in head and neck lesions. To study diagnostic accuracy of FNAC by histopathological correlation wherever available.

Materials and Methods: A prospective study was conducted from January 2016 to December 2018. FNA was performed on 1568 cases of head and neck lesions and cytomorphological features were studied. These cytomorphological features were correlated with concomitted histopathologic diagnosis, wherever available. Data analysis was done by Statistical Package for the Social Sciences software version 22.0 and presented in terms of proportions or percentage. Chi-square test was used to see the association between the different variables. A p-value of < 0.05 was considered as significant.

Results: There were 1568 FNAC cases enrolled, out of which lymph node lesions (n = 703) were the most commonest lesions followed by thyroid gland, miscellaneous group and salivary gland. Reactive hyperplasia of lymph nodes, nodular goiter, epidermal cyst and pleomorphic adenoma were the predominant diagnoses of lymphnodes, thyroid gland, miscellaneous group and salivary gland respectively. Histopathological correlation was available in 348 cases and showed sensitivity of 80.76%, specificity of 100%, positive predictive value of 100% and negative predictive value of 98.4%. The diagnostic accuracy of FNAC was 98.55%. The association between FNAC diagnoses and histopathological diagnoses were considered to be statistically significant.

Conclusion: FNAC is a valuable preliminary diagnostic tool for assessing head and neck lesions and serves as a guide for diagnosis, therapeutic and better management of various cases.

Keywords: Fine needle aspiration cytology; Histopathology; Lymph node; Thyroid; Salivary gland.

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Introduction

Head and neck swellings are the commonest clinical findings affecting all the age groups.[1] These swellings are extremely worrying for both physician and patient, due to myriad of pathological conditions.[1,2] Fine needle aspiration cytology (FNAC) is a simple outpatient procedure which is easy, accurate, reliable, repeatable and minimally invasive. FNAC

is of great value in early diagnosis and differentiation of wide plethora of infective, benign and malignant lesions in head and neck region. The most common sites which are encountered for FNAC in head and neck region are lesions from lymphnodes, thyroid gland, salivary gland, skin and soft tissue. Other lesions include congenital developmental cysts, carotid body tumors and skin adnexal tumors. Prior cytodiagnosis by FNAC helps in delineating the heterogenous lesions occurring in head and neck region which serves as an aid in the evaluation and planning of necessary management.[1–5] Consecutively in many non-neoplastic and cystic lesions, FNAC serves as both diagnostic and therapeutic tool. Hence the present study was undertaken to evaluate the role of FNAC in diagnosing various head and neck region swellings, to review the diversity of lesions in the patients attending our hospital and to correlate cytodiagnosis with histopathology.

Objectives of the study:

1. To study the cytomorphological features and classify various head & neck lesions.
2. To evaluate the role of FNAC in head and neck lesions.
3. To study diagnostic accuracy of FNAC by histopathological correlation wherever available.

Materials and Methods

This present prospective study was conducted in the department of pathology, Belgaum Institute of Medical Science, Belagavi from January 2016 to December 2018. All the patients with head and neck swellings irrespective of age and sex were included in the study. The study was started after getting the approval from ethical committee of the institution and also with the consent of the patients. In all the patients with head and neck lesions, clinical history, physical findings, imaging findings and probable clinical diagnoses were noted. FNA was performed by a pathologist by conventional palpation method using a 22 gauge needle or by image guided (ultrasonography or computerized tomography) for deep seated lesions. Direct smears were prepared, two of them were air dried and stained with Giemsa stain and other two slides were fixed in alcohol and stained with Papanicolaou stain. Also Ziehl Neelson staining for demonstration of acid fast bacilli was carried out. Cytomorphological features of various head and neck lesions were studied. Subsequent surgical specimens received were fixed in 10% formalin and subjected to gross examination, processing, paraffin embedding, cutting and stained by hematoxylin and eosin. The cytomorphological features were correlated with concomitted histopathologic diagnoses, wherever available.

Statistical analysis

Statistical analysis was done using Statistical Package for the Social Sciences software version 22.0 (SPSS Inc, Chicago) and data was presented in terms of proportions or percentage. Chi-square test was used to see the association between the different variables. A p-value of < 0.05 was considered as significant.

Results

The present study included 1568 cases of head and neck lesions. Age of the patients ranged from 1.5 months to 88 years, in which 51.3% were males and 48.6% were females. Third and fourth decade accounting to 40% were the frequently affected age group followed by second and fifth decade (Table 1).

Table 1: Age wise distribution of head and neck lesions

Age group	Number	Percentage
<10	179	11.4
11–20	241	15.3
21–30	335	21.3
31–40	289	18.4
41–50	221	14.1
51–60	152	9.6
>61	152	9.6
Total	1568	100.0

The commonest head and neck lesions in the present study were from lymphnodes accounting to 703 (44.83%) of cases followed by thyroid gland 395 (25.19%), miscellaneous group 357 (22.76%) and salivary gland lesions 54 (3.4%) of cases (Table 2 & Fig 1 & 2).

Table 2: Site wise distribution of head and neck lesions

Site	Number	Percentage
Lymphnodes	703	44.83
Thyroid gland	395	25.19
Salivary gland	54	3.4
Miscellaneous	357	22.76
Inadequate	59	3.76
Total	1568	100

Fig. 1A: Clinical photograph of post auricular swelling-Tubercular lymphadenopathy, **1B:** Enlarged thyroid gland- Multinodular goitre, **1C:** Central midline swelling-Thyroglossal cyst, **1D:** Bilateral supraclavicular swellings-Metastatic deposits of germ cell tumor from testicular origin

Fig 2A: Clinical photograph of Right cervical swelling- Benign spindle cell lesion- Schwannoma, **2B:** Scalp swelling- Benign skin adnexal tumor, **2C:** Bilateral parotid gland swelling- Sialadenosis, **2D:** Left parotid gland swelling- Pleomorphic adenoma.

In 59 cases (3.7%) out of 1568 cases, the aspirates were unsatisfactory and in all of them definitive diagnosis could not be given. Eleven cases from thyroid gland needed ultrasound guided FNAC.

The largest category of head and neck lesions were from lymphnodes. The highest number of cases were of reactive hyperplasia 17.7% (278 cases) followed by tubercular lesions 13.7% (215 cases). Malignant lesions included 0.8% (13 cases) of Non-Hodgkin lymphoma (NHL) and 0.12% (2 cases) of Hodgkin lymphoma (HL). Metastatic deposits of squamous cell carcinoma was commonest followed by adenocarcinoma and poorly differentiated carcinoma. One case each of papillary carcinoma thyroid gland and germ cell tumor of testicular origin were reported (Table 3 & Fig. 3).

Table 3: Distribution of various head and neck lesions according to cytological diagnosis

	Cytological diagnosis	Number	Percentage
Lymphnode			
Inflammatory/Benign	Reactive lymphadenitis	278	17.7
	Tubercular lymphadenitis	215	13.7
	Suppurative lymphadenitis	72	4.6
	Granulomatous lymphadenitis	24	1.5
	Rosai dorfman disease	1	0.06
Malignant	Non-Hodgkin's lymphoma	13	0.8
	Hodgkin's lymphoma	2	0.12
Metastatic deposits	Squamous cell carcinoma	87	5.5
	Adenocarcinoma	5	0.3
	Poorly differentiated carcinoma	4	0.2
	Germ cell tumor-Testis	1	0.06
	Papillary carcinoma thyroid	1	0.06
Thyroid gland			
Inflammatory/Benign	Nodular goitre	185	11.8
	Hashimotos thyroiditis	96	6.1
	Colloid goitre	57	3.6
	Adenomatoid goitre	16	1.02
	Toxic goitre	12	0.76
	Thyroglossal cyst	11	0.5
	Follicular neoplasm	8	0.19
	Granulomatous thyroiditis	3	0.12
	Graves disease	2	0.12
	Ectopic thyroid	2	0.7
Malignant	Papillary carcinoma	7	0.45
	Medullary carcinoma	1	0.06
	Anaplastic carcinoma	3	0.19
Salivary gland			
Inflammatory/Benign	Sialadenitis	21	1.34
	Sialadenosis	6	0.38
	Parotid cyst	1	0.06
	Pleomorphic adenoma	22	1.4
Malignant	Mucoepidermoid carcinoma	4	0.25
Miscellaneous			
Inflammatory/Benign	Epidermal cyst	187	11.92
	Lipoma	80	5.1
	Benign cystic lesion	25	1.6
	Branchial cyst	5	0.32
	Lymphoepithelial cyst	4	0.25
	Cystic hygroma	3	0.19
	Hemangioma	15	0.96
	Skin adnexal tumor	11	0.7
	Schwannoma	9	0.57
	Benign spindle cell tumor	5	0.31
	Paraganglioma	2	0.12
	Calcinosis cutis	1	0.06
Malignant	Basal cell carcinoma	1	0.06
	Malignant melanoma	1	0.06
Inadequate		59	3.76
Total		1568	100

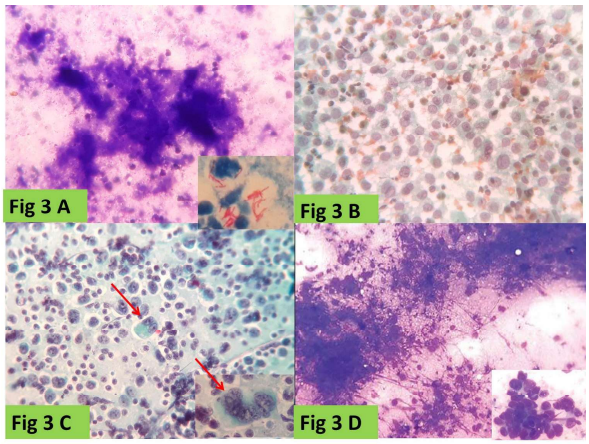

Fig 3A: Microphotograph from FNAC of cervical lymphnode showing caseous necrosis (Giemsa stain 40x). Inset showing Ziehl Neelson stain –Acid fast bacilli (100x)- Tubercular lymphadenitis. **3B:** Cervical lymphnode showing monotonous population of lymphoid cells- Non Hodgkin's lymphoma (Papanicolaou stain 40x). **3C:** Cervical lymphnode showing monotonous population of lymphoid cells and various types of Reed Sternberg cells- Hodgkin's lymphoma (Papanicolaou stain 40x). **3D:** Bilateral supraclavicular swellings showing poorly cohesive pleomorphic cells scattered singly, lymphocytes and tigroid background- Metastatic deposits of germ cell tumor from testicular origin (Giemsa stain 40x).

Thyroid gland lesions composed of 395 cases, second largest group in head and neck lesions. Nodular goitre was the highest number of cases accounting to 11.8% (185 cases) followed by other lesions. Among the malignant lesions papillary carcinomas were the commonest accounting to 0.45% (7 cases) followed by anaplastic and medullary carcinoma (Table 3 & Fig 4).

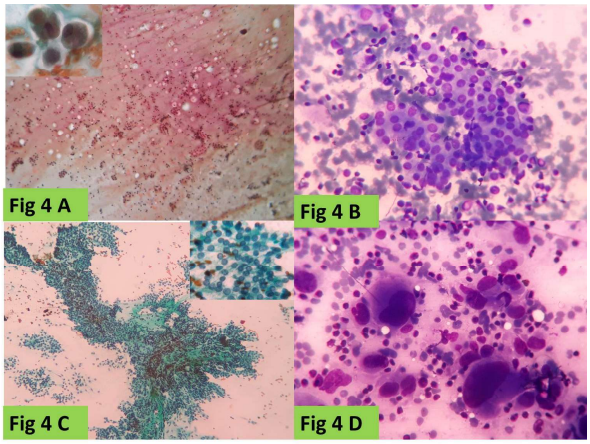

Fig 4A: Microphotograph from FNAC of thyroid gland showing thyroid follicular cells and thin colloid. (Papanicolaou stain 40x). Inset showing cyst macrophages- Colloid goitre (Papanicolaou stain 40x). **4B:** Sheets and clusters thyroid follicular cells with lymphocytes infiltrating.- Suggestive of Hashimotos thyroiditis (Giemsa stain 40x). **4C:** Papillary fragment of thyroid follicular cells. (Papanicolaou stain 40x)Inset showing cells with nuclear grooves and inclusions - Papillary carcinoma (Papanicolaou stain 100x). **4D:** Large malignant cells of varying sizes - Anaplastic carcinoma (Papanicolaou stain 40x).

The miscellaneous category which included the lesions arising from blood vessels, skin, soft tissue, cysts, neural lesions, congenital lesions and others. In the present study, these were the third largest category in head and neck lesions. The commonest lesions in them were epidermal cysts accounting to 11.92% (187 cases) and 5.1% (80 cases) of lipoma cases (Table 3).

Salivary gland lesions composed of 54(3.4%) cases. Among which pleomorphic adenomas were the majority accounting to 1.4% (22 cases). The malignant lesions were mucoepidermoid carcinoma accounting to 0.25% (4 cases) (Table 3 & Fig. 5).

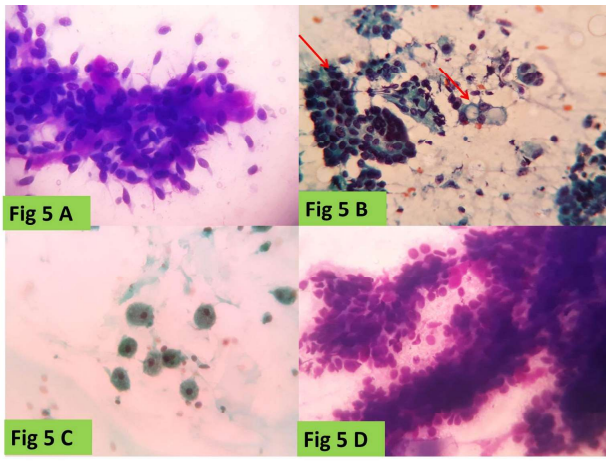

Fig 5A: Microphotograph from FNAC of parotid gland showing cohesive epithelial cells, myoepithelial cells and fibrillar fibromyxoid stroma -Pleomorphic adenoma. (Giemsa stain 40x). **5B:** Clusters of epithelial cells, intermediate cells, mucin secreting cells and dirty background- Mucoepidermoid carcinoma- (Papanicolaou stain 40x). **5C:** Scattered cyst macrophages and proteinaceous material- Benign cystic lesion. (Papanicolaou stain 40x). **5D:** Cluster of small basaloid cells with uniform nuclei and hyaline stroma- Benign adnexal tumor. (Giemsa stain 40x).

Histopathological correlation was available in 348 cases. Of these, histological findings were concordant with cytological diagnoses in 93.6% (326 cases) and discordant findings were seen in 6.32% (22 cases) (Table 4).

Statistical analysis revealed overall sensitivity, specificity, positive predictive value, negative predictive value were found out to be 80.76%, 100%, 100% and 98.4% respectively. The diagnostic accuracy of FNAC was 98.55%. The association between FNAC diagnoses and histopathological diagnoses showed *p*-value <0.05 and was considered to be statistically significant.

Table 4: Cyto -histological correlation of various head and neck lesions

Lymphnode		**Total Cytological cases**	**Corresponding histological cases**	**Concordance**	**Discordance**
Inflammatory/Benign	Reactive lymphadenitis	278	10	7	3 (2-TB LN 1-NHL)
	Tubercular lymphadenitis	215	2	2	-
	Suppurative lymphadenitis	72	8	6	2 (2-TB LN)
	Granulomatous lymphadenitis	24	7	4	3 (2-TB LN 1-HL)
Malignant	Non-Hodgkin's lymphoma	13	4	4	–
	Hodgkin's lymphoma	2	1	1	–
Metastatic deposits	Squamous cell carcinoma	87	8	8	–
Thyroid gland					
Inflammatory/Benign	Nodular goitre	185	58	53	5 (5-Follicular adenoma)
	Colloid goitre	57	7	6	1 (Hashimotos thyroiditis)
	Adenomatoid goitre	16	4	4	–

Lymphnode		Total Cytological cases	Corresponding histological cases	Concordance	Discordance
	Thyroglossal cyst	11	10	10	–
	Follicular neoplasm	8	4	3	1 Encapsulated follicular papillary carcinoma
Malignant	Papillary carcinoma	7	4	4	–
Salivary gland					
Benign	Pleomorphic adenoma	22	8	7	1 (Mucoepidermoid carcinoma)
Malignant	Mucoepidermoid carcinoma	4	3	3	–
Miscellaneous					
Inflammatory/Benign	Epidermal cyst	187	123	123	–
	Lipoma	80	46	40	1 (Pilomatricoma)
	Benign cystic lesion	25	7	3	4 (1-Epidermal cyst 2-Thyroglossal cyst 1-Basaloid SCC)
	Branchial cyst	5	2	2	–
	Lymphoepithelial cyst	4			
	Cystic hygroma	3			
	Hemangioma	15	12	12	–
	Skin adnexal tumor	11	8	8	–
	Schwannoma	9	8	8	–
	Benign spindle cell tumor	5			
	Paraganglioma	2			
	Calcinosis cutis	1			
Malignant	Basal cell carcinoma	1	1	1	–
	Malignant melanoma	1			
Inadequate		59	12	–	12 (4-TB LN 2-Hemangioma 2-Schwanoma 2-Epidermal cyst 2-Calcinosis cutis
Total			348	326 (93.6)	22 (6.32)

Discussion

FNAC was first introduced by Martin and Ellis in 1930.[1,6] Since then FNAC has become a popular procedure in the evaluation of various palpable swellings. FNAC is the first line of investigation tool for head and neck lesions which inturn helps in differentiating the myriad of etiologies and further in their management.[1–6] In the present study, 1568 cases of head and neck lesions were studied. The male to female ratio in our study was 1.1: 1 which is in concordance with other studies.[2–7] The age group presented with head and neck lesions were 3rd and 4th decade which is similar to other studies.[2–7] Maximum numbers of malignant lesions were seen in elderly age group comparable to the various studies conducted.[2–7]

Out of 1568 cases, 96.2% (1509 cases) yielded satisfactory conclusive cytological diagnoses. However 3.7% (59 cases) showed unsatisfactory inadequate diagnoses. Several other studies revealed higher range of unsatisfactory results

from 9.3–15% and quoted the probable reasons for these being smaller sized swellings, cystic lesions, less cellularity, fibrosis, necrotic degeneration and haemorrhagic aspirates. In the present study also, unsatisfactory results were mostly due to smaller swellings and haemorrhagic aspirates.

The commonest head and neck lesions in the present study were from lymphnode swellings accounting to 44.83% (703 cases) followed by thyroid gland, miscellaneous category and salivary glands. Which was in concordance with studies done by Nanik J,[7] Kishore SH,[8] Sreedevi P[9] and Meenai FJ.[10] In contrast Muddegowda PH[11] found thyroid gland swellings as the predominant lesion (Table 5).

Table 5: Comparison of commonest sites of head and neck lesions in various studies

Study	Lymphnode	Thyroid	Miscellaneous	Salivary Gland
Nanik J 2015[7]	64.3	17.5	13.5	4.8
Kishore SH 2015[8]	39.58	31.25	–	18.75
Jadhav 2018[20]	33.00	30.31	22.80	13.88
Meenai F.J 2018[10]	63.98	18.25	9.7	3.5
Present study 2019	44.83	25.19	22.76	3.4

In the lymphnode swellings the reactive lymphadenitis was the predominant cytodiagnosis accounting to 17.7%. The metastatic deposits of squamous cell carcinoma was the commonest malignant entity accounting to 5.5%. These results were in concordance with studies like Kishore SH,[8] Sreedevi P[9] Valiya LG.[12] In contrast, a study done by Meenai FJ[10] showed metastatic squamous cell carcinoma lymphadenopathy as the commonest cause of cervical swellings. The authors explained the reason, as the study been done in tertiary care centre with well-established oncology unit and higher rates of referral of cancer patients.

Histopathological correlation was available in 40 cases and only eight cases showed discordant results. 3 cases of cytodiagnosed reactive lymphnode turned out on histology as tubercular etiology in 2 cases and one case of NHL. 2 cases of suppurative lymphnode on cytodiagnosis turned out to be tubercular origin in histology. Of the 3 cases of granulomatous lymphnode, 2 cases turned out to be tubercular lesions and one case as HL. Possible reason for these eight discordant results may be due to the needle being not hitting the exact site of the pathological lesion. Similar explanations of missing the exact site of lesion by the needle, less cellularity and haemorrhagic aspirates were given by the other authors attributing to the failure to obtain consistent results.[8-10,12,13]

Amongst the thyroid gland swellings, FNAC diagnosis revealed maximum cases of nodular goitre accounting to 11.8% followed by Hashimoto's thyroiditis, colloid goitre and others. The papillary carcinoma was commonest malignant tumor. Analogous to the studies done by Kishore SH,[8] Sreedevi P[9] Meenai FJ[10] Rathod GB[14] wherein benign lesions of thyroid gland were frequent and among malignant lesions, papillary carcinomas were the commonest. A study done by Valiya LG[12] quoted that FNAC serves the purpose of both diagnostic and therapeutic in cystic thyroid lesions and cytodiagnosis helps to know the necessity of the surgical intervention. In the present study 87 cases of thyroid gland lesions had histopathological correlation and showed discordance only in 6 cases. 5 cases of nodular goitre turned out to be follicular adenomas. 1 case of follicular neoplasm was diagnosed as encapsulated variant of follicular papillary carcinoma on histopathology. Similar results were seen in a study done by Gagneten[15] who concluded saying cell poor aspirates lead to diagnostic dilemmas and hence should do multiple aspirations from different areas of thyroid gland swellings in order to obtain representative material.

In our study among the miscellaneous category, epidermal cyst (11.9%) and lipoma (5.1%) were the commonest lesions. Comparable results were seen in studied done by Sreedevi P[9] Meenai F.J[10] Bhagat VM.[16] In contrast, a study done by Singal[13] found lipomas followed by epidermal cysts and hemangiomas as the commonest entities. Histopathological correlation was obtained in 210 cases. Of which, only 6 cases showed discordance, 1 case of lipoma on FNAC turned out to be pilomatricoma on histopathology. 3 cases of benign cystic lesions on cytology, 1 case was epidermal cyst and 2 cases were Thyroglossal cysts. Other one case of benign cystic lesion turned out to be basaloid squamous cell carcinoma on histopathology. Similar diagnostic dilemma was also encountered by Sahni

S et al.[17] and concluded saying that, major drawback of FNAC in head and neck lesions is the presence of cysts and cystic change. This cystic change can be seen both in benign and malignant lesions which at times poses difficulty hence, authors suggested to do re-aspirations from residual solid area after draining the cyst under ultrasound guidance.

In the present study, maximum cases in salivary gland lesions were pleomorphic adenoma followed by sailadenitis. Malignant lesions were least accounting to 4 cases of mucoepidermoid carcinoma. These results were in concordance with other studies wherein pleomorphic adenoma was the frequent benign and mucoepidermoid carcinoma being the commonest malignant entity.[7,9–11] However studies done by Kishore SH[8] Valiya LG[12] and Rathod GB[13] had discordance having inflammatory and reactive lesions as the majority cases. 11 cases had histopathological correlation where in 10 cases showed consistent results only one case of pleomorphic adenoma on FNAC turned out to be mucoepidermoid carcinoma on histopathology. Studies reveal that cellular pleomorphic adenoma with squamous metaplasia and cellular atypia always posed diagnostic dilemma and should be cautious in the cytodiagnosis.[7–12]

In the present study, histopathological correlation for head and neck lesions were available in 348 cases. Of which, 93.6% showed concordant results with cytological diagnosis whereas 6.32% showed discordant results. Similar ranges of concordant and discordant results were seen in various other studies conducted[10,18,19] (Table 6).

Table 6: Concordance and discordance of cytohistologic results in various head and neck lesions studies

Study	Concordance %	Discordance %
Maniyar AU 2013[18]	85.87	14.13
Khetrapal S et al. 2015[19]	91.8	8.2
Meenai FJ 2018[10]	94.7	5.6
Present study 2019	93.6	6.32

Overall sensitivity, specificity, positive predictive value, negative predictive value were found out to be 80.76%, 100%, 100% and 98.4% respectively. The diagnostic accuracy of FNAC was 98.55% in the present study which was comparable to values obtained in other similar studies conducted on head and neck lesions[8,20-22] (Table 7).

The major limitation of the present study was less number of cases with cyto-histopathological correlation. However this less number is acceptable as FNAC is first line of investigative tool which can obviate the need of surgery if the lesion is non-neoplastic.

Table 7: Diagnostic reliability of FNAC on head and neck lesions in various studies

Study	Sensitivity	Specificity	PPV	NPV	Accuracy
Kishore H 2015[8]	81.8	96.8	85	90	93.02
Sharma N 2016[21]	95.45	100	100	97.29	98
Dallari 2017[22]	80.36	95.65	91.84	88.89	89.86
Jadhav 2018[20]	78.57	100	–	–	95.7
Present study	80.76	100	100	98.46	98.55

Conclusion

FNAC is a simple valuable, reliable, repeatable and cost effective outpatient procedure. The sensitivity, specificity, positive predictive, negative predictive value, accuracy and good agreement between cytological and histological correlation findings exemplifies the fact that FNAC is a valuable preliminary diagnostic tool for assessing head and neck lesions. Hence, FNAC of head and neck lesions serves as a guide for diagnosis, therapeutic and better management of various cases.

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Original Article

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Molecular Classification of Breast Carcinoma by Immunohistochemical Study

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Abstract

Background and Aims: Breast cancer with morphological classification has limitation with similar clinical and histological features behave differently regarding prognosis and therapy response. Hence the molecular classification has been introduced to predict the clinical outcome. The aim of this study were to classify breast cancer into various molecular subtypes using surrogate IHC biomarkers such as ER, PR, Her2/neu and to find the correlation of each subtype with clinicopathological features.

Materials and Methods: A total one hundred and twelve cases were enrolled in the study. The surgical specimens were evaluated histopathologycally; Suitable block was subjected for immunostain (ER, PR and Her2/neu). Based on their expression status molecular phenotyping was done.

Statistical Analysis Used: All the data were analysed with chi square test by SPSS Statistics Version 23.0. Armonk, NY: IBM Corp software.

Results: The mean age of the patient was 51.11 ± 12 years. Most common histological type was invasive ductal carcinoma, no special type (84.8%). Tumor size with <5 cm (68%) and left laterality (60%) being the most prevalent. Majority of cases were in Grade II and pT2 category. Molecular subtypes had following distribution: Basal like and luminal B were accounted 30% each, while luminal A and Her2/neu enriched were 20% each respectively. There was an association between tumour grade with molecular subtypes and ER, PR receptor expression status with significant *p*-value.

Conclusions: Incorporation of molecular subtyping into traditional histopathological reporting help in better therapeutic management and increases prognostic accuracy. In the current study Basal like presented in advanced stage of their disease.

Keywords: Invasive ductal carcinoma; Luminal subtypes; Prognostic markers.

Introduction

Breast cancer has increase in the incidence which has a negative effect on the health globally and as well as in India.[1] In India the lack of awareness about breast cancer coupled with the lack of screening, causes patients to present at a later stage making the prognosis and survival dismal as compared to the western world.[2,3]

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The awareness and screening for breast cancer is the prime modality of reducing the morbidity and mortality. Morphologically identical breast cancers can display divergent clinical outcomes and responses to therapy. However with the introduction of predictive and prognostic markers there has been a major advance in the management of breast cancer.[4] The WHO morphological classification has minimal prognostic and predictive implications. However the further grading and staging of the tumour provide better prognostic markers.[5]

In the timeline of further in understanding of breast cancers, immunohistochemistry (IHC) first allowed us to segregate breast cancers into two main classes: estrogen receptor positive (ER+) and estrogen receptor negative (ER−) followed by progesterone receptor (PR) status which is regulated by estrogen.[6] A decade later, the next step forward was the emergence of nucleic acid in situ hybridization. This led to the identification of two new categories, dependent on whether human epidermal growth factor receptor-2 (HER2) was amplified or not. Breast cancers overexpressed with Her2 are associated with poor prognosis and shows better response to anti Her2 targeted therapy. The Perou[7] and Sorlie et al.[8,9] have identified several intrinsic subtypes of breast cancer based on gene expression analysis such as luminal A, luminal B, normal breast-like, HER2-enriched, and basal-like, with heterogeneous behaviour in the clinical outcomes and responses to therapy.[10]

With recent developments in the field it was identified that Imminohistochemistray being feasible and reproducible, acts as a surrogate for gene expression analysis for further classification.[11] Hence routine IHC evaluations on breast cancer tissue may deliver prognostic significance and information to guide clinical management.[12]

The aim in the current study was to classify morphological subtypes of breast cancer into molecular subtypes with the help of restricted panel of immuno markers and correlate with clinicopathological features.

Materials and Methods

A retrospective study was conducted on an one hundred and twelve cases of invasive breast cancer diagnosed in the Department of Pathology, from October 2014 to August 2016. This study included mastectomy/modified radical mastectomy cases which were proven histopathologicaly and excluded breast biopsies, lumpectomies specimens.

Clinical details were collected from the case file. The Heamtoxylin & Eosin slides were retrieved from the archives of the Department of Pathology and clinic-histomorphological features like age, laterality, histological, tumor size, grade, stage and lymph vascular involvement were analyzed. Bloom Richardson grading system was used for tumor grading and overall College of American Pathologists (CAP) protocol was followed for Histopathological diagnosis and all invasive breast carcinoma were graded from Grade I to Grade III according to Nottingham Histologic Score system. Sections were further subjected to immunohistochemical (IHC) study. Primary antibody Ki-67 (Code-GM001, Mouse Monoclonal Antibody, Pathnsitu) and ER, PR and Her2/neu (Code-EP3, Rabbit Monoclonal Antibody, Pathnsitu) were used. The Polyexcel HRP (non-biotin, micro-polymer based) DAB Detection system was used with adequate positive and negative controls.

Interpretation of IHC

- Scoring of IHC for ER, PR, Her2/neu was done according to the 2014 ASCO/CAP guidelines.
- For ER, PR staining score was considered Positive if ≥1% Immunoreactive tumor cells present; Negative if <1% Immunoreactive tumor cells present
- Her2/neu staining was scored as
- 0 = no staining or incomplete, faint/ barely perceptible membrane staining in < 10% of invasive tumour cells;
- 1+ = incomplete, faint/ barely perceptible membrane staining in > 10% of tumour cells;
- 2+ = incomplete and weak-to-moderate circumferential membrane staining of > 10% of tumour cells or complete, intense, circumferential membrane staining in <10% of tumor cells ;
- 3+ = complete, intense, circumferential staining of > 10% of tumour cells.
- Scores of 0 or 1+ was considered tumour negative for Her2/neu expression, score of 2+ as equivocal and required confirmation with FISH, while 3+ was regarded as positive expression of Her2/neu.
- The slides were observed and scored by two independent observers with consensus reached in case of any discrepancy.

Ethical Clearance

The study was approved by institutional ethical committee**.**

Statistical Analysis

The data were analyzed using IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY: IBM Corp. Frequencies and percentages of all the variables were computed. Chi-square test was used to compare the association of ER, PR, HER-2 expression and molecular subtypes with clinicopathological parameter such as age, tumour laterality, tumor morphological/histological type, tumor size, grade, TNM stage, LVI. The results were considered statistically significant if *p*-value was <0.05

Results

A total one hundred and twelve cases were enrolled in the study. The mean age of patient at the time of diagnosis was found to be 51.11 ± 12 (range from 22–85 years old). The age groups were grouped into three categories as <40, 41–50, >51 with following distribution of cases 20.5%, 31.3%, and 48.2% respectively. All patients were female and majority of them showed left breast involvement.

Most of them (84.8%) were invasive ductal carcinoma IDC-NST (Fig. 1), among them (25.9%) cases were associated with DCIS (ductal carcinoma in situ component). The another 17 cases were categorized as Other subtypes due to there small in number; four cases of mixed

(IDC + Pagets disease), four cases of mucinous and four medullary, three papillary, one each apocrine, and sever anaplastic (Table 1).

Based on ER (Fig. 2), PR (Fig. 3) and Her2/neu expression status (Fig. 4), molecular subtypes are as follows: Basal like and Luminal B were accounted for an about 30.4% each; followed by Luminal A (19.6%) and Her2/neu (19.6%). In all molecular subtype, invasive ductal carcinoma was most common histological type (Table 1).

Age group categories did not find any significant association neither with hormonal status nor molecular subtypes.

Most of our cases (68%) had tumour size <5 cm. There was no significant association between ER, PR, Her2/neu status and molecular subtypes. According to Bloom Richardson grading system; majority of our cases (51%) were in Grade II. We found a significant association between receptor expression status and Luminal subtypes with tumour grading.

Lymphovascular invasion was seen in 60% of cases and there was no significant association with neither hormonal receptor expression status nor molecular subtypes (Table 1). Overall majority of our cases 54% were in Stage 2 (pTNM).

No significant association with neither hormonal receptor status nor molecular subtypes (Table 1).

Table 1: Correlation of Luminal subtypes with variable like age, tumor site, size, grade, pT category and lymphovascular invasion

Variables	Luminal A (*n* = 22)	Luminal B (*n* = 34)	Her2/neu enriched (*n* = 22)	Basal like (*n* = 34)	*p*-value
Age					
≤ 40 yrs (*n* = 23)	6 (26.1%)	5 (21.7%)	4 (17.4%)	8 (34.8%)	0.798
41–50 yrs (*n* = 35)	7 (20.0%)	9 (25.7%)	7 (20.0%)	12 (34.3%)	
>50 yrs (*n* = 54)	9 (19.6%)	20 (30.4%)	11 (19.6%)	14 (30.4%)	
Size					
<5 cm (*n* = 76)	17 (22.4%)	21 (27.6%)	14 (18.4%)	24 (31.6%)	0.622
>5 cm (*n* = 36)	5 (13.9%)	13 (36.1%)	8 (22.2%)	10 (27.8%)	
Site					
Right (*n* = 44)	9 (20.5%)	11 (25.0%)	9 (20.5%)	15 (34.1%)	0.785
Left (*n* = 68)	13 (19.1%)	23 (33.8%)	13 (19.1%)	19 (27.8%)	
Grade					
Grade I (*n* = 19)	6 (31.6%)	8 (42.1%)	1 (5.3%)	4 (21.1%)	0.044*
Grade II (*n* = 57)	12 (21.1%)	20 (35.1%)	10 (17.5%)	15 (25.3%)	
Grade III (*n* = 36)	4 (11.1%)	6 (16.7%)	11 (30.6%)	15 (41.7%)	

Variables	Luminal A (n = 22)	Luminal B (n = 34)	Her2/neu enriched (n = 22)	Basal like (n = 34)	p-value
pTCategory					
pT1 (n = 21)	06 (28.6%)	6 (28.6%)	5 (23.8%)	4 (19.0%)	p = 0.579
pT2 (n = 61)	10 (16.4%)	19 (31.1%)	9 (14.8%)	23 (37.7%)	
pT3 (n = 26)	05 (19.2%)	8 (30.8%)	6 (23.1%)	07 (26.9%)	
pT4 (n = 4)	01 (25.0%)	01 (25.0%)	2 (50%)	00 (00%)	
Lymphovascular invasion					
Present (n = 67)	14 (20.9%)	22 (32.8%)	11 (16.4%)	20 (29.9%)	0.713
Absent (n = 45)	8 (17.8%)	12 (26.7%)	11 (24.4)	14 (31.1%)	

*p < 0.05, indicates statically significance

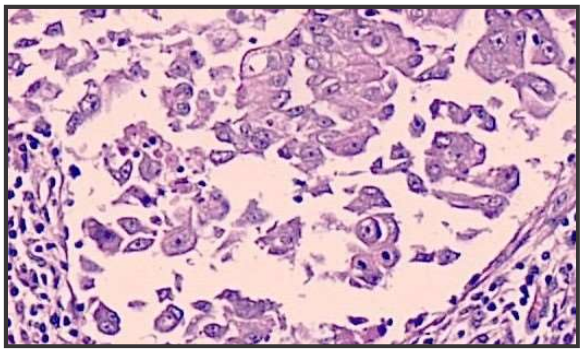

Fig. 1: Photomicrograph of invasive ductal carcinoma (H&E, X40).

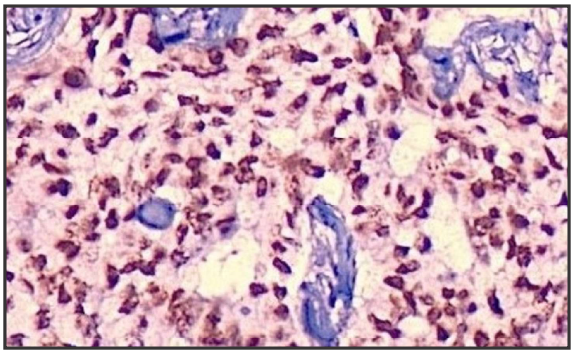

Fig. 2: Photomicrograph of positive ER immunostain in IDC (ER,X 40).

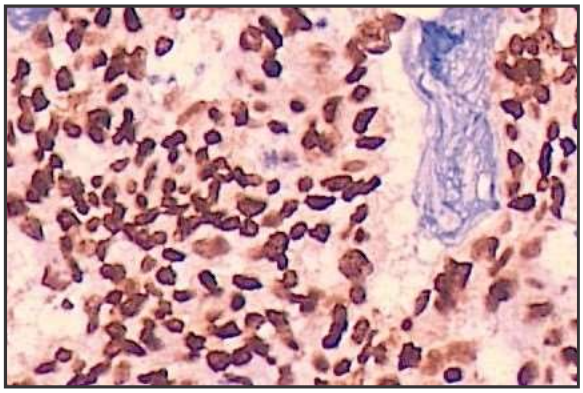

Fig. 3: Photomicrograph of positive PR immunostain in IDC (PR,X 40).

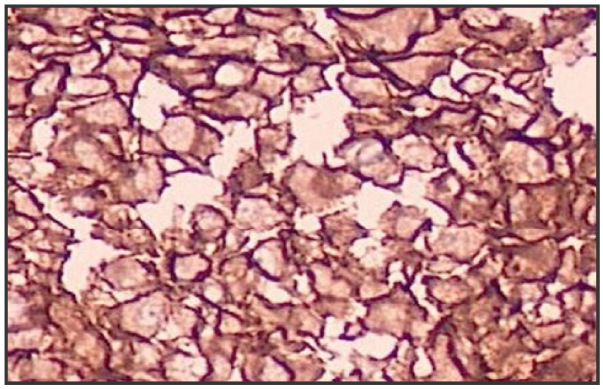

Fig. 4: Photomicrograph of Her2/neu 3+ immunostain in IDC (Her2/neu,X 10)

Discussion

It is well known that breast tumor prediction and prognosis relay on factors such as clinocapthological parameter and IHC expression status. Immunohistochemistry is most important factor in prognosis and hence it has become an integral part in histopathology reports for appropriate treatment.[13] The current study was undertaken to understand the correlation between clinicopathological parameters and IHC profile.

In the present study we had one hundred and twelve mastectomy cases. The age range was between 22–85 years with mean age being 51.11 ± 12 and maximum number of cases were noted in >51 years and found to be concordant with study done by Kanakarajan A et al.[14] in 2015. In an article published by Nikhra P et al.,[15] in 2014 found an age range between 31–75 years with mean age of 49.2. Another study by Rao C et al.[16] in 2013, JCRT noticed age range of 41–50 years with mean age 46.8%. Our study did not find any significant

association between age grouping with hormonal receptor expression status and molecular subtypes.

Among histological types we found IDC-NST was most common type 84.9% with similar findings in other studies done by Nikhra Pet al.,[15] Akbar M[11] and Tiwari S et al.[12] Based on hormonal receptor expression status, molecular subtyping was done and we had found luminal B and Basal like each 30.4% followed by luminal A (19.6%) and Her2/ neu (19.6%) subtypes. various other studies had variable distribution (Table 2). Laterality of breast tumor: most frequent involvement being the left side of the breast as compared to right side and which was similar to the study done by Tiwari S et al.[12] and Ambroise et al.,[18] Azizun-Nisa et al.[19] We discovered that majority of our cases were <5 cm (60%) in tumour size; there was no evidence of significant association of tumor size with hormonal expression status nor with molecular subtypes; which was concordant with Widodo I et al.,[17] were as Rao C et al.,[16] and Spitale A et al.[20] found a significant association between hormonal receptor status and tumor size. Regarding tumour grade we had majority of our cases in Grade II and found a significant association with respect to hormonal receptor status and molecular subtypes, similar finding were observed by Tiwari S et al.,[12] Widodo I et al.[17] and Rao C et al.[16]

Table 2: Proportion of luminal subtypes among different studies

Author	Luminal A	Luminal B	Her2/neu	Basal like
Andrade A C et al.[13]	23.7%	44.6%	14.50%	17.10%
Widodo I et al.[17]	54.8%	16.7%	20.2%	25.0%
Akbar M et al.[11]	28.4%	25.0%	30.0%	16.6%
Kanakarajan A et al.[14]	35.0%	14.0%	18.0%	34.0%
Tiwari S et al.[12]	27.1%	25.7%	25.7%	15.7%
Current study	19.6%	30.4%	19.6%	30.4%

In the current study TNM stage; T2 (54%) was most prevalent followed by T3 (23%), T1 (19%) and T4 (4%) with no significant association between hormonal receptor status expression nor molecular subtypes. Were as Tiwari et al.[12] study found majority of cases in T3 (57.2%) followed by T2 (41.4%) and T1 stage. While Akbar M et al.[11] had following presentation T1 and T2 (38.4%), T3 (45%), and T4 (13.3%). Spitale A[13] had predominance of T1 (42.9%) followed by T2, T3 and T4 none of these studies found any significant association with molecular subtypes. At about 60% of cases had lymphovascular invasion without any significant association with hormonal receptor status or molecular subtypes. Were has Rao et al.[16] had only 19.8% of cases had LVI without significant association. Another study Spitale A[20] had 85.3% positive nodal status with no significant association. While Widodo I et al.[17] found a significant association with respective of nodal status.

Conclusion

Carcinoma of breast are usually manifested in late stage mainly due to lack of awareness and delay in detection. There is a need for breast cancer screening, use of various tests and methodologies (ancillary studies-IHC) to explore and predict the biology of the cancer which allows the clinician to better understand the biology of tumour and highlight the clinical outcome. Hence the key to treating the breast tumour necessitates its early detection. The current study suggest IHC based assay to identify the main tumor intrinsic subtypes which varies in their clinic-pathological parameters and extremely important to classify into different molecular subtypes which will lead to different prognosis and therapeutic options. Our study demonstrates IDC-NST as the most prevalent histological type and among molecular phenotype, Basal like and luminal B was the most common followed by Luminal A and Her2/neu enriched. Majority of cases were in Grade II and pT2 in pT category. Luminal groups respond to hormonal treatment while her-2/ neu group respond well to biological therapies using transtuzumab. On the other hand, Basal like phenotype, has been associated with poor clinical outcomes, which likely reflect this subtypes have high proliferative capacity as well as the lack of directed therapies since basal-like tumors do not typically express ER or Her2/neu, they usually respond to chemotherapy.

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Original Article

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Epidemiology of Domestic Accidents

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Abstract

Background: Man has been trying to have safe environment from time immemorial. Most of his time he is leading in the house because of availability of better comforts compared to his occupational environment. If the domestic environment is not safe he will be prone to various types of accidents. The same domestic conditions are not suitable to all the age groups. Global domestic accidents are in the increasing trend and one of the important causes of higher mortality. For prevention of domestic accidents, one should know the reasons for accidents. The present study is to know causes of domestic accidents in different age groups.

Materials and Methods: The present study is a longitudinal study conducted from 2004 to 2007 in Forensic Department of Gandhi Medical College. This is made on the dead bodies subjected to postpartum examinations in the mortuary. A sample size of 100 subjects was taken through simple random method from reported cases due to domestic deaths. Data collected by using first information report, hospital records and postmortem examination report. Laboratory support was obtained in ambiguous postpartum reports. The entry of data a format was designed with pretesting of adequate sample. Data analyzed using excel.

Result and Observations: In the present study 100 subjects were taken. Among the study subjects 59% are males and 41 females. 41% of domestic accidents are in children. Significant deaths are from illiterate and from low income groups. Most of the deaths reported from day wage earners and from manual labors. Injuries due to falls, burns and poisoning are the major causes observed in the present study. Three fourth of deaths occurred during day time. In old people deaths occurred in wash rooms due to falling.

Conclusion and Recommendations: Injuries are the leading causes of deaths in all age groups. Injuries, burns, poisoning, drowning, electrocution, poisonous animal bites, and asphyxia are seen as causes of death. Creating awareness on domestic accidents and preventive measures will play an important role.

Keywords: Domestic accidents; Asphyxia, Electrocution, Injuries.

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Introduction

Accidents take place in a wide variety of environment including domestic environment. The following are some of the domestic accidents commonly seen in various age groups. Fires (including the Deepavali accidents in children), Arson Inhalation of smoke (including carbon monoxide. Lightening. Electrical hazards

Liquefied Petroleum Gas explosions in Kitchens, Kerosene pumps stove explosions Accidental poisoning consumption of stored chemicals (including the organophosphates, chemicals used for cleaning or gardening, oxalic acid, sodium meta bisulphate. Over Dosage of Medicines and consumption of medicines under confusion in elderly people. Accidental falls in the bathrooms in elderly people. Toddler – injuries (like scalds and other injuries).

Socio-economic conditions of the families play an important role in acquiring basic comforts of home.[1] These are compromised in low income groups. Irregular arrangements of furniture, imperfect electrical wiring and exposing of sharp objects in kitchen are commonly observed in some of the upper socio-economic families as causes for domestic accidents. Birth asphyxia is the main cause of death in new borne babies. Poisoning due to colors of dyes is the main cause in infants. Toddlers have more curiosity of exploring and may susceptible to accidents due to injuries. Addictions to drugs are commonly seen in adolescent age groups. Psychological hazards related to stress are seen in adult age group. Degenerative changes due to increase of age is responsible domestic accidents in elderly.

Domestic accidents are common all over the world.[1] In the rural areas of developing countries, domestic accidents are a serious problem.[2] It is quite a new pattern of injury, attributable to domestic accidents emerging with technical or cultural change.[3] The public health experts have coined the name Modern Day Epidemic to accidents.[4] Within the accidents, domestic accident is gaining more importance among the researchers.[5] Domestic accidents are one of the five leading causes of death in industrialized and developing countries.[6]

Domestic accidents are of two types. They may be natural and intentional like suicides or homicides. Accidents can be prevented through behavioral changes of public and structural changes of domestic environment.[3] Structural changes of home environment are giving more promising results in most of the cases. The present study is to know the epidemiological features of domestic deaths. The study was conducted in Gandhi Medical College, Hyderabad.

Objectives

1. To correlate the socio-demographic factors in relation to domestic deaths
2. To know the types of domestic deaths

Materials and Methods

The study is made on the dead bodies of the deceased, which were subjected to Postmortem examinations in the mortuary of Department of Forensic Medicine, Gandhi Medical College, Hyderabad, from January 2004 to June 2007. Only those dead bodies, which died of domestic accidents, are selected.

The inquest, First information report, Statements made by the relatives, Hospital records, Panchanama of scene of offence etc, are collected from the Police, apart from the Postmortem examination report from the Department to get the data. Some information is also collected from the relatives, who attended the Mortuary at the time of Postmortem examination, for history of events. Visit to the scene of offence is made whenever it is necessary.

In some cases where they are admitted in to the Hospital, their investigations, including X-rays and CT scanning reports are taken and they correlated with findings of Postmortem examination.

After collecting the above information, a data sheet is prepared and analyzed. The data is then processed. All the information is tabulated.

Results

The incidences of domestic accident deaths were more due to injuries (37%) followed by burns (28%) and poisoning (17%). In this total the males out numbered the females by 13%.

The present study was mainly aimed to analyze the different deaths occurring in the domestic environment. In this study 100 subjects were taken. The study period was from 2004 to 2007. The sex ratio of the study subjects was M: 59: F: 41. The study shows that, accidents were common in childhood including toddlers and children (41). Again, it rose in the age group of more than sixty years (34). No neonates died in the present study, and only one 10 months male infant died of drowning in a bath room, by falling in to a water tub.

Table 1: Age and Sex distribution of Domestic Accidents

	Male	Female	Total
Neonate (less than 28 days)	0	0	0
Infant (less than one year)	1	0	1
Toddler (one to three years)	9	5	14
Child (Three to twelve years)	15	12	27
Adolescent (Thirteen to nineteen years)	8	6	14

	Male	Female	Total
Adult (Twenty to fifty nine years)	6	4	10
Old aged (Above Sixty years)	20	14	34
Total	59	41	100

The incidence of domestic accidents was more in illiterate and in low socio-economic Group 1. Majority of the victims were from labour category, of both industrial and agricultural origin. Deaths among professionals and skilled men were less. More number of domestic deaths reported from urban area. There was no difference on basis of status of marriage.

Table 2: Marital status of Victims of Domestic accidents

	Male	Female	Total
Unmarried	33	23	56
Married	20	14	34
Widowed	6	3	9
Divorced	0	1	1
Total	59	41	100

Injuries due to falls (14), burns and scalds (10), and poisoning (10) were the leading causes of death in toddlers and children. Deaths due to Drowning (5) were exclusively seen in this age group of people. One male child died of electrocution, while playing with kite on terrace, one male child died of scorpion sting, and another female child died of strangulation when she was playing in a cotton sling (made like a cradle).

Many of the deaths (76) occurred during day time. All animal bites (3) occurred during night time only. Incidence of injuries (11), burns (5) and electrocution (4) were also significant during night time. One old aged male person died after falling in to unprotected wall of balcony, in the night time.

Table 3: Occupation of victims of Domestic accidents

	Male	Female	Total
Non working	12	8	20
Students	10	6	16
Labourer	25	10	35
House hold	4	14	18
Skilled labourer	7	2	9
Professional	1	1	2
Total	59	41	100

In adolescents also injuries (5) was leading over burns (4) and poisonings (3). One girl drowned to death by falling in to a water sump in the garden. In adults, burns (5) were the leading cause, over injuries (3) and electrocution (2).

Table 4: Residence of victims

	Male	Female	Total
Rural	19	8	27
Urban slum	26	25	51
Urban	14	8	22
Total	59	41	100

In relation to the place of accident, Kitchen (17) was the place for most of the accidents in toddlers and children, followed by living room (7), bed room(5), bath room(5), garden (5), and staircase (2). Bath room (11) was the area for receiving injuries in old aged people. Living room (9) was also another important area to meet with accidents in old age. Other prone areas include stairway (6), garden/ terrace (3), bed room (2), and kitchen (2), and one security guard died in out house.

For adolescents and adults, Kitchen (8) was found to be the risky area, followed by bed room (5), garden (5), living room (4), stairway (1), and bath room (1).

With regards to the rooms where accidents took place, Injuries (7) and burns (7) were common in the living room, followed by poisoning (5). One electrocution also occurred in living room. Injuries (6) and burns (4) were also common in bed room. One asphyxial death and one poisoning was seen in an old women in bed room. Head injuries (4), injuries to spinal column (2) and one fracture of femur were among the injury deaths. All these occurred due to fall from height, when they were working

Bath room was the place, where most of the old people slipped and received fatal injuries (11). Drowning (6) of children and toddlers occurred in bath rooms. One incidence of burns occurred in an adolescent female, nearby bath room, when she was heating water. Fractures of long bones of lower limb (7), head injuries (4) were seen in injury deaths.

Kitchen was the place to receive most of the fatal accidental burns (16). Poisonings (7) also occurred in kitchen apart from injuries (2) and electrocutions (2). People fell down from stairway and received injuries in 9 cases.

Poisoning (4), Electrocution (3), snake and scorpion bites (3), Injuries (2) and one drowning were seen in garden.

One security guard died in outhouse due to inhalation of smoke.

Table 5: Place of occurrence in relation with sex/age.

Place of occurrence	Sex	Children	Adolescent	Adult	Old age	Total
Living room	Male	4	2	0	5	11
	Female	3	2	0	4	9
Bed room	Male	2	1	2	1	6
	Female	3	1	1	1	6
Bath room	Male	4	0	1	4	9
	Female	2	0	0	7	9
Kitchen	Male	10	3	0	1	14
	Female	7	2	3	1	13
Stairway	Male	1	0	1	5	7
	Female	1	0	0	1	2
Terrace/ garden	Male	1	0	1	5	7
	Female	1	1	0	0	2
Out house	Male	0	0	0	I	1
	Female	0	0	0	0	0

Discussion

Community based studies carried out at Ghana (1999),[7] Driscoll et al. in Australia and Macleod et al.[8] reported higher injury incidence in older people. It was observed that in the age group 5–15 years, 25.3% suffered from domestic accidents in Agarwal et al.[9] study and in the present study it was 27% it can be explained on the basis of their exploratory habits. The Children are at high-risk because of their mode of reaction and impulsiveness and their lack of experience in the calculation of risk. As per the Agarwal study,[9] the percentages of deaths due to domestic accidents in age group of 15–45 years were 34.3% compared to the present which is 24%. As per the EHO meeting at Bonn.[10] in May 2008 the accidental domestic deaths in the age group of 0-14years was 50% which is high compared to the present study which is 6%.

In the present study, males suffered more domestic accidents compared to females the ratio was 59:41 As the per Birute Lithuania study.[11] the percentage of deaths of boys who died due to domestic accidents were 64.6% and girls were 35.4%. As per the study of Mackesske and fetch Banbury.[12] UK, deaths due to domestic accidents injuries in age group of 65 years were 18% in females and 32% in males compared to the present study which was 34.1% in females and 33.8% in males.

In the present study the deaths due to injuries were 37% followed by burns 28%, poison 17%, drowning 7%, Electrocution 6% Animal bites 3%, and Asphyxia 2% As per R. Agarwal et al. study.[9] it was observed that fall from height was a major mode of injury of 44.3%, followed by Mechanical injury 34.6% and burns whichs was 13% which is similar to the present study. According to the study of Dr. Nathalie Robbel in analysis of the Lerese.[13] the accident deaths in kitchen were 30% and in bathroom are 25% compared to the present study where in the kitchen it is 27% and in bathroom are 18%. As per the study of Agarwal,[9] Percentage of injuries deaths in kitchen it were 16.3%, in the stair case 7.3% and bathroom 2.3% compared to the present study where the percentage of deaths due to domestic injuries are 27% in the kitchen, 9% in the stair case and 18% in the bathrooms. As per study of Dr. Gbriele Ellasabar of Germany,[14] the accident deaths at staircase were 9.2% compared to the present study which is 9% of the total.

Conclusion

1. Children and Old people are the most vulnerable victims for these accidents. There is little variation in sex distribution, and male showed increased tendency to meet with domestic accidents. Injuries, burns, poisoning, drowning, electrocution, poisonous animal bites, and asphyxia are seen as causes of death. Most of the accidents occurred during day time. Burns occurred in kitchen frequently. Poisoning occurred under confusion or due to unprotected spraying in the garden. Electrocution found exclusively in male population, may because of over caution in females or over confidence in male.
2. Poisonous animal bites are seen in garden areas, because of their habitat. Drowning is commonly seen in bathrooms. One old security guard died in his outhouse, where there was burning chulla, liberated smoke, and caused suffocation. Another old woman died of accidental smothering in bed room, when she lay down in prone position, had accidental smothering.
3. Electrocution, drowning, and asphyxia caused instantaneous deaths in many cases. Injuries and poisoning caused deaths within 3 days in most of the cases. Burns caused late deaths.
4. Increasing awareness and accessibility to health care systems are making the relatives

to the victims for rescuing them. And that is why many of the spot death cases are brought to hospital.

Recommendations

In the present study, it is observed that, many of the deaths could be prevented. Majority of the deaths occurred due to lack of awareness and protective measures, Hence some remedies noted, would reduce the incidence.

Children and especially toddlers, being curious start exploring, and become victims of accidents. Hence, the things which harm them must be kept beyond their reach, like, sharp objects, heavy objects, hot objects, inflammable and poisonous substances.

Old aged people, because of their incapability to look after themselves due totheir low sensory deficits, motor incapacitation, and reduced reflexes, hence, they must be always under vigilance. Protective measures like railings, guards must be kept to their cots, their toilets must have skid proof flooring. Surfaces of the skid proof floor must always be kept dry. Hearing aids, walking sticks, surgeries for cataracts and treatment for other illnesses, certainly reduces the incidence of injuries.

Kitchen must be well ventilated to let out the fumes by using exhaust fans. All inflammable materials must be handled properly. Insecticides must not be kept in kitchen room to prevent accidental poisoning.

Toilet cleaners, acids etc. must be kept at height. The tiles on the floor of the toilet should be rough (anti-skid) so that one cannot slip.

Garden tools must be kept away from the reach of the children and all garbage and remains of food must be regularly removed, to prevent the habitat of poisonous insects.

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Case Report

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Crime Concealed As Drowning

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Abstract

Drowning is a type of violent asphyxial death. Deaths due to drowning are usually suicidal and accidental in manner, but homicidal drowning is not uncommon. But it is very difficult for autopsy surgeon to give cause of death when deceased found dead in water with ligature mark on the neck and other injuries on the body. A dead body of an unknown male, aged around 35–40 years was brought to mortuary of BLDE hospital Vijaypur for medico-legal post mortem examination with alleged history of accidental drowning. The case was registered u/s 174(C) CrPc. Post mortem examination revealed cause of death as head injury sustained by blunt trauma. The ligature mark present on the neck was opined as postmortem in nature. The viscera preserved revealed alcohol. Manner of death was opined as homicidal in nature.

Keywords; Drowning; Ligature mark; Postmortem examination; Homicidal.

Introduction

Drowning is a form of asphyxia due to aspiration of fluid into air passages caused by submersion in water or other fluid.[1] The medico legal question likely to arise in a case of drowning is weather the death was due to drowning or the body was thrown in to the water after death.[3] Accidental drowning is more common amongst non swimmers, children, drunkards, epileptics and persons suffering with underlying pathology. Committing the crime and concealing it by the perpetrators by masking the evidence is not new in forensic practice. The perpetrators of the crime try their level best to plant the new evidence to evade inquiry and punishment. A murdered victim may have been thrown in water to conceal the crime and to go scot free. Throwing the body in water after having committed murder by other means is frequently encountered by investigating officers. Absence of prima-facie evidence' may mislead the investigating officer. Collecting the masked evidence by the investigating officer and autopsy surgeon is a challenging job to fix the offender of the crime. Meticulous post mortem examination and necessary investigations help to give appropriate cause and manner of death.

Case Report

Unknown male, aged around 35–40 years found dead in a water pond of a farm house was brought for autopsy. Two wheeler was found near the pond with beer bottle lying near the vehicle. The police have registered the case u/s 174(C) CrPc. Preliminary information given by the police is accidentally drowned to death under the influence of alcohol. The whole body was stained with mud. The body was turned to green at some places

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indicating onset of decomposition. On examination fair complexed well-nourished and well-built adult male, whose length was measuring 168 cm. Dried bloody discharge was found at both nostrils. Soddening, bleaching and wrinkling of sole and palm were seen (Fig. 1). Face was congested. No signs of struggle were present. The front of neck showed ligature marks (Fig. 2). The ligature mark was present only on left side of neck (Fig. 3) and was deficient on right side of neck (Fig. 4). It was running obliquely upwards. Chain present in the neck was corresponding to ligature mark (Fig. 5). The ligature mark was at the level of thyroid cartilage with the pattern of metallic chain. Length of ligature mark was 14 cm. No echymosis and abrasions were seen along the edges of ligature mark. The subcutaneous tissue, neck muscles, laryngeal cartilages, thyroid cartilage, tracheal rings and carotid arteries were not injured (Fig. 6). Lungs were showing no signs of drowning, normal in weight but were congested. All other vital organs were congested. Contusion of scalp was seen at the occipital region measuring 8 × 6 cm (Fig. 7). Patchy subarachnoid hemorrhages at the both parietal lobes were witnessed (Fig. 8). Viscera preserved for chemical analysis revealed the alcohol. The cause of death was opined as head injury sustained by blunt trauma.

Fig. 1:

Fig. 2:

Fig. 3:

Fig. 4:

Fig. 5:

Fig. 6:

Fig. 7:

Fig. 8:

Discussion

The crime may be concealed by burning the dead body, run over by heavy vehicle, dropping from height, burying in the soil, throwing in water. In this case the body was thrown in water after having killed by other means. The absence of ante mortem signs of drowning and presence of injuries over neck and head helped us to opine the cause of death as homicidal in nature. Visit to crime scene may help the autopsy surgeon to come to the conclusion. Homicides may be staged or vital evidence removed or tampered with, if the aim is to disguise it as an accident. Medical evidence can assist when attempting to establish the intent of the accused at the time of assault.[2] Failure to collect necessary evidence by investigating officer and autopsy surgeon may lead to injustice. Evidence of certain typical findings such as head injury and intoxicating drugs in the stomach of the deceased will suggest homicide, even in absence of signs of struggle.[3] Presence or absence of a ligature mark alone does not help us to reach at the conclusion. Besides any beaded threads and ornaments worn round the neck may produce depressed marks.[4] The ligature mark in the present case is post mortem in nature which must have been produced by body being dragged with chain available in the neck. That's why the ligature mark is oblique and deficient on right side of neck. Soddening, bleaching and wrinkling indicate that body was laying in water for longer period of time. It does not conclude as to antemortem or post mortem.

Conclusion

Assailants are very keen to conceal crime by different methods. So there may be wrong interpretation by inexperienced autopsy surgeons and hence it may lead to injustice. So it is important that our keen observation and opinion should be conclusive for the administration of justice.[5]

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Case Report

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Adenomyoepithelial Adenosis of Breast: A Case Report and Review of Literature

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Abstract

Adenomyoepithelial adenosis of breast is a very rare type of adenosis. The proliferation of epithelial and myoepithelial cells of breast together can result in spectrum of lesions ranging from Adenomyoepithelioma, adenomyoepithelial adenosis and adenomyo epithelial carcinoma. Adenomyoepithelial adenosis can transform into adenocarcinoma of breast and myoepithelial carcinoma. The diagnosis, differentiation and follow up is mandatory with wide local excision of the lesion with tumour free margins as it can recur, become malignant and metastasise rarely with inadequate excision. Here we report a case of adenomyoepithelial adenosis of the breast in a 30 years old female.

Keywords: Breast; Adenomyoepithelioma; Adenomyoepithelial adenosis; Malignant transformation.

Introduction

Breast tissue is a potential site for epithelial and myoepithelial proliferations independently or together. The atypical proliferations can result in hyperplastic and nepolastic lesions of breast.[1] The adenomyoepithelial adenosis (AMA) is a rare type of adenosis with both epithelial and myoepithelial hyperplasias resulting in proliferation of tubules as well as nodular proliferation of myoepithelial cells around the tubules. The epithelial and myoepithelial cells proliferate in an asynchronous manner and the arrangement is alternate.[2] AMA is prone to progress to carcinoma.[3,4] We report a case of Adenomyoepithelial adenosis which though rare need to be followed up in view of recurrence, malignant transformation and metastasis especially in case of excision with inadequate margins.

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Case Report

Thirty years old woman presented to the surgical OPD with a palpable lump in the upper and inner quadrant of right breast of six years duration.

O/E A mobile lump measuring 3 × 3 cms in the upper and inner quadrant of right breast. A clinical diagnosis of fibroadenoma was made.

USG features were suggestive of Fibroadenoma with axillary lymphadenitis and Mammogram features were in favour of Birads II-III.

FNAC was done. FNAC: Proliferative breast disease.

Excision of the lump was done

Gross

Received 2 nodules in one container. Largest

measuring 3 × 2.5 × 1 cm. Smallest measuring 2 ccs in aggregate. C/s greyish yellow, soft to firm (Fig. 1).

Fig. 1: Mass measuring 3 × 2.5 cms c/s yellowish whitewith multiple small pieces 1cc in aggregate.

Microscopy

Multiple sections showed a poorly circumscribed lesion composed of tubular structures of varying sizes, some dilated lined by flattened epithelial cells with outer myoepithelial cells and some of the tubules are filled with eosinohilic secretions. Occassional tubules showed apocrine metaplasia. The tubules are surrounded by nodular collections of cells which are round to oval with clear cytoplasm and uniform nuclei. No atypia seen. Only occasional mitosis seen (Fig. 2,3). In view of the proliferated tubular structures and surrounding clear myoepithelial cells proliferation, diagnosis of AMA was made.

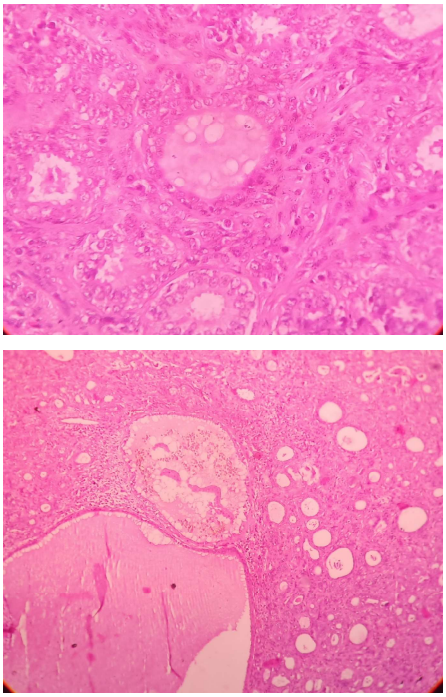

Fig. 2 &3: H & E X400 Tubules of varying sizes surrounded by nodular proliferation of round to oval cells.

IHC

PAN Cytokeratin Cytoplasmic Positivity in the lining epithelial cells of the tubular structures (Fig. 4). SMA cytoplasmic positivity in the myoepithelial cells in the basal cells of the tubules and in the cells around the tubules (Fig. 5). P63 nuclear positivity in the myoepithelial cells (Fig.6). The above IHC confirmed the diagnosis of AMA.

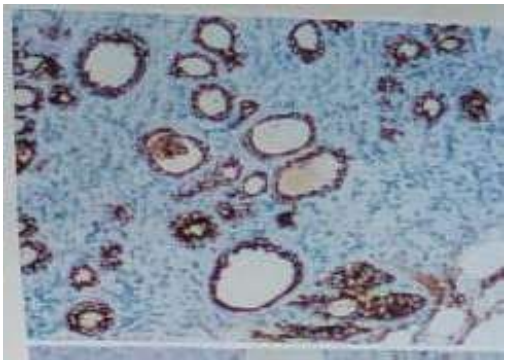

Fig. 4: IHC X400 PanCK Strong cytoplasmic positivity in the epithelial cells lining the tubules.

Fig. 5: IHC X400 SMA strong cytoplasmic positivity in the myoepithelial cells.

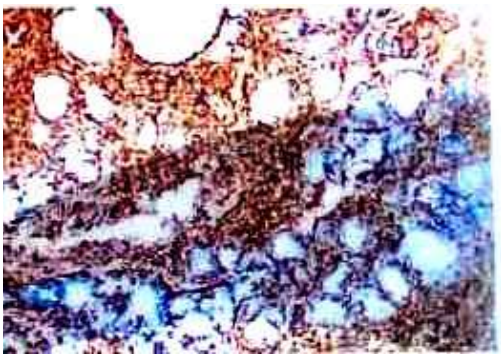

Fig. 6: IHC X400 P 63 nuclear positivity in the myoepithelial cells.

Discussion

Adenomyoepithelial lesions are seen in salivarygland, parathyroid, skin and breast.

Myoepithelial lesions of the breast can be classified as myoepitheliosis (ME), AMA, adenomyoepithelioma (AME) and Epithelial myoepithelial carcinoma (EMC).[5] AMA is a rare type of adenosis mixed or surrounded by AME.[2,3] Pia–Foschini et al.[6] is of the view that these lesions can be referred as tubular AME instead as AMA. AMA can also be associated with fibrocystic change, ductadenosis, papilloma, duct ectasia and apocrine metaplasia. AMA presents as palpable mass from 1.3 cms to 5 cms in size and in our case the size was 3 cms.[4,7,8,10] The epithelial proliferation is seen in the form of round or irregular tubular structures lined by cuboidal to columnar epithelium which may show apocrine metaplasia and squamous metaplasia. Around the tubules prominent proliferastion of myoepithelial cells are seen.[2,4] There will be no significant atypia or mitosis. Our case showed all the above features except squamous metaplasia. Kiaer et al.[7] and Eusebi et al.[8] have reported one case each of AMA in 46 year old woman. Mitra et al.[9] have reported a case of AMA in a 17 year old girl. In our case the patient is 30 years old. AMA is prone for progression to carcinoma.[4] AMA can transform into adenocarcinoma or malignant AME. Microglandular adenosis (MA) and tubular carcinoma (TC) need to be differentiated from AMA. MA lacks the myoepithelial cells. TC has irregular, angulated tubules surrounded by desmoplastic stroma and myoepithelial cells are absent.[10] IHC for dual population of epithelial and myoepithelial cells are confirmatory in AMA. AMA is prone to transform into adenocarcinoma and malignant transformation in a 50 year old female with a lump breat of 20 years duration was reported. The mastectomy revealed AMA with 5 adenocarcinoma foci [4]

Conclusion

The behaviour of AMA of breast is generally benign but it is a lesion with low malignant potential. Recurrence and metastasis may occur as a result of inadequate excision with out wide free margins. Furthur study and follow up of more AMA can throw more light as to the course of the lesion. We report this case for its rarity.

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Corporate (collective) author

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