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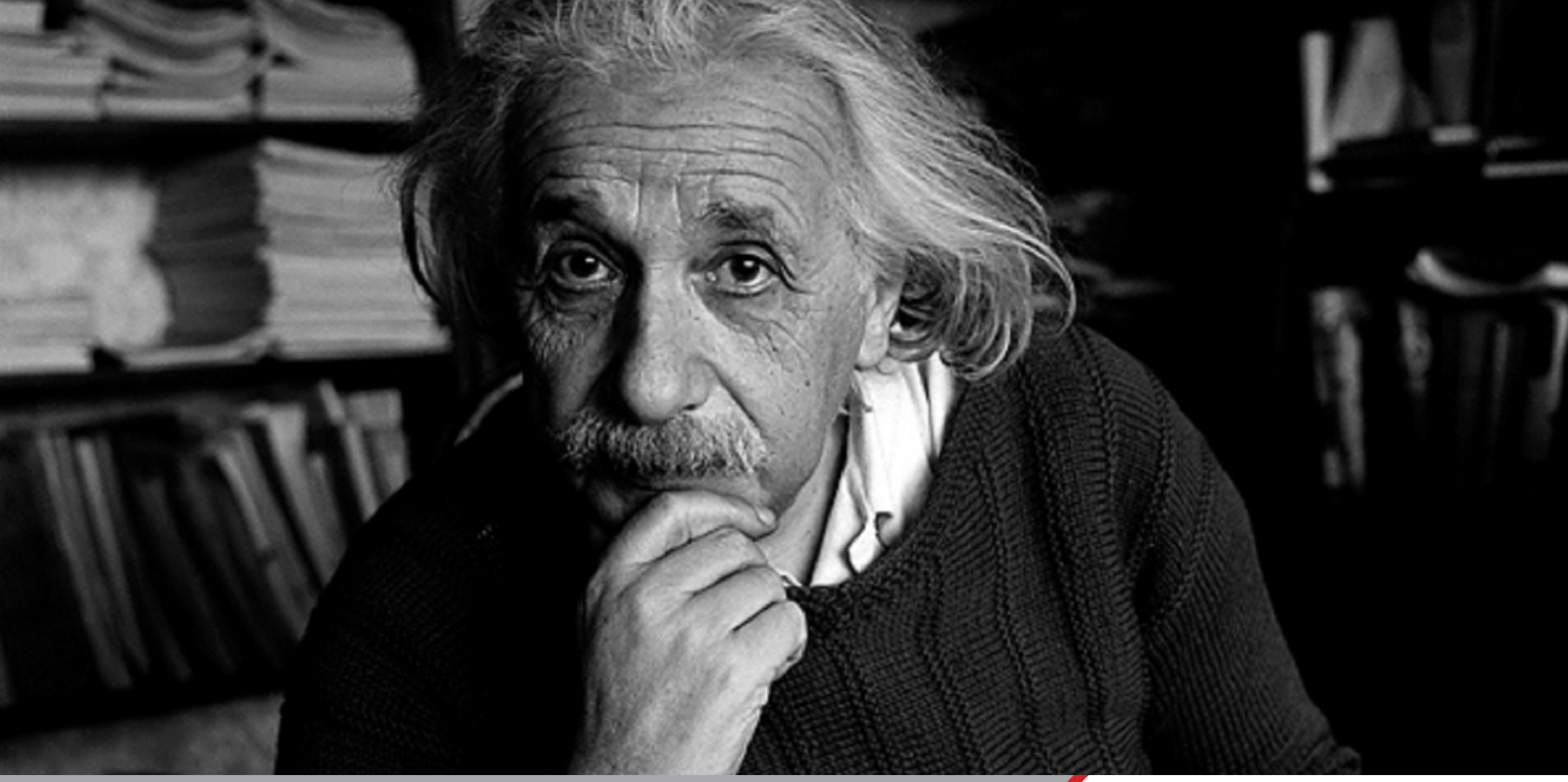

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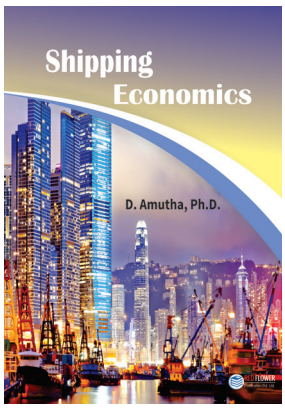

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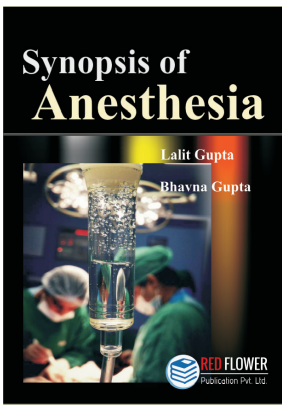

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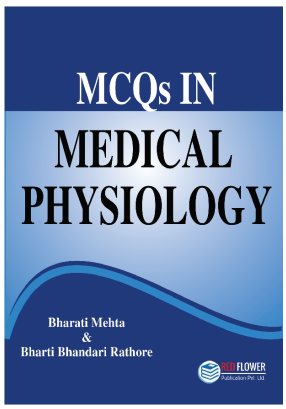

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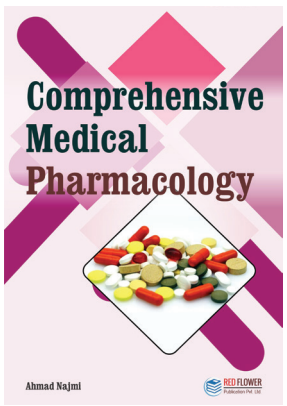

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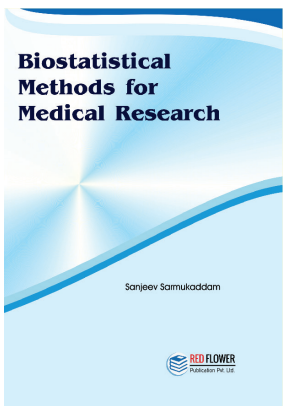

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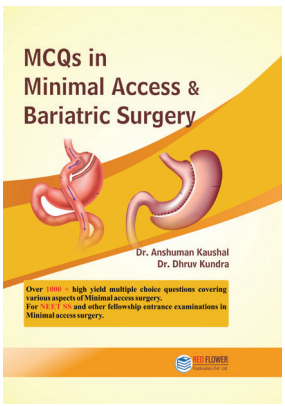

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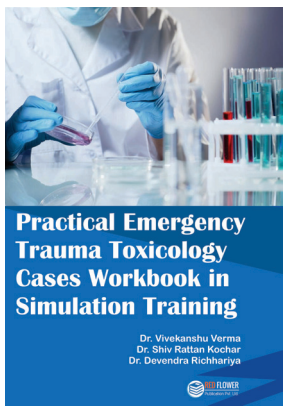

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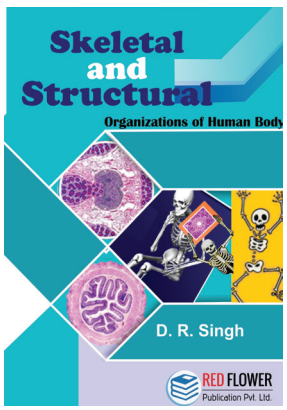

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ORIGINAL ARTICLE

Sexual Dimorphism of Adult Human Spleen in Haryana State of North India

Bhumica Dang[1], Pradeep Bokariya[2], Yogesh Vashist[3], Sanjay Gupta[4], Jyoti Rohilla[5]

ABSTRACT

INTRODUCTION: Spleen is an important lymphoid organ of human body in the upper left part of the abdomen. Spleen performs various functions as it produces immune response against blood-borne antigens and acts as the graveyard of defective and aged erythrocytes. It exhibits sexual dimorphism. The present study is conducted to evaluate sexual dimorphism in morphometry of spleen (spleen weight, length, width, thickness and surface area) in the Haryana region. Region-wise assessment of spleen size gives a broad perspective of spleen sizes and also helps in understanding the ranges in morphometry of spleen with respect to gender. The study proves helpful in context of providing spleen size for spleen transplantation.

MATERIALS AND METHODS: After taking permission from Institute Ethics Committee, 30 male and 30 female adult human spleens in the age group of 16-70 years belonging to the Haryana region of North India were included in the study. The study was conducted in the Anatomy department along with collaboration from the Forensic department at Pt. B.D. Sharma PGIMS, Rohtak. The data thus obtained was recorded and analysed using suitable software.

RESULTS: Statistical significance in dimorphism of splenic weight, length and splenic total surface area in males and females. The results of the present study would be useful for anthropologists, and forensic medicine experts to identify a spleen.

KEYWORDS | spleen, sexual dimorphism, morphometry

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INTRODUCTION

SPLEEN, THE LARGEST UNIT OF LYMPHOID tissue in the body is a soft, purple-colored organ about the size of a fist in the left hypochondrium. It is shaped like the segment of an orange.[1] Spleen is situated in the upper and left part of abdomen between the fundus of stomach and the diaphragm. It lies in the left hypochondrium and partly in epigastrium. Its axis is oblique and is directed downward, forwards, and laterally coinciding with the tenth rib. Two surfaces can be usually recognized, a convex diaphragmatic surface and a visceral surface. The visceral surface has concave gastric and renal impressions and a flat colic impression. The visceral surface has a depression called as hilum in the posterior part of the gastric surface, through its blood vessels, nerves and lymphatics enter or leave the organ. The tail of pancreas is in relationship with it. The normal spleen varies greatly in size. Its

average dimensions are approximately: length 5 inches, breadth 3 inches and thickness 1.5 inches. The average weight in an adult is about 140-200 gms.[2]

Spleen develops as a lobulated mass from the mesoderm of upper part of dorsal mesogastrium under cover of its left layer. There have been some studies depicting sexual differences between splenic parameters, but there is paucity of such study as far Haryana region of North India is concerned so it is thought pertinent to conduct this study.

MATERIALS AND METHODS

The permission from Institute Ethics committee was taken prior to commencement of study.

Material for the present study consisted of apparently healthy spleen of 60 adults (30 male and 30 female) in age group of (16-70) years, belonging to Haryana region of North India.

The specimens were obtained from the department of Forensic Medicine. The medico-legal autopsies which had been performed within twenty four hours of death were included, so that the morphometry is not altered due to decomposition, as Modi reported, that owing to putrefactive changes, spleen becomes pulpy, greenish steel and gets reduced to a different mass in 2-3 days in summer,[3]and the exclusion criteria such as diseases tuberculosis, HIV, hepatitis, SLE, rheumatoid arthritis, thalassemia, polycythemia, lymphomas were noted and spleen from healthy subjects were collected. Spleen samples had not been sufficient in all the age groups and body weight of cadaver is not feasible to be measured so these two criteria were not considered for the study.

Morphometric parameters and the methods used were as follows:

1. *Weight of the spleen:* The weight of the spleen was recorded by using Electronic Weighing Balance of "SARTORIUS-AZ3102 M-PowerSeries" with sensitivity of 0.1 gm.
2. *Length of spleen:* length was noted on diaphragmatic surface by a thread from superior angle to inferior angle passing through maximum convexity. (Figure 1)
3. *Breadth of spleen:* breadth was noted on diaphragmatic surface again by the thread passing horizontally through the maximum convexity and through the mid-point of the length. (Figure 1).
   Thread had been measured against the ruler and length and breadth of spleen was measured.
4. *Thickness of spleen:* Thickness was noted by passing a needle through the maximum convexity and through mid-point of length on diaphragmatic surface. Distance traversed by the needle is measured by the help of a ruler that gives the thickness of spleen. (Figure 1)
5. *Areas of various surfaces* (diaphragmatic, gastric, renal and colic) were calculated after wrapping each surface in butter paper and cutting neatly from the borders; they were outlined on the graph paper. Counting of the squares within the outline gave the surface area. (Figure 1)

Three readings of splenic weight, length, breadth, thickness, and surface area measurements were taken, and their mean values were taken as final reading. The data so obtained was subjected to statistical analysis. Student T-test was applied to study the sexual dimorphism.

P value was calculated and analyzed[4] as:

>0.05 – Statistically Insignificant

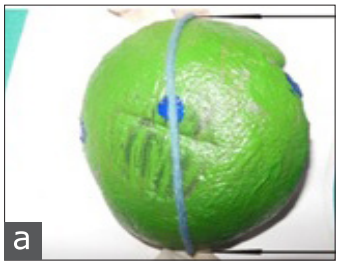
<0.05 – Statistically Significant

<0.01 – Statistically Highly significant

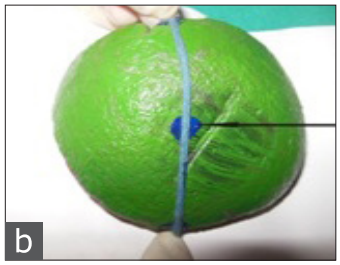
RESULTS

1. **Weight of spleen in male and female.**

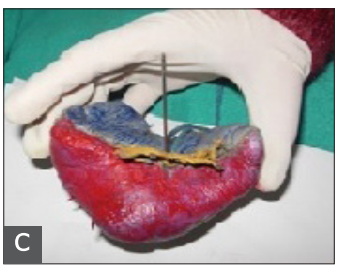
In males, the splenic weight varied from 90 gm to 148 gm. The mean weight was 131.60 ± 12.90gm. In females, the splenic weight varied from 70gm to 94gm. The mean weight was 87.86 ± 5.69 gm. When splenic weight of male was compared with that of females; it showed p



Comparison Showing the method of measuring the Spelnic length between two fixed points. 1. Superior angle 2. Inferior angle



Showing the method to measure Splenic breadth (taking the midpoint of the Splenic length as the fixed point).



Showing the method of measuring the thickness of the spleen.

Showing the measurement of the surface area of renal surface.

value as <0.01. The difference was found to be highly significant statistically. (Table 1)

2. **Sexual dimorphism in dimensions (length, breadth and thickness) of spleen**.

I **Length of spleen**

In males, the length of spleen varied from 9.5 cm to 17 cm. (mean length 11.45 ± 1.43 cm). In females, the length of spleen varied from 8 cm to 13 cm. (meanlength 9.91 ± 1.18 cm). The difference was found to be extremely statistically significant (p value =.000166). (Table 1).

II **Breadth of spleen**

In males, breadth of spleen varied from 5 to 8 cm. (mean breadth was 6.26 ± 0.73 cm). In females, breadth of spleen varied from 4 to 8 cm. In females; mean breadth of spleen was 6.01 ± 0.914 cm. The difference was not statistically significant. (Table 1).

III **Thickness of spleen**

In males, thickness varied from 1.5 to 2 cm. (mean thickness was 1.92 ± 0.09 cm). In females, thickness varied from 1.5 to 2 cm. (mean splenic thickness was 1.92 ± 0.15 cm). The difference was not statistically significant as p value was 0.91. (Table 1).

3. **Sexual dimorphism in total surface area of spleen**.

In males, surface area varied from 213 cm sq to 308 cm sq. (mean surface area of spleen was 256.23 ± 23.46 cm sq). In females, surface area varied from 123 to 202 cm sq. (mean surface area was 158.96 ± 25.41 cm sq). When comparison between the two was done; P value was < 0.01. The difference was found to be highly significant. (Table 1).

DISCUSSION

The present study was conducted to see sexual dimorphism of spleen in North- Indian population (specifically of Haryana). Such study was not done in the past to the best of my knowledge. The comparison of the observations of morphometric parameters of the spleen in our study with those of other workers is shown

Serial No.:	Morphometric parameter	Male (n=30)	Female (n=30)	P Value
1	Splenic weight (gm)	131.6 ± 12.8	87.86 ± 5.7	P <0.01 (Significant)
2	Splenic length (cm)	11.45 ± 1.44	9.91 ± 1.18	P <0.01 (Significant)
3	Splenic breadth (cm)	6.26 ± 0.74	6.01 ± 0.90	p> 0.01 (Non-significant)
4	Splenic thickness (cm)	1.92 ± 0.09	1.92 ± 0.25	p> 0.01
5	Splenic total surface area (sq cm)	256.23 ± 23.47	158.96 ± 25.82	P <0.01 (Significant)

Table 1: Measurements of spleen morphometry.

LENGTH	PRESENT STUDY (Cadaveric)	ASGHAR (by CT Images)[15]	MITTAL (Sonographic)[13]	MACHALEK (Cadaveric Study)[11]
Male	11.45 ± 1.43	10.91 ± 1.67	9.40 ± 0.91	12.3
Female	9.916 ± 1.18	10.34 ± 1.58	9.34 ± 0.95	11.2
Sex Difference	Significant	Not significant	Not significant	Significant

Table 2: Comparison of splenic length with other studies

Average Splenic width (cms)	Present study 6.13+/-0.82	Arora et al[14]	Asghar et al[15,16] 6.26+/-1.66	Spielmann et al[12]	Mittal & Choudhry[13]	Machalek et al[11]
Males	6.26 +/-0.73	–	6.74 +/- 1.62	5.0 +/-0.8	3.45+/-0.59	7.5
Females	6.01 +/- 0.91	–	5.61 +/- 1.58	4.2 +/-0.7	3.45+/-0.59	7.4
Sexual difference	Not significant	More in Males	Not Significant	–	–	–

Table 3: Comparison of splenic width with other studies.

Splenic thickness	Present study	Arora et al[14]
Average	1.89+/-0.16	–
Male	1.86+/-0.17	–
Female	1.92+/-0.15	–
Sexual difference	Not significant	More in Males

Table 4: Comparison of splenic thickness with other studies.

Total surface area of spleen	Present study	Asghar et al [15,16]
Males	256.23+/-23.46	290.35+/-14.78
Females	158.96+/-25.41	205.56+/-77.65
Sexual difference	Highly Significant	Significant

Table 5: Comparison of splenic total surface area with other studies

in the table: 1-5 as per available literature.

In our study, average weight in males was 131.6 ± 12.90 gm and in females average weight was 87.86 ± 5.69 gm. The difference was found to be highly statistically significant. In the study done by Krumbhaar and Lipincott, they had found that male spleens were heavier than the female spleens.[5] Jain *et al.* calculated mean average weight in males as 149 gm and 146.4 gm in females.[6] Sprogoe-Jakobsen *et al.* reported that in males; average weight was found to be 130.3 gm while in females average weight was 124.2 gm.[7] Their study concluded that spleen weight is not correlated to sex apart from the fact that females are smaller than males. Grandmaison *et al.* reported that in males; average weight was reported as 156 ± 87 gm, while in females average weight was 140 ± 78 gm.[8] Kim *et al.* studied the average weight in males as 115.29 ± 42.93 gm; and in females average weight was 99.51 ± 43 gm.[9] There was no statistically significant difference in the spleen weight of males and females. In 2006, Kohli and Aggarwal compared the spleen weights at

various places e.g. Delhi, U.P., Bombay, and Nagpur and gave the average weight of spleen in males as 130-160 gm and in females as 120-150 gm.[10] The average length of spleen in males was 11.45 ± 1.43 cm and in females it was 9.91 ± 1.18 cm. The difference was found to be extremely significant. (p value = 0.00016). In a study done[4] on the cadavers by Machalek *et al.*[11] (sample size =35); average in males was found to be 12.3 cm and average in females was 11.2 cm. In study by Spielman *et al.*[12] average in males was found to be 11.40 ± 1.7 cm and average in females was found to be 10.30 ± 1.1 cm. Mittal *et al.*[13] did sonographic study on 100 male and 100 female subjects and came out with average of 9.40 ± 0.91 cm in males and 9.34 ± 0.95 cm. Asghar *et al.*[15,16] did study on CT images and found the average to be 10.67 ± 1.62 cm and in males average was found to be 10.91 ± 1.67 cm and in females it was 10.34 ± 1.58 cm. The difference in our study and in other studies was not much. Sexual dimorphism was positive in our study and length is more in males as was concluded by the sonographic study of Arora *et al.*[14] Sexual dimorphism was not reported by Machalek *et al.*[11] and by Asghar *et al.*[15,16] (As shown in Table 2)

Machalek *et al.*[11] (cadaveric study; n= 35 each) concluded that average width was 7.5 cm in males and 7.4 in females. Mittal *et al.* [13] (sonographic study; n =100 each) concluded that 3.45 ± 0.59 cm was average width in males and in females. Study by Asghar *et al.*[15,16] concluded that average width was 6.26 ± 1.66 cm.

Average width in males was 6.74 ± 1.62 cm and in females was 5.61 ± 1.58 cm. In our study, average width was 6.13 ± 0.82 cm. In males, it was 6.26+ /- 0.73 cm. In females, average width was 6.01 ± 0.914 cm. Sexual dimorphism was not seen in our study as well as those in the studies by Machalek *et al.*[11] and Asghar *et al.*[15,16] (As shown in Table 3)

Splenic thickness was calculated, and average came out to be 1.89 ± 0.16 cm. In males; average thickness was 1.86 ± 0.17 cm and in females; average thickness was found to be 1.92 ± 0.15 cm. Thickness was found to be greater in females in our study though the difference was not statistically significant but in the study done by Arora *et al.*[14] thickness was more in males. (As shown in Table 4).

Average total surface area in our study 207.59 ± 24.43 sq cm. In males, it was 256.23 ± 23.46 sq cm and in females it was 158.96 ± 25.41 sq cm (p value < 0.01). The difference was highly statistically significant. The average surface area calculated by Asghar *et al.* was 254.01 ± 127.56 sq cm. In males, it was 290.35 ± 14.78 sq cm. and in females it was 205.56 ± 77.65 sq cm (p value was > 0.5)[15,16] (As shown in Table 5).

CONCLUSION

The broad objective of the study was to assess the morphometry and sexual dimorphism of spleen in Haryana region of North India.

Thirty spleens of each male and female human cadavers (of Haryana region) were taken and studied for morphometry and sexual dimorphism. The results showed sexual dimorphism in splenic weight, length and total surface area. IJFMP

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ORIGINAL ARTICLE

A Study on Histopathological Changes and Neonatal Outcomes in the Placenta of COVID-19 Positive Mothers–A Prospective Study

Sudha V[1], Muthu Subramanian[2], Ganthimathi Sekhar[3], Chitra Srinivasan[4]

ABSTRACT

CONTEXT: It has been estimated that are about 168 million lab confirmed COVID 19 cases worldwide as of 28th may, 2021. Due to the high prevalence of this disease, it is of utmost importance to study its effect on the vulnerable population of pregnant women.

AIM: Aim of the study are 1) the histopathological changes in placenta of COVID19 mothers. 2) To correlate the histopathological changes with the fetal outcome in COVID 19 positive mothers.

MATERIALS & METHOD: Twenty five placentas of Covid 19 positive mothers were received in formalin with proper clinical history including age of the mother, gestational age, mode of delivery, complications during pregnancy and during labor, baby weight and APGAR score of the baby. The specimen were allowed to fix in neutral buffered formalin for a period of 48 hrs. The placentas were then grossly and histopathologically examined.

RESULTS: Out of 25 placentas, some showed features of maternal vascular malperfusion (MVM), particularly villous infarct, villous agglutination and intervillous and perivillous fibrin deposits. Some showed fetal vascular malperfusion features like avascular villi, stem vessel obliteration were also present in a few of the cases. Out of the 25 pregnancies, 21 babies were delivered live with normal birth weight. There were 4 spontaneous abortions ranging from 14 - 22 weeks.

CONCLUSION: As the placenta acts as a bridge between the mother and the developing baby, any insult to the placenta in the form of maternal or fetal vascular malperfusion may result in an adverse perinatal outcome.

KEYWORDS | placenta, COVID-19, histoplathology, malperfusion

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INTRODUCTION

THE COVID-19 PANDEMIC IS STILL ACTIVE IN many parts of the world. It is caused by the novel coronavirus SARS-CoV-2, an enveloped positive-stranded RNA virus. It has a characteristic spike protein. The host receptor for SARS-CoV-2 cell entry is the angiotensin-converting enzyme 2 (ACE2) receptor.[1] The expression and distribution of ACE2 receptor has been reported in heart, lungs and kidneys, which exhibit tissue-specific activity patterns.[2-4] Some of the previous studies have shown the expression of ACE2 receptor on the syncytiotrophoblast and the cytotrophoblast. It has also been found on the endothelium and the vascular smooth muscle of both primary and secondary villi of the placenta.[5] The primary site of infection is the respiratory system, but recent research shows that it is also capable of infecting other organs including the placenta.

The placenta is a key organ that fulfills

several critical roles as the interface between the mother and fetus and plays a major part in preventing maternal-fetal transmission of pathogens.[6] It has been reported that the novel coronavirus may pose a greater risk in pregnant women than in non-pregnant women and increase the risk for requiring intensive care and mechanical ventilation during pregnancy.[7,8] It also increases complications like preterm births.[9] Poor respiratory function due to infection in mother is likely to impact maternal and fetal oxygenation during pregnancy.

Although the syncytiotrophoblast (ST) of the villi, which lines the surface of the placenta, acts as a barrier to placental infection, viral infections of the placenta do occur most commonly with DNA viruses and histologically show evidences of chronic inflammation. Our study aims at identifying the histopathological changes in the placentas of mothers who had Covid-19 infection, which is a RNA virus.

METHOD AND MATERIALS

This was a prospective study done to identify the histopathological changes in the placentas obtained from mothers who tested positive for COVID-19 by RT-PCR. All the placentas of COVID-19positive mothers received in the Department of Pathology of a tertiary care center in South India between November 2020 and April 2021 were included in this study. Total of 25 placentas were received and fixed in 10% neutral buffered formalin for 48 hours before dissection due to the infectious nature of the disease. All relevant clinical information was retrieved from the medical case record of the patients. The placenta were examined for macroscopic changes. Sections were submitted from membrane rolls, the umbilical cord, the maternal and fetal surfaces of the placenta and from any obvious lesions. The sections underwent routine processing, embedding, sectioning at 4µm and staining with hematoxylin and eosin (H&E). Histological examination was performed in each of the sections submitted.

RESULTS

A total of 25 placentas of RT-PCR confirmed COVID-19 positive mothers were examined. Out of which, 2 had clinical history of preeclampsia, 2 had hypothyroidism, 1 had oligohydramnios and the rest of the pregnant mothers had no specific clinical history.

21 of the pregnant mothers were in the third trimester at the time of diagnosis of COVID-19 and delivered in the third trimester.4 out of 25 mothers were diagnosed earlier in their pregnancy and had extremely preterm delivery(< 20 weeks of gestation) and underwent spontaneous expulsion in second trimester. Out of the 4, one had previous history of abortion. 15 of them were primi and the rest of them were of gravid 2, 3 and 4.

Majority of (18/25) mothers underwent lower segment cesarean section (LSCS) and only 3 had normal delivery. Out of 18 mothers,10 had previous LSCS. All babies born at term were with the birthweight ranging between 2.5 kg and 3.2 kg with one exception of 1.66 kg. In all these cases, the infants had 5-minute Apgar score of 8 or 9, and were admitted in the well-baby nursery, and discharged home without apparent sequelae.

All the placental discs appeared grossly normal except for the presence of subtle pale areas in few placentas. All the cords contained three vessels with no knots or any other gross lesions. The cords showed either central or eccentric insertion. One placental disc showed thrombotic lesions in the vessels of the chorionic plate.

Histopathological examination showed varied features of maternal vascular malperfusion, fetal vascular malperfusion, acute and chronic inflammatory pathology and few other findings like perivillous fibrin deposits, villous edema, increased syncytial knots, dystrophic calcification etc.

As a feature of maternal vascular malperfusion, 11/25 cases had villous infarct of more than 30%, villous agglutination and perivillous fibrin deposition. Decidual arteriopathy in the form of fibrinoid necrosis, mural hypertrophy, decidual artery perivasculitis and calcification were seen in few

CASE NO	AGE	GA	G	P	MODE OF DELIVERY	BIRTH WEIGHT	APGAR 1'	APGAR 5'	MATERNAL COMPLICATIONS
1	23	22 wks	2	1	Spontaneous expulsion	Dead	8/10	9/10	Hypothyroidism
2	33	38 wks	2	1	LSCS	2690	8/10	9/10	–
3	33	38wks +2d	2	1	LSCS	2630	8/10	9/10	–
4	32	39 wks	2	1	LSCS	2560	8/10	9/10	–
5	23	14 wks	1	1	Spontaneous expulsion	Dead	8/10	9/10	–
6	28	39 wks+ 5d	2	1	NVD	2930	8/10	9/10	–
7	30	38 wks 2d	3	1	LSCS	3220	8/10	9/10	Preeclampsia
8	27	40 wks	1	1	LSCS	3150	8/10	9/10	–
9	21	40 wks	1	1	LSCS	2490	8/10	9/10	Postdated, Oligo-hydraminos
10	25	39 wks +2d	2	1	LSCS	3162	8/10	9/10	–
11	28	38 w+ 4d	1	1	LSCS	1660	8/10	9/10	–
12	32	38 wks	1	1	LSCS	2970	8/10	9/10	–
13	32	38 wks	3	2	LSCS	3070	8/10	9/10	–
14	23	39 wks +6d	1	1	LSCS	3650	8/10	9/10	Eclampsia
15	23	40 wks	1	1	LSCS	3000	8/10	9/10	Hypothyroidism
16	28	39 wks+ 5d	2	1	NVD	2930	8/10	9/10	–
17	25	17wks+1d	1	1	Spontaneous expulsion	DEAD	8/10	9/10	–
18	25	39 wks +2d	2	1	LSCS	3200	8/10	9/10	–
19	24	37 wks+3d	4	0	LSCS	2700	8/10	9/10	–
20	34	37 wks+4d	3	1	LSCS	2780	8/10	9/10	–
21	25	38 wks+5d	2	1	LSCS	2600	8/10	9/10	–
22	29	37 wks+6d	1	1	NVD	2490	8/10	9/10	–
23	20	19 wks+3d	1	1	Spontaneous expulsion	DEAD	8/10	9/10	–
24	30	34 wks	3	1	LSCS	2620	8/10	9/10	Preeclampsia
25	24	38 wks	2	1	LSCS	3100	8/10	9/10	–

Table 1: Clinical and Neonatal details of covid 19 positive mothers

of the cases. Retroplacental hematoma was seen in one case. (Fig. 1), (Fig. 1-4)

Out of 25 cases, features of fetal vascular malperfusion were seen in 12cases, 3/25 cases had avascular villi, fetal vessel mural fibrin deposition.[4] cases had stem vessel obliteration, one case had chorionic plate thrombus, 4 cases had chorangiosis and one had chorangioma. (Fig. 2) (Fig. 2-5)

Maternal inflammatory response in the form of acute chorioamnionitis was diagnosed in 6 cases. 2 were of stage 3 and grade 3 and all others were stage 1 and stage 2. Chronic inflammatory pathology like chronic villitis and chronic chorionitis were seen in 2 of the cases. Peri villous fibrin deposits were seen in 11 cases,increased syncytial knots were seen in 9 cases, intervillous thrombus was seen in 3 cases and dystrophic calcification of more than 10% was seen in 10 cases. (Fig 3) (Fig 3-6)

DISCUSSION

The pathology of placentas of COVID-19 positive patients has not been specifically addressed so far. The cesarean section (CS) rate in our study for women with confirmed COVID-19 infection is (18/25) 72%. According to other studies, the same has been reported as ranging from 42.9% to as high as 91–92%.[10] As per Di Mascio in his systematic review, cesarean section was not needed for mild and moderate Covid-19 infections but the procedures were performed in maternal interest, due to concern of sudden maternal decompensation and other comorbidities like Preeclampsia, eclampsia and oligohydramnios as observed in our study.

Maternal vascular malperfusion can reduce or completely interrupt the uteroplacental circulation, resulting in placental infarcts which consist of collapsed maternal intervillous spaces and necrotic villi, abruptio placentae, and ischemic lesions.[11] Peripheral infarcts on the maternal side of the placenta are common at term and, if small, usually not clinically significant. Perinatal morbidity is related with infarcts of >5 percent of the placental mass or

greater than 3 cm in diameter.[12,13] If 20 percent or more of the placenta is affected, infarcts are considered clinically severe (e.g. associated with fetal growth restriction/stillbirth).[14]

In our observation, findings that correlate with maternal vascular malperfusion include, maternal floor infarct of more than 10% of parenchyma and villous agglutination were seen in (11/25)44%. Only 3 of them had clinical history of preeclampsia and eclampsia. Features of decidual arteriopathy including mural hypertrophy and calcifications were seen in(3/25) 12 % and (8/25) 32 % respectively. Increased syncytial knots (>1 in 3 to 5 terminal villi and/or >10 nuclei per knot) were present in 40% with few cases of increased intervillous fibrin deposition. Maternal hypertensive disorders, including gestational hypertension and preeclampsia are the major risk factors for MVM,[15,16] which were observed in 8% in our study. The manuscript by Shanes *et al.*[17] describes an increased prevalence of MVM in their series of 16 placentas delivered to women with COVID-19.

Fetal vascular malperfusion (FVM) is an indicator of fetal well-being and outcome. The most striking histological abnormality in our study was the occurrence of extensive avascular fibrotic villi in 12% of placentas. Avascular villi are usually the results of fetal vascular damage. Obliterated or collapsed vessels could be identified in 20% of the stem villi and larger intermediate villi, but the smaller intermediate and terminal villi showed hyalinised stroma. Fetal vessel thrombus has been associated with maternal diabetes, 14 coagulation disorders 15 and pre-eclampsia.[16] In our study only 3 patients i.e., 12% had history of pre-eclampsia. Chorangiosis were seen in 20% of placenta. Only one case showed a feature of chorangioma which was a microscopic lesion. Most chorangiomas are incidental but benign findings, but as size increases, there is an increasing risk of adverse outcome due to high output heart failure.[18] Notably, a higher concentration of chorangioma is associated with reduced oxygen saturation.

Viral infections like TORCH (Toxoplasma, others, rubella, cytomegalovirus [CMV], herpes) are very common during pregnancy. Among those infections CMV is the leading cause of prenatal viral infections. In a study conducted by Jenna M Iwasenko *et al.* Fetal thrombotic vasculopathy was the only histopathological abnormality associated in 60% CMV-infected placentas.[19]

In another case control study , placental and fetal findings were interpreted in 62 fetal deaths in which CMV, Herpes and Parvoviruses were detected through PCR. Fetal hydrops and chronic villitis were evident in all those cases. [20] whereas in another study on Herpes simplex virus infected placentas the microscopic findings were remarkable for the absence of both inflammation and characteristic viral inclusions.[21]

In a study on Zika virus, the placenta demonstrated prominently enlarged, hydropic chorionic villi with hyperplasia and focal proliferation of Hofbauer cells. No acute or chronic villitis, villous necrosis, remote necroinflammatory abnormalities, chorioamnionitis, funisitis, or hemorrhages were present.[22]

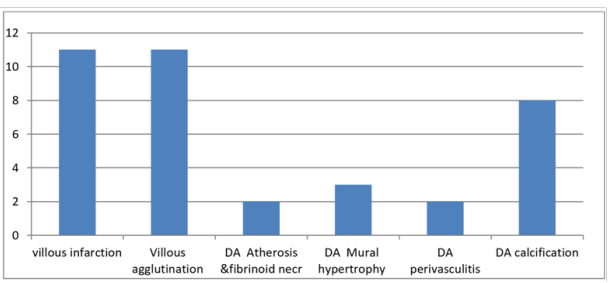
HIV-associated placental findings are well described which include acute chorioamnionitis, low placental weight, and maternal vascular malperfusion and lower rates of chronic villitis.[23]

As covid-19 is also a viral infection, we expect inflammatory pathology in placentas of infected mothers. Acute inflammatory pathology in the form of acute chorioamnionitis of various stages and grades were present in 24% of placentas and chronic inflammatory pathologies, particularly chronic villitis or chronic intervillositis and deciduitis were present in only 8%. There are only case reports identifying a chronic inflammatory process so far.[24,25,26] This is a brief report of initial findings seen in placentas of Covid-19 infected mothers.

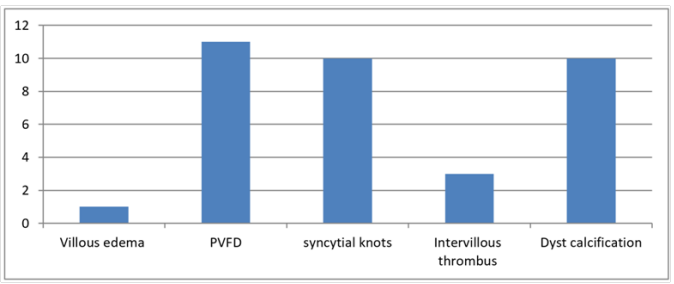
In viral infections, the conventional light microscopic findings along with other ancillary techniques like immunohistochemical / histochemical, in situ hybridization as well as PCR are necessary to establish a diagnosis

CASE NO	MVM	FVM	OTHERS
1	Villousinfarction, decidual artery mural, hypertrophy perivasculituis and calcification	Avascularvilli, stem vessel Obliteration Obliteration	Chorionic deciduitis, CIP
2	Villous infarction	–	Syncytial knots, intervillous thrombi, dystrophic calcification
3	-	–	–
4	Villous agglutination	–	Villous edema, PVFD, syncytial knots, dystrophic calcification
5	Villous agglutination, decidual artery calcification	Fetal vessel mural fibrin, Chorangiosis	Villous edema, PVFD, syncytial knots, dystrophi calcification
6	Villous agglutination, decidual artery Mural hypertrophy	Stem vessel obliteration	Maternal inflammatory response, villous edema, syncytial knots
7	Villous infarction, Villous agglutination, Decidual artery perivasculitis	Fetal vessel mural fibrin, chorionic plate infarct	PVFD
8	–	–	–
9	–	–	–
10	–	–	–
11	Villous infarction, decidual artery calcification, retroplacental hematoma	–	Maternal inflammatory response, syncytial knots
12	Villous infarction, villous agglutination, decidual artery calcification	Chorangiosis	PVFD, syncytial knots
13	Villous agglutination	–	Maternal inflammatory response, PVFD, syncytial knots
14	Villous agglutination, decidual artery Mural hypertrophy and calcification	Avascular villi, fetal vessel mural fibrin, stem vessel obliteration, chorangiosis hypercoiled umbilical chord	Maternal inflammatory response, PVFD, syncytial knots, dystrophic calcification
15	–	Chorangiosis	–
16	Villous agglutination	–	PVFD, dystrophic calcification
17	Villous infarction, villous agglutination, decidual artery atherosisand calcification,		PVFD
18	Villous infarction, decidual artery calcification	–	Intervillous thrombi, Dystrophic calcification
19	Villous infarction, decidual artery atherosis	stem vessel obliteration	Maternal inflammatory response, intervillous thrombi
20	–	–	–
21	Villous infarction, villous agglutination, decidual artery calcification	–	PVFD, syncytial knots, dystrophic calcification
22	Villous agglutination	Stem vessel obliteration, chorangiosis	CIP, PVFD, syncytial knots
23	Villous infarction	–	Maternal inflammatory response, chronic deciduitis
24	Villous infarction	–	Dystrophic calcification
25	–	–	–

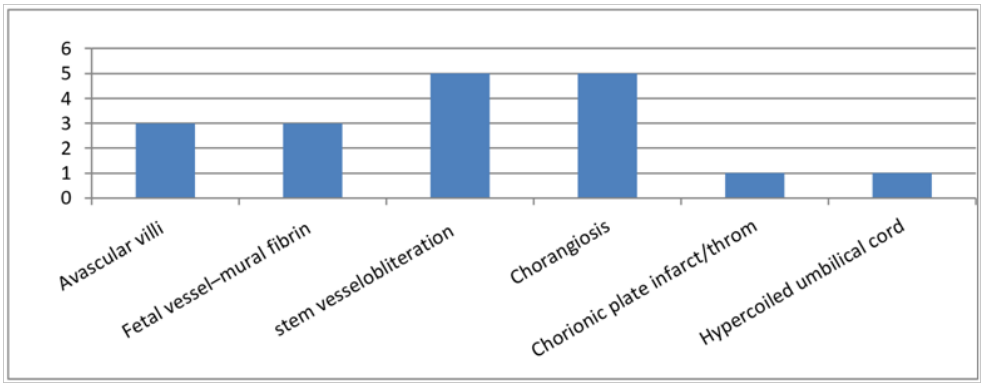
Table 2: Microscopic features in placentas of Covid-19 positive mothers.



Graph 1: Showing the distribution of various placental changes.



Graph 2: Showing the distribution of various maternal vascular malperfusion changes.



Graph 3: Showing the distribution of various maternal vascular malperfusion changes.

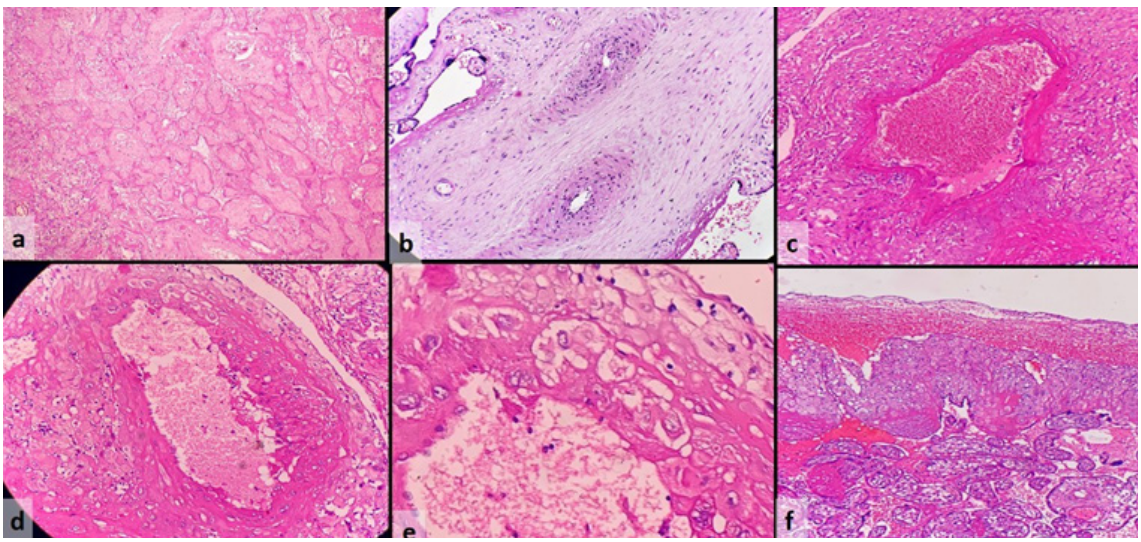


Figure 1: a) Massive villous infarct, H&E, x200, b) Mural hypertrophy, H&E, x200, c) Decidual arteriopathy, H&E, x200, d) Decidual atherosis, H&E, x200, e) Decidual atherosis H&E x200, f) Retroplacental Hemorrhage, H&E, x200

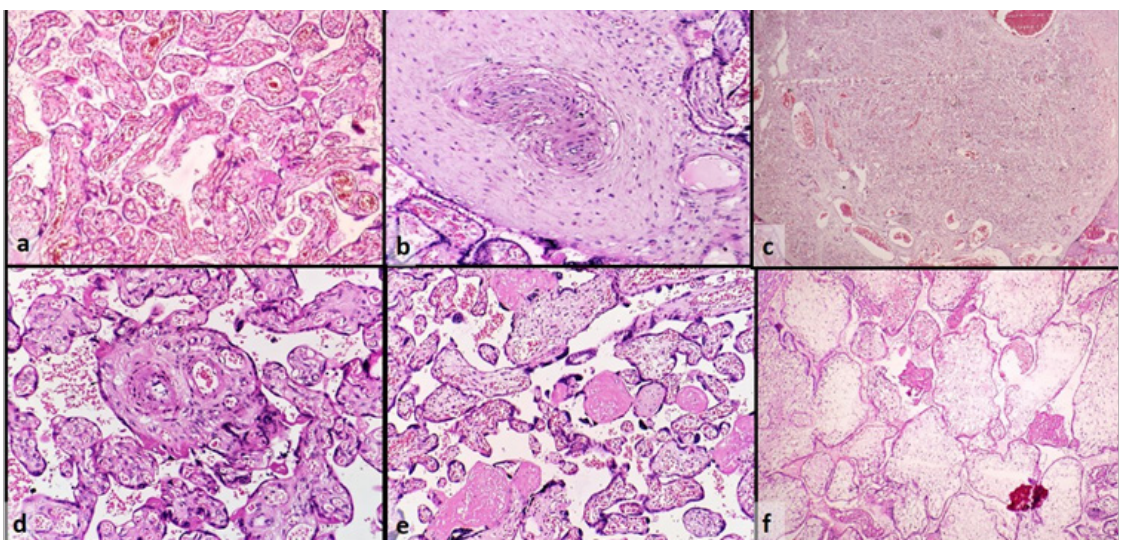


Figure 2: a) Massive villous infarct, H&E, x200, b) Mural hypertrophy, H&E, x200, c) Decidual arteriopathy, H&E, x200, d) Decidual atherosis, H&E, x200, e) Decidual atherosis H&E x200, f) Retroplacental Hemorrhage, H&E, x200

VIRUSES	VASCULOPATHY	CHRONIC VILLITIS	HYDROPIC VILLI	PVFD	ACUTE CHORIOAMNIONITIS	DECIDUITIS
CMV[19,20]	+	+	-	+	-	-
Herpes[20,21]	-	+	-	-	-	-
Parvovirus B19[20]	-	+	-	-	-	-
Zika virus[22]	-	-	+	-	-	-
HIV[23]	+	+	-	-	+	-
Covid 19	+	+	-	+	+	+

Graph 1: Microscopic features of placentasin various other viral infections

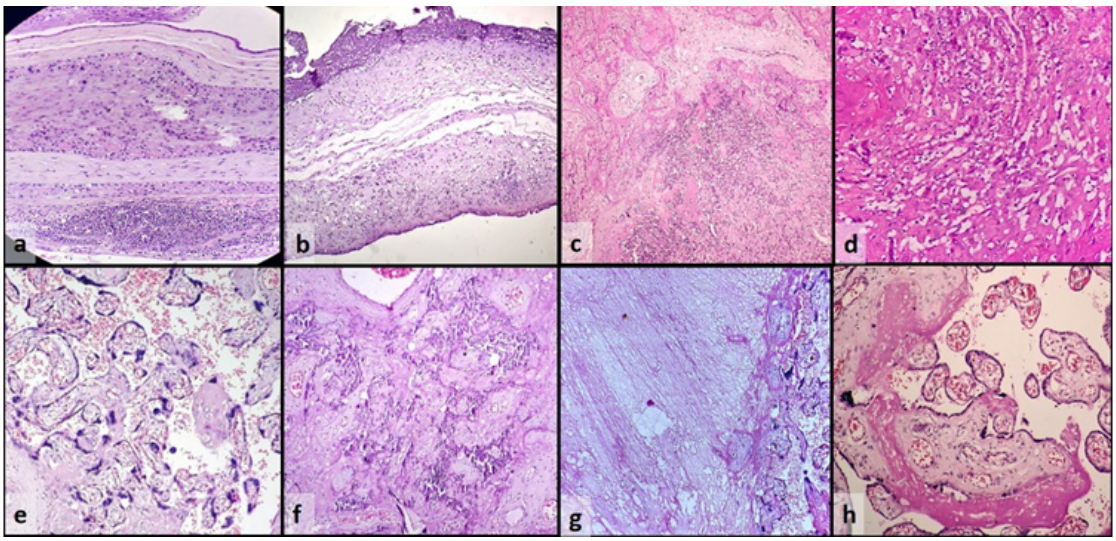


Figure 3: a) Massive villous infarct, H&E, x200, b) Mural hypertrophy, H&E, x200, c) Decidual arteriopathy, H&E, x200, d) Decidual atherosis, H&E, x200, e) Decidual atherosis H&E x200, f) Retroplacental Hemorrhage, H&E, x200

thereby the pathological findings can be correlated. This study is subject to some limitations due to relatively low number of patients observed. Further larger studies are necessary to determine the reproducibility and significance of these initial findings.

CONCLUSION

COVID-19 can potentially cause some abnormalities in the placenta of pregnant ladies and can lead to adverse pregnancy outcomes including reduced fetal growth, stillbirth, pre-eclampsia, and premature birth. We report various placental pathology observed in 25 patients with Covid-19 infection. No pathognomonic features are identified; however, there are increased rates of maternal vascular malperfusion features, suggesting an abnormal maternal circulation. These findings provide mechanistic insight into the observed epidemiologic associations between COVID-19 in pregnancy and adverse perinatal outcomes. Collectively, these findings suggest that increased antenatal surveillance for pregnant women diagnosed with SARS-CoV-2 could also be warranted. IJFMP

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ORIGINAL ARTICLE

Histopathological Evaluation of Cardiac Lesions in Autopsy Specimens

Clement Wilfred D[1], Chinki Anupam[2]

ABSTRACT

CONTEXT: Evaluation of cardiac autopsy specimens is crucial for identifying concealed cardiovascular pathology and providing insights into the pathogenesis and progression of disease. Hence, this study was undertaken to evaluate the histopathological features of cardiac lesions in autopsy specimens.

METHOD: The was a prospective cross-sectional study conducted on cardiac specimens from routine autopsies over a period of three and half years, between January 2018 and June 2021, at M.S. Ramaiah Medical College and Hospitals, Bengaluru. The hearts were evaluated grossly and microscopically to identify the various histopathological changes. **RESULTS:** A total of 250 cases, with mean age of 39±15 years and male-female ratio of 4.4:1, were evaluated. In 207 (82.8%) cases 299 morphological lesions were identified, comprised of coronary atherosclerosis (52.4%), myocardial infarction (26%), aortic atherosclerosis (21.2%), cardiac hypertrophy (12%), valvular disease (2%), aortic dissection (2%), cardiac tamponade (1.6%), pericarditis (1.2%), myocarditis (0.8%) and cardiomyopathy (0.4%). **CONCLUSION:** Cardiac lesions were detected in 82.8% in autopsies. The most frequent finding is coronary atherosclerosis with triple vessel involvement being the commonest. Severe luminal occlusion, calcification and thrombosis are most frequent in Left anterior descending coronary artery. The next most common lesion is Myocardial Infarction, the most significant pathogenetic mechanism of which is coronary atherosclerosis. There is a strong association between coronary and ascending aorta atherosclerosis. Thus, many preventable and concealed lesions are discovered at cardiac autopsies and this data is important for assessing disease trends and introducing new interventions and therapeutic management regimes.

KEYWORDS | atherosclerosis, autopsy, cardiac specimen, coronary, myocardial infarction

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AUTOPSY PROVIDE AN OPPORTUNITY TO STUDY the etiopathogenesis of human diseases, to evaluate the influence of diseases on other organs systems, to correlate the macro and microscopic features of organs with clinico-laboratory findings and to determine the probable cause of death.[1]

India has a high burden of cardiovascular disease (CVD) accounting for 28.1% of total deaths and 14.1% of total disability-adjusted life.[2,3] According to Global Burden of Disease study, the age-standardized CVD death rate in India is 272 per 100,000 population, which is definitely higher than the global average of 235.[2] Further its incidence is increasing, especially in the young urban population due to high incident rates of risk factors like obesity, diabetes, hypertension, dyslipidemia and smoking.[2]

Cardiac specimen is routinely sent for histomorphologic evaluation, following post-mortem examination, in order to detect any concealed CVD, especially in cases of sudden/ unnatural death. Many CVD's are incidentally detected at autopsy.[4] A wide and varied spectrum of cardiac lesions can be discerned on histopathology post autopsy and this data can provide valuable insights into the pathogenesis,

progression, epidemiology and clinical management.[1,4] Hence the present study was conducted with the objective of evaluating the histopathological features and determining the frequency of the varied lesions identified in routine cardiac autopsy specimens.

MATERIALS AND METHOLOGY

This was a single centre prospective cross-sectional study conducted on all cardiac specimens from routine consecutive autopsies over a duration of three and half years, between January 2018 and June 2021, at M.S. Ramaiah Medical College and Hospital, Bengaluru. Autolysed specimens and perinatal and neonatal autopsies were excluded.

The specimens were received in the autopsy division of histopathology section and in every case the standard protocol for surgical grossing by "Virchoff's method" was followed. The dimensions, weight, thickness of right and left ventricular and interventricular septum were recorded. The status of the i) atrial, ventricular and septal walls (defects/infarcts); ii) chambers (normal/dilated); iii) valves (stenosis/calcification//regurgitation); and iv) tendinous cords – (thickening/fusion/rupture) were recorded. The aorta was observed for atheromatous lesions, aneurysmal dilation and dissection. The three major epicardial coronary arteries were sectioned along their entire course, starting from their ostia, every 3 to 5 mm and examined for atheromatous lesions and thrombi. For microscopic examination, representative bits were taken from the right and left ventricular walls and atrioventricular junctions, interventricular septum, apex and all the three major coronary arteries and aortic stumps. Additional bits were taken wherever necessary. The tissue bits were processed as per standard protocol and paraffin embedded blocks were cut and stained by haematoxylin and eosin (H & E). Light microscopic evaluation of the H & E stained slides was done and results were recorded. Coronary artery occlusion was graded based on narrowing in cross-sectional area as follows as follows: Grade 1- ≤ 25% block, Grade 2- 26- 50% block, Grade 3- 51- 75% block and Grade 4- ≥76% block.[5]

The age, sex, cause of death and autopsy findings were obtained from the deceased post-mortem files.

Statistical Analysis: SPSS Version 18.0 software was used for analysis. All the continuous variables were expressed as mean and standard deviation and all qualitative variables as proportion. The percentage and frequency of each type of cardiac lesion was determined.

RESULTS

A total of 250 cardiac specimens were received, over a three and half year's duration. The mean age of the deceased was 39±15 years (age range: 11 to 79 years) with male: female ratio of 4.4:1 Majority of the cases occurred in the 4th decade followed by 3rd decade (Table 1, facing page).

Cause of Death: The most common cause of death was cardiac disorders (37.2%) followed by respiratory disorders (16%). (Table 2). The unnatural cause of death is included in unintentional injuries (traffic accidents, snake bites and honey-bee stings) and in intentional injuries (homicide and suicide) (Table 2).

In 207 (82.8%) cases, 299 morphological lesions were identified depicted in Table 3, along with the age and sex distribution. In 134 cases (53.6%), multiple lesions were identified (Table 4). The most common histopathological lesion identified was coronary atherosclerosis (52.4%; 131/250) followed by myocardial infarction (26%; 65/250). There was no specific finding in 43 (17.2%) cases.

Of the 131 cases of coronary atherosclerosis, 39, 25 and 67 cases showed single, double and triple vessel diseases respectively (i.e. a total of 290 coronary arteries showed atherosclerotic plaques). (Figure1) Left anterior descending coronary artery (LAD) (40.7%; 118/290) was the most common to be involved followed by right coronary artery (RCA) (30%; 87/290) and left circumflex coronary artery (LCX) (29.3%; 85/290). Severe atherosclerosis with grade IV luminal occlusion was found most commonly in LAD. Superimposed thrombus and calcification were found in 7.6% (22/290) and 31.7% (92/290) of the lesions. The distribution of coronary atherosclerotic changes with extent of luminal occlusion and secondary changes are

AGE RANGE	NO. OF CASES (%)	MALES	FEMALES	M: F RATIO
10-20	30 (12%)	17	13	1.3:1
21-30	52 (20.8%)	40	12	3.3:1
31-40	67 (26.8%)	58	9	6.4:1
41-50	43 (17.2%)	40	3	13.3:1
51-60	36 (14.4%)	34	2	17:1
61-70	16 (6.4%)	10	6	1.6:1
71-80	6 (2.4%)	5	1	5:1
TOTAL	250	204	46	4.4:1

Table 1: Age and sex distribution of cases.

CAUSE OF DEATH		NO. OF CASES
Unnatural causes	Unintentional	17 (6.8%)
	Intentional	26 (10.4%)
Natural causes	Cardiac	93 (37.2%)
	Respiratory	40 (16%)
	Neurological	10 (4%)
	Hepatic causes	27 (10.8%)
	Renal Failure	11 (4.4%)
	Sepsis	15 (6%)
	Haematological	1 (0.4%)
	Unknown	10 (4%)
Total		250

Table 2: Distribution of cause of death

Coronary Artery	Grading of Coronary Artery Occlusion				Superimposed Thrombosis	Dystrophic calcification
	Grade I (≤25%)	Grade II (26-50%)	Grade III (51-75%)	Grade IV (>75%)		
RCA	12	36	25	14	3	30
LAD	10	37	39	32	16	35
LCX	10	32	28	15	3	27
Total	32	105	92	61	22	92

Legend: RCA - Right Coronary Artery, LCA - Left Circumflex Coronary Artery, LAD - Left Anterior Descending Coronary Artery.

Table 5: Distribution of coronary artery atherosclerotic changes.

Morphological lesions	No. of lesions	Mean Age	Males	Females	M:F
Coronary Atherosclerosis	131	45± 14 (20-75)	116	15	7.7:1
Myocardial infarction	65	45± 15 (19-75)	58	7	8.2:1
Aortic Atherosclerotic Plaque	53	49± 14 (21-75)	48	5	9.6:1
Myocardial Hypertrophy	30	35± 13 (14-67)	26	4	6.5:1
Valvular Heart Diseases	5	35.8 (13-50)	5	-	-
Aortic Dissection	5	41 (27-65)	3	2	1.5:1
Cardiac Tamponade	4	53 (20-65)	2	2	1:1
Pericarditis	3	47 (31-65)	2	1	2:1
Myocarditis	2	15 (11-20)	1	1	1:1
Cardiomyopathies	1	19	1	-	-
Total	299	39±15 (11-75)	178	29	6.1:1

Table 3: Morphological lesions identified in cardiac autopsy specimens with the age and sex distribution

MULTIPLE LESIONS IDENTIFIED	NO. OF CASES
Coronary Atherosclerosis and Myocardial infarction	65
Coronary Atherosclerosis and Aortic Atherosclerotic Plaque	53
Coronary Atherosclerosis and Myocardial Hypertrophy	10
Myocardial Hypertrophy and Aortic dissection	3
Coronary Atherosclerosis and Valvular Heart Diseases	1
Cardiac Tamponade with Aortic dissection and Coronary Atherosclerosis	1
Cardiac Tamponade with Aortic dissection, Myocardial hypertrophy and Coronary Atherosclerosis	1
Total	134

Table 4: Multiple morphological lesions identified in cardiac autopsy cases.

Cardiovascular lesions	Present study, 2021 (n=250)	Garg S et al[7], 2018(n=141)	Shah SN et al[8] 2019 (n=152)	Rani E et al[9] 2017(n=97)	Joshi C et al[6] 2016(n=115)	Kulkarni MP[14] 2018(n=250)
Coronary Atherosclerosis	131(52.4%)	78(55.3%)	93(61.2%)	75(77.3%)	74(64.3%)	123(49.2%)
Myocardial infarction	65(26%)	20(14.1%)	67(44.1%)	3(3.1%)	33(28.7%)	62(24.8%)
Aortic Atherosclerosis	53(21.2%)	–	–	–	–	–
Myocardial Hypertrophy	30(12%)	10(7.09%)	20(13.2%)	–	60(52.2%)	14(5.6%)
Valvular Heart Diseases	5(2%)	2(0.14%)	–	–	–	9(3.6%)
Aortic Dissection	5(2%)	–	–	–	–	–
Cardiac Tamponade	4(1.6%)	–	–	–	–	–
Pericarditis	3(1.2%)	4(2.8%)	–	1(1.03%)	1(0.9%)	–
Myocarditis	2(0.8%)	5(3.5%)	–	–	11(9.6%)	–
Cardiomyopathies	1(0.4%)	–	–	–	–	3(1.2%)
Others	–	–	14 (9.2%)*	18 (18.6%)**	11 (9.6%)***	9 (3.6%)****
No specific finding	43(17.2%)	22(15.6%)	51(33.6%)	0	29(25.2%)	30 (12%)

Table 6: Comparison of morphological lesions with other studies.

*"n" indicates the total no of cases studied; The percentages are calculated from the total no of cases studied; * comprises of 14 cases of congestion, ** includes chronic ischemic heart disease (13.4%), congestion (2.1%), stromal fatty infiltration (2.1%), pericarditis & cysticercosis (each 1%); *** includes sickle cell anemia (5.2%) & fatty streaks (4.4%); **** includes DIC (1.2%), acute leukemia (0.8%), papillary fibroelastoma, amyloidosis, ventricular septal defect & sickle cell anaemia (each 0.4%)*

depicted in Table 5.

The aortic stump (ascending aorta) showed fatty streaks and atherosclerotic plaques in 76 and 53 cases, respectively. Of the atherosclerotic plaques, 3.8% (2/53) were complicated with surface erosions and 7.5% (4/53) showed calcifications. The 65 cases of myocardial infarction comprised of 22 (33.8%) recent infarcts and 43 (66.2%) old and healed infarcts (Figure 2).

Myocardial hypertrophy was seen in 30 cases with mean weight of 378±88 gm (range: 300-650 gm), mean left ventricular thickness of 1.7± 0.2 cm (1.3- 2.2cms) and mean right ventricular thickness of 0.7± 0.2 cm (0.4-1.3cms) (Figure 3A).

DISCUSSION

Histopathologic evaluation of heart in autopsies has greatly furthered our knowledge, providing valuable insights into the pathobiology of various cardiovascular diseases especially, congenital heart diseases, coronary atherosclerosis and myocardial infarctions.[1] The only way to study cardiac morphological features and correlate it with clinical features is via autopsy, as it is not possible to do this in the living.[4] These autopsy studies not only provide valuable information regarding the cause and nature of death, but also provide valuable epidemiological information.[6]

The comparison of various morphological lesions identified in our study with other studies is shown in Table 6.

In the Present study cardiovascular lesions were identified in 82.8% of the cardiac autopsies similarly in the study by Garg S *et al.* 84.4% of the cardiac specimens showed lesions.[7] Where as in studies by Shah SN *et al.* and Joshi C *et al.* cardiac lesions were found in 66.7% and 74.2% of the autopsies respectively.[6,8] The male: female ratio was 6.1:1 in our study emphasising that males have a higher risk of cardiovascular disease. Similarly, many other cardiac autopsy studies showed male predominance: Dhankar V *et al.* Joshi C *et al.* Shah SN *et al.* and Garg S *et al.* found male: female ratios of 2.7:1, 6.8:1, 3.1:1 and 12.8:1, respectively in their studies.[4,6-8]

The commonest morphological lesion identified was coronary atherosclerosis (52.4%) which is in sync with studies by Dhankar V *et al.* (61.5%), Joshi C *et al.* (64%), Garg S *et al.* (55.3%), Shah SN *et al.* (61.2%), Rani E *et al.* (77.3%) and Karanfil R *et al.* (75%).[4,6-10] Secondary changes like dystrophic calcification and superimposed thrombosis were present in 31.7% and 7.6% of the atherosclerotic lesions, respectively, in our study. Similarly, Marwah N *et al.* observed thrombosis in 7.5% of the lesions.[11] In other studies the frequencies of calcification and thrombosis ranged from 17% to 53.3% and 5% to 10.8%, respectively.[6-8] In our study triple vessel involvement was most frequent followed by single vessel and double vessel involvement. However, in studies by Venkatesh K *et al.* and Sudha ML *et al.* triple followed by double and single vessel involvement was observed.[5,11,12] Literature review revealed that the most frequently involved artery is LAD (45-64%) followed by RCA (24-46%) with LCX being least affected (3-10%).[5,8,11,12] Our experience also is similar with LAD being the most frequently involved and LCX being the least involved. We observed that severe luminal occlusion (Grade IV stenosis), dystrophic calcification and superimposed thrombosis are most frequent in LAD, which is in sync with studies by Venkatesh K *et al.* and Marwah N *et al.*[5,11] Thiripurasundari R *et al.* evaluated coronary arteries from 77 cases of unnatural deaths and observed that LAD shows maximum narrowing (49.4%) compared to other arterys.[13] Unlike our findings, Shah SN *et al.* observed these changes more commonly in the LCX.[8] Such discrepancies in frequency of lesions, among studies, could possibly be attributed to a selection of cases and handling of tissues (if meticulous sampling is not done atherosclerotic lesions, being focal, can be missed).[11]

The second most common lesion identified was MI (26%), which is in accordance with studies conducted by Joshi C *et al.* (28.7%) and Kulkarni MP (24.8%) *et al.*[6,14] higher frequency was reported by Shah SN *et al.* (44.1%) and lower frequency was quoted by Garg S *et al.* (14.1%).[7,8] The differing frequencies among studies may be attributed to the time variability between onset of myocardial ischaemia and time of death.[7] The morphologic features of MI, and hence its identification, depends

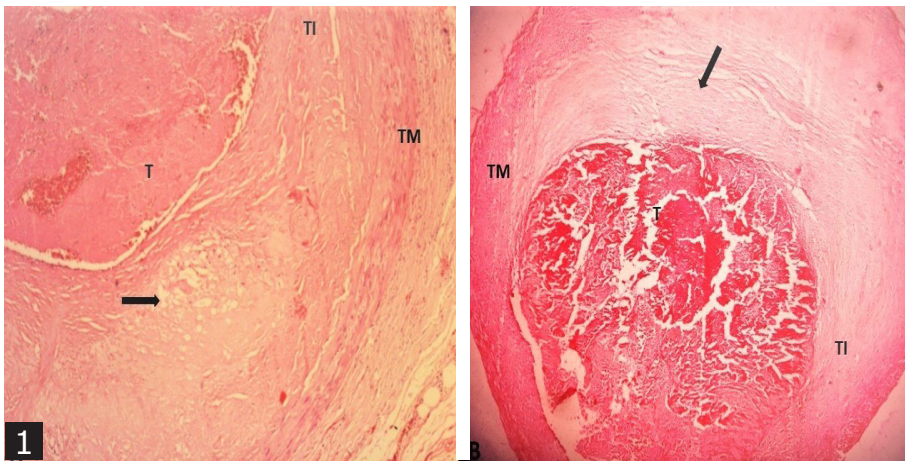

Figure 1: Coronary atherosclerosis with superimposed thrombus. Arrow shows atherosclerotic plaque. T- thrombus, TI- tunica intima, TM- tunica media (H&E stain; A- x10; B- x5).

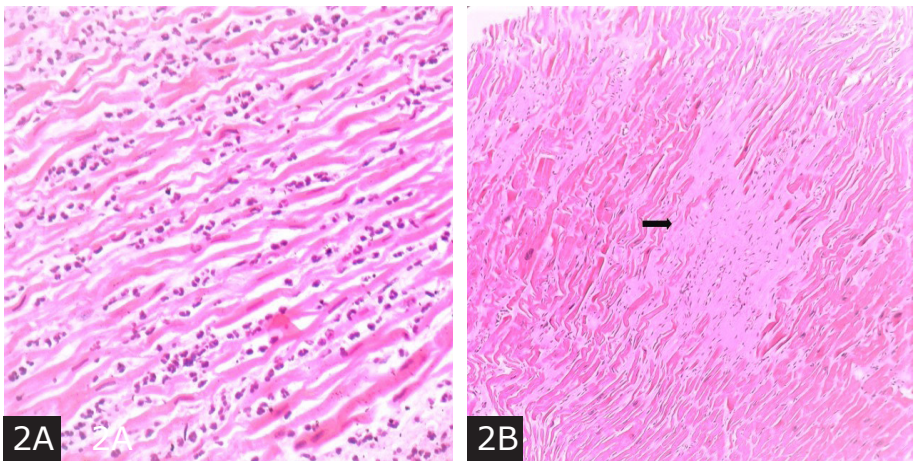

Figure 2: Myocardial infarction. 2A shows recent infarction with necrotic cardiac myocytes and interstitial neutrophilic infiltrates. 2B shows old/ healed infarct (arrow) with replacement fibrosis and scarring (H&E stain; A- x10; B- x5).

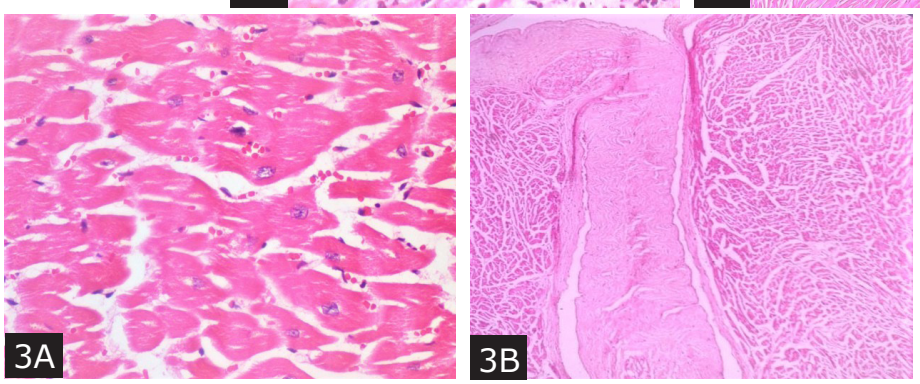

Figure 3A: Shows myocardial hypertrophy. **3B** shows serofibrinous pericarditis (H&E stain; A- x10; B- x5).

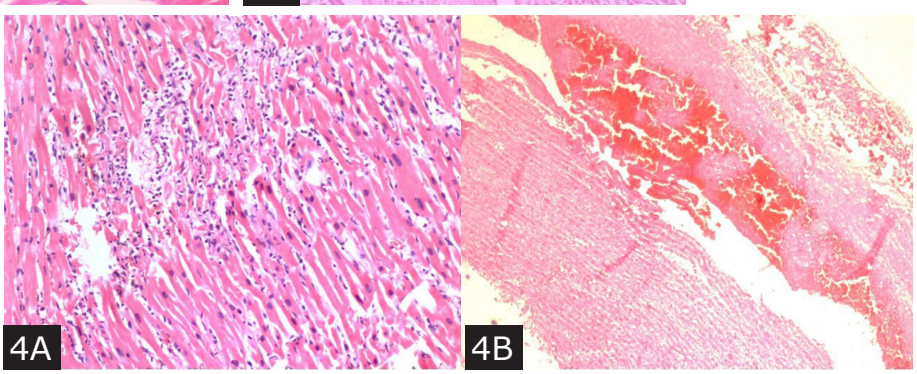

Figure 4A: Shows myocarditis. **4B** Shows aortic dissection (H&E stain; A- x10; B- x5).

on the time interval between infarction and death.[15] It is well documented in literature that the single most important pathogenic mechanism of MI is coronary atherothrombosis.[11,15] In accordance with this, all our cases of myocardial infarction had significant coronary atherosclerosis.

In 21.2% of the cases, atherosclerotic plaques were found in ascending aorta. Concurrent coronary atherosclerosis was present in all these cases. Many studies have shown significant association between coronary and aortic atherosclerosis, further risk factors are similar for development of these lesions.[16,17]

In this study myocardial hypertrophy was present in 12% of cases. Literature review reveals varying frequencies of cardiac hypertrophy, ranging from 5.6% to 66%.[6-8,10,14]

We observed 5 cases of valvular heart disease comprised of 3 cases of chronic rheumatic heart disease and 2 cases of infective endocarditis. Garg S *et al.* identified 2 cases of valvular heart disease comprised of 1 case each of aortic stenosis and infective endocarditis.[7]

Five cases of aortic dissection (AD) were detected in our study; one was associated with Marfan syndrome and four (80%) cases showed concentric left ventricular hypertrophy, suggestive of hypertension (Figure 4B). Literature review reveals that hypertension is the most important risk factor for AD.[18] Huynh N reviewed 336 cases of AD over 6 decades.[19] They identified hypertension (84%), prior cardiovascular surgery (38%), bicuspid valve (14%), and connective tissue disease (9%) as the most prevalent risk factors.[19] More than 60% of their cases were not detected clinically and were first identified at autopsy.[19]

There were 4 cases (1.6%) of cardiac tamponade, in our study, with myocardial rupture and hemorrhage in the pericardial cavity. Microscopic examination of the ruptured site revealed interstitial hemorrhage, acute inflammatory infiltrates and necrotic myocytes. Two of these cases were associated with aortic dissection. The remaining cases, probably, were consequence of ruptured MI. Dhankar V *et al.* reported 5 cases of (9.6%) cardiac tamponade.[4] One of their cases was due to blunt trauma and the remaining 4 cases were attributed to possible ruptured acute MI.[4]

Pericarditis was found in 3 (1.2%) of the cases, both of which were serofibrinous type (Figure 3B). Literature review revealed variable frequencies of pericarditis, detected at autopsies, ranging from 0.9% to 2.8%.[6,7,9] Pericarditis usually is associated with a systemic disorder (infections, rheumatic fever, autoimmune diseases like systemic lupus erythematosus, uremia, cancer) or other cardiac disease (MI, post cardiac surgery), primary pericarditis is rare and usually of viral etiology.[6,7,15]

Myocarditis was found in only 2 (0.8%) cases (Figure 4A). Both of these cases showed mild to moderate perivascular and interstitial infiltrates of lymphocytes with an occasional myocyte apoptosis. The frequency of myocarditis reported in literature ranges from 3.5% to 29%.[7] The major causes of myocarditis are infections (predominantly viral) and immune mediated reactions and should be differentiated from MI which also shows inflammation and myocyte necrosis.[15]

We had one case (0.4%) of hypertrophic cardiomyopathy, which was characterised by cardiac hypertrophy (weight: 820gm), asymmetrical septal hypertrophy involving the subaortic region and compression of left ventricular cavity. On microscopy, myocyte disarray, myocyte hypertrophy and patchy interstitial fibrosis were present. Data on cardiomyopathy detected at autopsy is sparse. Dhankar V *et al.* reported a single case (1.9%) of dilated cardiomyopathy and Kulkarni MP reported three cases with cardiomyopathy.[4, 14]

Rare lesions were identified by some authors. Kulkarni MP *et al.* reported one case each of papillary fibroelastoma and amyloidosis; Dhankar V *et al.* reported one case each of metastatic squamous cell carcinoma and tuberculosis and Garg S *et al.* reported one case of cysticercosis.[4,7,14] Thus unknown and unexpected lesions can be diagnosed

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on autopsy studies. However, we did not identify any such rare lesions in our study.

CONCLUSION

Our study highlights the varied histopathologic spectrum of cardiac lesions on autopsy. The frequency of detecting cardiac lesions is 82.8%. The most common finding is coronary atherosclerosis, with triple vessel involvement being most frequent, which is in accordance with other studies. Severe luminal occlusions, calcification and thrombosis are most frequent in Left anterior descending coronary artery. The second most common lesion is MI, the most significant pathogenic mechanism of which is coronary atherosclerosis, a fact emphasized by many other authors. As widely established in literature, there is a strong association between coronary and ascending aorta atherosclerosis. The other less frequent lesions identified are valvular heart disease, aortic dissection, cardiac tamponade, serofibrinous pericarditis, myocarditis and hypertrophic cardiomyopathy, in that order. Thus, many preventable and concealed lesions are discovered on cardiac autopsies. Such studies provide a better understanding of cardiovascular diseases. These insights into the pathophysiology are indispensable for assessing disease trends and introducing new interventions and therapeutic management regimes in patients with cardiac diseases. IJFMP

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ORIGINAL ARTICLE

Robustness Index of Clavicle: A Beneficial but Less Explored Parameter for Sex Determination

Anuradha Singh[1], Rajendra Baraw[2], Jayanthi Yadav[3]

ABSTRACT

CONTEXT: Determination of sex in a mutilated or fragmented body eases the dilemma of a Forensic expert to a certain extent. Apart from other long bones, clavicle is one of the bones which is less explored but has drawn considerable interest in this field, particularly in relation to sexual dimorphism.

AIM: The purpose of this research was to evaluate the sexual dimorphism of clavicle, based on Robustness Index in dry bone sample.

MATERIALS AND METHODS: The study was conducted in the mortuary of the Department of Forensic Medicine, Gandhi Medical College, on 100 cases (50 males and 50 females) in which medico-legal postmortem examination was done. Clavicle bone of the deceased in 25 to 60 year age group were collected during autopsy, dried and then examined for the study. Measured Robustness Index is the ratio of Maximum length of clavicle and Mid clavicular circumference. Prior approval of the Institutional Ethics Committee was taken.

RESULTS: Robustness Index was found to be larger in males compared to females in dry clavicle. By discriminant function analysis, sex can be estimated with an accuracy of about 81%. However, these values were found to be more accurate in males with accuracy of 82% for males and 80% for females. **CONCLUSIONS:** Determination of sex by means of Robustness Index of clavicle can be considered a reliable indicator in dried state of the bone and the accuracy rate was high for males than females.

Keywords: Identification, Sexual Dimorphism; Robustness Index; Clavicle; Mid-shaft circumference; Maximum length of clavicle.

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INTRODUCTION

THE LATIN WORD CLAVICLE MEANS 'a small key', forming the anterior portion of the shoulder girdle placed at the upper and anterior part of the thorax, immediately above the first rib. Clavicle is the less studied element of the shoulder girdle. Of all the long bones, the clavicle is the only membranous bone placed horizontally in the body and it possesses certain gender and age specific traits.[1] Several studies have been conducted on sexual determination from skeletal elements. Robustness Index is the ratio of Mid-shaft circumference with Maximum length of clavicle which indicates the robustness of clavicle as both the parameters make clavicle a strong bone.

The present study was designed to identify these morphological features (predictors) and

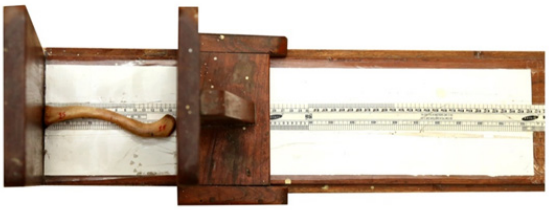
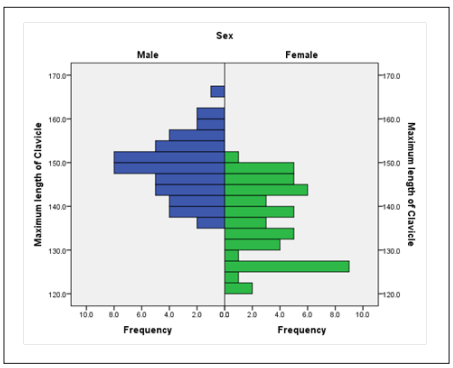
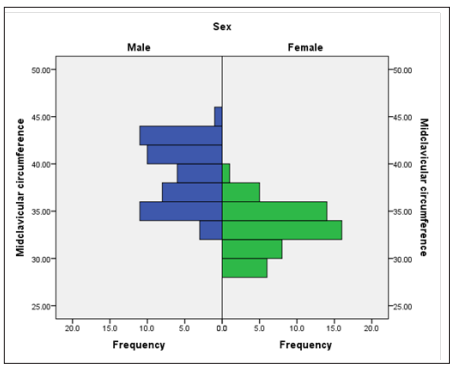


Figure 1: Measurement of Maximum length of clavicle with Osteometric board

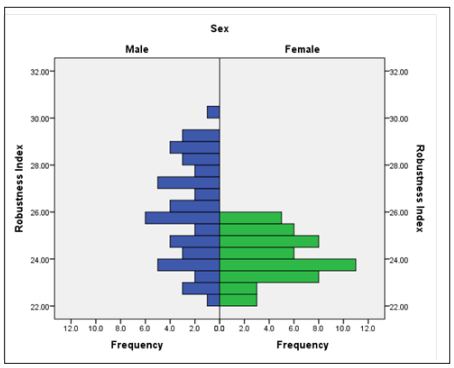
Figure 2: Measurement of midclavicular circumference with thread



Graph 1: Histogram showing frequency-distribution of Maximum length of Clavicle



Graph 2: Histogram showing frequency-distribution of Mid-clavicular circumference



Graph 3: Histogram showing frequency-distribution of Robustness Index

examine the sexual dimorphism of adult clavicle in the population of Central India (Bhopal region), applying linear discriminant function analysis. As the skeletal remains that are usually bought for anthropological examination are in the dried and fragmented state, this study was conducted on dry clavicle.

MATERIALS AND METHOD

The study was conducted on 100 clavicles (50 males, 50 females) recovered from the medicolegal autopsies conducted in the Mortuary of Department of Forensic Medicine and Toxicology, Gandhi Medical College, Bhopal. Cases with known age and sex in between the age group of 25-60 years were taken for the study. Case below 25 years and above 60 years and with any chronic illness, metabolic disorders, congenital anomalies, bony deformities, fracture of clavicle in Road Traffic Accidents or by any other reason were excluded. After obtaining written informed consent, the thorax was opened and clavicle was recovered using routine standard autopsy technique. The gap was packed with cotton and body contour was restored. The clavicle then cleaned to remove maximum soft tissues. It was then tagged with a numbered plastic disc. These bones along with their plastic discs bearing the number were buried in the ground and left over for sufficient time (about 1 month), so that the bones were completely separated from the soft tissue. It was then cleaned and dried at room temperature. Measurements were taken in the dry state.

Maximum length of clavicle (MCL):

The straight maximum distance between the sternal and acromial end measured by placing the clavicle in horizontal plane on the Osteometric board, taking precaution that sternal end and concavity of acromial half of clavicle are placed in the same line, the maximum length of clavicle is noted. Three readings were taken and the average was recorded. (Fig 1)

Midclavicular Circumfenrence (MCC):

Maximum length of Clavicle (MCL) in Male & Female (in mm)							
Sex	N	Minimum	Maximum	Range	Mean	Std. Deviation	Statistical significance
Male	50	135.9	166.0	30.1	148.71	6.6522	P< 0.05
Female	50	122.2	150.2	28.0	136.88	8.5184	
Total	100	122.2	166.0	43.8	142.80	9.6520	
Midclavicular Cicumference (MCC) for Male & Female (in mm)							
Sex	N	Minimum	Maximum	Range	Mean	Std. Deviation	Statistical significance
Male	50	32.40	45.46	13.06	38.67	3.28199	P< 0.05
Female	50	28.18	38.62	10.44	33.04	2.42797	
Total	100	28.18	45.46	17.28	35.85	4.03253	
Robustness Index (RI) for Male & Female (in mm)							
Sex	N	Minimum	Maximum	Range	Mean	Std. Deviation	Statistical significance
Male	50	22.24	30.15	7.91	26.01	2.06363	P< 0.05
Female	50	22.00	25.92	3.92	24.13	1.00715	
Total	100	22.00	30.15	8.15	25.07	1.86943	

Table 1: Descriptive statistics of MCL, MCC and RI

PARAMETERS	DF SCORE	CLASSIFICATION RESULT	
Maximum clavicle length	DF = 0.131MCL – 18.685	Males- 80% Females- 70%	75% 75%
Midclavicular circumference of clavicle	DF= 0.346MCC – 12.421	Males- 72% Females- 88%	80%
Robustness Index of clavicle	DF= 0.616RI – 15.441	Males- 88% Females 84%	86%
All Three parameters together	DF= 0.245MCL- 0.555MCC + 1.208RI	Males-82% Females -80%	81%

Table 2: Discriminant function analysis of all variable

Studies by various experts	Sample size	Age Group	Year of Study	Male (mm)	Female (mm)	Region	Accuracy
Sehrawat et al [22]	263	17-94	2016	25.99 ± 2.36 6	24.20 ± 1.98	Chandigarh (India)	M-61.5 F-72.1
Akhlagi et al [14]	120	–	2012	29.9	29.4	Iran	–
Kralik et al [9]	200		2014	26.87	25.91	Greece	–
Benwoke et al [8]	40	25-70	2019	25.54	22.64	Nigeria	–
Jit and Singh et al [10]			1966	24.8	22.8	Chandigarh	–
Present study	100	25-60	2017	26.01±2.1	24.13±1.0	Bhopal (India)	M- 88% F-84%

Table 3: Studies on Robustness Index (RI) associated with Sex

It is measured at Midclavicular point, determined with the help of osteometric board. The circumference was measured with the help of non-stretchable white colour twine thread. The twine thread was applied two rounds encircling the midclavicular point taking precaution that the thread is neither stretched nor overlaps on each other. Then a straight line was drawn over all the three threads completing two circles around the midpoint. Now the thread is removed from the bone and placed as a straight line and the distance between two farthest marks was measured in mms on Osteometric board and was divided by two which gave the Midclavicular circumference. (Fig. 2)

Robustness Index:

Mean of Robustness Index is significantly

higher in males as compared to females. For RI (In males, Mean = 26.01, S.D = 2.1, In females, Mean =24.13, S.D = 1.0), t (95) = 5.8, p < 0.01(Table 1), shows that variable has significant mean difference. The Robustness Index of male clavicles is found between 22.24 mm to 30.15 mm. and forfemale clavicle is found between 22.00 mm to 25.92 mm. The following discriminant function is obtained from discriminant coefficient: DF= 0.616RI – 15.441. It is observed that 44 among 50 males (88%) and 42 females from 50 (84%) were correctly classified by this DF score. It implies that criteria for Robustness Index of clavicle can be used with 86% accuracy for sex discrimination.

If all the three parameters Maximum length of clavicle, Midclavicular circumference and Robustness Index taken together for sexual dimorphism, It is observed with the help of Discriminant function, DF= 0.245MCL-0.555MCC + 1.208RI – 45.387, 41among 50 males (82%) and 40 females from 50 (80%) were correctly classified. It implies that all three parameters if combined together can be used with 86% accuracy for sex discrimination. (Table no. 3)

DISCUSSION

Based on the observations and results of the clavicle measurements, it can be concluded that Robustness Index of clavicle is higher among males as compared to the females in Bhopal. Also, male clavicle can be sexed with a higher accuracy rate; when only clavicle is received for examination. DF score was calculated as DF= 0.245MCL- 0.555MCC + 1.208RI – 45.387 where by merely placing the values of MCL, MCC, and Robustness index measurements in the discriminant function analysis equation helps us to determine sex with an accuracy of 81% in Bhopal (Central region). Robustness Index can be a reliable indicator for sex determination in dried state of the bone.

The overall observation suggests that even in a single country, variations are seen with regard to estimation of sex with the help of Clavicle. The causes for this can be Environmental, socioeconomic, geographical, heredity and growth patterns. The worldwide variation also comes in both extremes. As India is heterogeneous population, studies in different region should be conducted for correlation and comparison. IJFMP

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ORIGINAL ARTICLE

Profile of Deaths due to Drowning in a Tertiary Care Centre Located along Sea Shore and River Bank

Shashikantha Naik CR[1], Yogesh C[2], Lohith Kumar R[3], Abishek Yadav[4]

ABSTRACT

CONTEXT: Profiling of drowning is essential for understanding its full burden which is vital to resourcing and directing prevention efforts as drowning is still aone of the leading causes of morbidity and mortality.

AIM: The aim of this study is to analyse the factors associated with drowning cases recoded in a tertiary care centre located along sea shore and river bank in one year.

SETTINGS AND DESIGN: A retrospective content-based analysis of drowning cases recorded in one year from January 1st 2019 to 31stDecember 2019 in a tertiary care centre located along sea shore and river bank and the results were tabulated.

RESULTS: Of the 36 cases, 26 cases were males and 10 were females accounting for 76.3% and 27.7% respectively with 88.88% (32 cases) accidental drowning and 36.11% (13 cases) in the age group of 30-45 years.

CONCLUSIONS: Our study concludes that the middle-aged rural males form the majority of drowning in large water bodies highlighting the absence of safety measures and awareness of swimming skills contributing to the causal factors of drowning.

KEYWORDS | drowning, accidental deaths, swimming deaths, drowning prevention, drowing safety measures

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INTRODUCTION

DROWNING IS THE PROCESS OF experiencing respiratory impairment due to submersion /immersion in liquid; outcomes are classified as death, morbidity and no morbidity.[1] Drowning is a global public health issue, with the WHO estimating that 372,000 people die from drowning annually.[1] Drowning is the second leading cause of death from unintentional injury, after road traffic injuries. About 97% of all deaths from drowning occur in low- and middle-income countries due to conditions such as poor infrastructure, poor regulation of water bodies and low awareness of water risks and swimming skills.[2,3] As per the National Crime Records Bureau-Accidental Deaths and Suicides (2012), every day, eighty persons die of drowning in India, which accounts for 7.4% of all unnatural deaths. In 2013, there were 29,456 deaths by

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drowning.[4] Identifying risk factors leading to drowning is essential for developing targeted, efficient prevention strategies. Proposed contributory factors for drowning in rivers include a lack of barriers controlling access to water, an absence of adult supervision for young children, poor swimming skills, minimal awareness of the dangers, the consumption of alcohol, transportation on water, a lack of safe water supply, and disasters related to flooding.[1] The circumstances leading to drowning are complex. In high-income countries people interact with water primarily for recreation.[5] By contrast, drowning in low- and middle-income countries often occurs as a result of interactions with water due to daily life or occupational endeavours.[6]

The real number of deaths by drowning is likely to be higher due to under-reporting, as victims are not hospitalised or cases are not recorded because of a lack of death collection tools in many low- and middle-income countries (LMICs).[7] Official data categorization methods for drowning exclude intentional drowning deaths (suicide or homicide) and drowning deaths caused by flood disasters and water transport incidents. Non-fatal drowning statistics in many countries are not readily available or are unreliable. Hence this study would give insight into medicolegal and epidemiological factors of drowning cases reported in a tertiary care hospital in South India.

METHODS AND MATERIALS

A total of 36 drowning cases were studied that was recorded in one year from January 1st 2019 to 31st December 2019 in a tertiary care centre located along sea shore and river bank. It was a retrospective analytical study with secondary data obtained from the Medical Records Department in the hospital. It was a based on content analysis where a proforma was formed related to the nature and details of the drowning cases that was used to obtain the data. All age group registered as drowning cases and treated in the hospital were included in the study. Unregistered cases and cases that were sent for further referral from the hospital were excluded from the study. The data was analysed and results were tabulated using simple tables and pie charts. Percentage calculations were made for better statistical reporting.

METHODS AND MATERIALS

On environmental factors related to the events of drowning, presence of wave was observed in 26 (72.22%) cases, absent in 9(25%) cases and one not known. Winter season saw maximum drowning with 18(50%) cases, 5(13.88%) cases in summer, 9(25%) cases in monsoon and 4 (11.11%) cases in post monsoon season. All the drowning cases were wet drowning. 27 (75%) cases were recorded in the day and 7 (19.44%) cases were recorded in the night with 2 (5.55%) cases remain unknown.

Life jacket was not used in all the cases. Only 4 cases (11.11%) knew swimming and 30 (83.33%) cases were not aware of swimming. 32 (88.88%) cases have been previously involved in drowning events. Safety measures were present during the drowning of 15 (41.66%) cases and absent in 21 (58.33%) cases. Of the 36 cases, 19 (52.77%) cases were not under supervision and 16 (44.44%) cases were under supervision with one case remaining unknown. All the events were fatal. Asphyxia was the cause of death in 35 (97.22%) cases and not opined in one case. Of the 36 cases, 32 (88.88%) were accidental, 1(2.77%) case was a suicide and intention were not known in 3 (8.33%)cases. Post mortem changes were normal in 34 (94.44%) cases and 2 (5.55%) cases were decomposed. Figure 1 and 2 represent the waterbody distribution and seasonal distribution of drowning cases, respectively.

DISCUSSION

Understanding the epidemiology of drowning injuries is fundamental in directing preventative efforts. The major purpose of collecting epidemiological data is to create and follow the

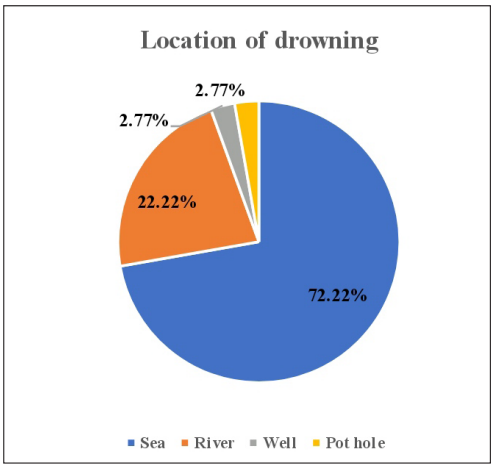

Figure 1: Testing Water body distribution of drowning.

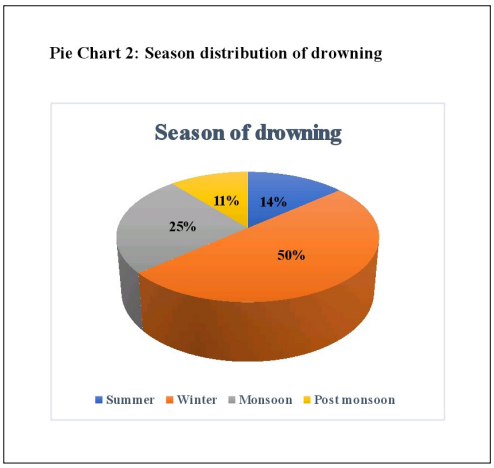

Figure 2: distribution of drowning by Seasons

AGE	CASES (%)
<15 years	4 (11.11%)
15-30 years	9 (25%)
30-45 years	13 (36.11%)
45-60 years	8 (22.22%)
>60 years	2 (5.55%)

Table 1: Age distribution of drowning cases

effectiveness of preventive strategies, which include education, engineering, legislation and enforcement. There are various locations and risk factors for drowning that reporting will never be simple. Improving drowning data in countries has been identified as a key strategy by the World Health Organization (WHO) to better understand the full extent and circumstances of drowning, to target interventions and evaluate their effectiveness.[8]

Analysing the human factors, males form the majority of the drowning cases (76.3%) similar to a study done in Singapore.[9] Possible explanations for this gender difference include riskier behaviour than their female counterparts and therefore expose themselves to more dangerous situations when around bodies of water.[10] Sociocultural reasons may also play a role, in that in some cultures, male toddlers are allowed more time for exploration than their female counterparts, including in water where males typically swim and are involved in water recreation more often than females.[11]

With regards to age distribution, middle aged group from 30-45 years have been most affected in our study (36.11%), 25% affected in 15-30 years and only 11.11% of under 15 age group population were affected. This is comparable to a study done in Western Cape, South Africa where 54.84% cases were reported among 15-45 years.[12] Winter season saw 50% of drowning cases in our study similar to a study by Morris *et al.,*[13,] where the months of December to February recorded the maximum cases equating to the winter months in India. Rural population were more affected in drowning recording 52.77% cases similar to a study done by Turgut[14] showing rural areas in LMICs pose a significantly greater risk than urban areas to potential drowning victims.

75% of the cases were recorded in the day from 6am to 6pm compared to the study

done in Seychelles[15] where maximum events occurred from 12 noon to 2pm. Boating remains the commonest activity prior to drowning (41.6%) similar to a study done in Canada[16] with fishing and swimming forming the next categories. Untrained drivers, old age of boats, overcrowding and presence of wave (present in 72.22% cases in our study) may be the contributing factors for drowning while traveling in a boat[17]. Adults were more likely than children to drown in large, open bodies of water and adult men in particular were more likely to drown in the ocean and lagoons when compared with adult women[12] echoing our study where 72.22% cases were drowned in sea and closed water bodies like pools and wells contribute lesser in rural population and low income countries.[18]

Usage of alcohol and recreational drugs contribute a significant amount to the drowning mortality but in sharp contrast, only 5.55% of the cases were reported to be under the influence of alcohol. However, one paper shows around 74% of drowning is related to alcohol.[19] About 83.3% cases were not aware of swimming skills and 52.77% cases were not under supervision, both variables similar to a study done in Kerala.[4] Therefore, though children may be accompanied by family members while playing in water bodies, the need of "close supervision" or "touch supervision" has to be emphasized.[20,21] In our study, life jackets were worn by none of the cases and safety measures were absent in 58.33% of the cases. Safety equipments and Flotation devices such as lifejackets are indispensable on all water transportation vessels, whether for public or private use as absence of them can cause major drowning incidents as that occurred in the European Seas.[22]

The use of International Classification of Diseases (ICD) codes to explore drowning is a common approach but provides a limited understanding of causal factors, impacting the development and reporting on the effectiveness of prevention strategies.[23] Much of the evidence to support the proposed risk factors for drowning is based on population-based studies or case series. Other prevention strategies include focusing on pool safety such as restricting access to private pools for young children, education and training at schools on life skills, increasing public awareness through media campaigns, and the implementation of water safety legislation, community awareness, improved supervision of children around water bodies, building lifesaving facilities and enforcement of boat construction and maintenance regulations.[24]

However, there are certain limitations in our study which includes a small sample size, lack of certain information where many of the causal factors have "not known" categories in them which remains as a hindrance to the accumulation of proper evidence-based drowning data. Besides these, the unregistered drowning cases may contribute significantly to the underreporting of drowning statistics in India. Good epidemiological studies are needed to identify the risk factors and evaluate the proposed prevention strategies for drowning in India. Furthermore, future research should focus on the intent for drowning which would help to inform policies and prevention interventions.

CONCLUSION

Our study concludes that the middle-aged rural males form a majority of drowning in large water bodies highlighting the absence of safety measures and lack of swimming skills contributing to drowning. Understanding drowning risk factors aids in implementation of effective preventative strategies. The comparison of drowning data between countries allows for identification of similarities in drowning risk and therefore effective prevention, as well as informing potential improvements in data collection and coding. Nationwide population-based studies are essential to identify the risk factors in accordance with the social, cultural and religious practices that enables to develop preventive strategies according to the needs of the country. IJFMP

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ORIGINAL ARTICLE

Fatality as a Result of Traditional Circumcision in Mthatha Region in South Africa (2004-2014)

Banwari Meel

ABSTRACT

CONTEXT: The practice of culture is to protect people and preserve life. No culture allowed becoming a danger to human beings, sacrificing young lives year after year. The community keeps turning a blind eye to one death after the other because of tradition and culture. Objective: The main objective of the study was to describe the deaths that occurred between 2004 and 20014 due to traditional circumcisions.

METHOD: This is a record review descriptive study. The data were collected from the Forensic Pathology Laboratory of Hospital Complex from 2004 to 2014.

RESULTS: A hundred and fifty-five cases of circumcision-related deaths were reported over a period of 11 years (2004-14) in the region of South Africa. The causes of death included septicaemia (66-42.6%), blunt trauma (6-3.9%), dehydration (4-2.6%), renal failure (3-1.9%), hypothermia (2-1.2%), and pulmonary thrombo-embolism (2-1.2%).

CONCLUSIONS: Death due to circumcision is unethical and unacceptable conduct due to unacceptable cultural practices. This practice must be banned. A strong political message needs to be sent to the community as well as to the practitioners of circumcision.

KEYWORDS | circumcision, sepsis, death, ukwaluka, xhosa tribes

Author's Credentials:
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INTRODUCTION

Over half a million traditional circumcisions have been performed in KwaZulu-Natal in the last five years without any death or amputation.[1] Globally, 30% of men are circumcised, mostly for religious reasons. In many African societies, male circumcision is carried out for cultural reasons, particularly as an initiation ritual and a rite of passage to manhood.[2] Male circumcisions (*ukwaluka*) is one of the oldest traditions observed by many societies. The ritual is performed at specific periods in life with the main purpose of integrating the male child into society according to cultural norms.[3] Over the last two decades, thousands of youths have been admitted to hospitals after ritual male circumcision; hundreds have undergone penile amputations and hundreds have died in the province of Eastern Cape, South Africa.[4]

A study carried out by Meissner and Buso (2007) in the Eastern Cape showed that the incidence of circumcision-related complications and fatalities remained virtually unchanged in the observation period 2001-2006.[5] Many initiation schools are officially sanctioned, others are unregulated and allow phoney surgeons to operate with unsterilized blades.[6] According to Rijken, 825 boys have

died from complications since 1995 and many more have suffered from what he calls male genital mutilation.[6] Circumcisions undertaken in non-clinical settings carry significant risks of serious adverse events, including death.[7] A study carried out by Peltzer *et al.,* (2008) showed that in 192 initiates physically examined on the fourteenth day after circumcision by a trained clinical nurse, high rates of complications were found: 40 (20.8%) had mildly delayed wound healing, 31 (16.2%) had a mild wound infection, 22 (10.5%) mild pain and 20 (10.4%) had insufficient skin removed.[7]

A study published by the author (2009) also reported 25 deaths related to traditional circumcisions over a period of two years (2005-06). The causes of death were septicaemia (9 - 25%), pneumonia (5 - 20%), dehydration (3 - 12%), assault (3 - 12%), thromboembolism (2 - 8%), gangrene (2 - 8%) and congestive heart failure (1- 4%). The youngest victim was 12 years old.[8] To break this cycle of deaths as a result of traditional circumcision, comprehensive community education, including traditional healers and community leaders, could be a step towards avoiding these unnecessary deaths.

Ritual circumcision is often defended on the basis of its usefulness as a mechanism for the maintenance of social order, particularly in relation to the perceived crisis in youth sexuality marked by extremely high levels of gender-based violence as well as HIV infection.[9] A recent (2015) study by the author showed that it is dangerous to mix culture and politics on the issue of traditional circumcision, and the right to life cannot be sacrificed at the altar of culture and politics.[10] All the victims recorded in the register of the Forensic Pathology Laboratory between 2004 and 2014 were included in this study. The purpose of this retrospective descriptive study is to highlight the ongoing problem of deaths of young initiates because of botched circumcision in the Mthatha region of South Africa.

METHOD

This is a retrospective record review descriptive study of deaths related to traditional circumcision in the Mthatha region of South Africa. It was conducted over a period of 11 years (January 2004 and December 2014). The data were collected from the Forensic Pathology Laboratory of Mthatha Hospital Complex. This is the only forensic pathology laboratory in this region, catering to a population of about 600,000 people and is attached to the School of Medicine at Walter Sisulu University, a teaching and learning platform for medical students and doctors. This mortuary provides services to six local municipalities, namely Mthatha, Tsolo, Ngqeleni, Libode, Qumbu and Engcobo. Mthatha (Umtata) is the main city and the other municipalities are in the same area. Therefore, it is designated the Mthatha region.

The laboratory conducts about 17,000 to 18,000 autopsies every year and has been designated as an M-6 forensic pathology laboratory in this region. All deaths from unnatural causes are notifiable to this mortuary and a forensic officer is always ready to collect the dead bodies, round the clock. There are three doctors and 19 forensic officers, one record clerk, one data capture clerk, three supervisors, a cleaner and a facility manager. There also four security officers who control access to the laboratory. Autopsies on deceased persons who had died from all kinds of unnatural causes or suspected unnatural causes, such as firearm injuries, stab wounds, motor vehicle accidents, blunt trauma, burns, hanging, suffocation, lightning strikes and complications of circumcision are autopsied in this mortuary. All (13,650) medico-legal autopsies performed during the period under study were recorded in the postmortem register. The name, address, age, gender, occupation and cause of death were entered in the register. Two or three underlying or contributory causes of death were recorded in the post-mortem register of circumcision-related deaths. One prominent cause of death was considered in this study. The cause and mechanism of death were not differentiated in this manuscript. The cause of death and underlying or contributory or associated cause of death are used throughout in the description. All cases of circumcision-related deaths were

Age	No. of deaths
11	1 (0.6%)
12	0 (0%)
13	3 (1.9%)
14	6 (3.9%)
15	18 (11.6%)
16	17 (11%)
17	31 (20%)
18	41 (26.5%)
19	21 (13.5%)
20	11 (7%)
21	1 (0.6%)
22	1 (0.6%)
23	0 (0%)
24	1 (0.6%)

Year	No. of deaths
2004	7 (4.5%)
2005	6 (3.9%)
2006	14 (9%)
2007	12 (7.8%)
2008	16 (10.3%)
2009	21 (13.5%)
2010	17 (11%)
2011	17 (11%)
2012	16 (10.3)
2013	10 (6.4%)
2014	19 (12.3%)
Total	155 (100%)

Underlying cause of death	No. of deaths
Septicaemia	66 (42.6%)
Blunt trauma	6 (3.9%)
Dehydration	4 (2.6%)
Renal failure	3 (1.9%)
Hypothermia	2 (1.2%
Pulmonary thromboembolism	2 (1.2%)
pneumonia	1 (0.64%)
Congestive heart failure	1 (0.64%)
Pulmonary obstructive lung disease	1 (0.64%)
Empyema	1 (0.64%)
Epilepsy	1 (0.64%)
No underlying cause of death	67 (43.25%)
Total	155 (100%)

District	No. of deaths
Mthatha	48 (30.9%)
Tsolo	16 910.3%)
Ngqeleni	17 (11%)
Libode	58 (37.4%)
Qumbu	8 (5.2%)
Engcobo	8 (5.2%)
Total	155 (100%)

reviewed and analysed manually. The ethical approval was granted by the faculty research committee (No. 4114).

RESULTS

A hundred and fifty-five cases of circumcision-related deaths occurred over a period 11 years (2004-14) in the former Transkei region of South Africa (Table 1). The average death rate was (14-9%) deaths per year. The highest number (21 - 13.5%) of circumcision-related deaths occurred in 2009 and the lowest number (6 - 3.9%) in 2005 (Table 1). The youngest victim was 11 years old and the oldest 35 years. The highest number (41 - 26.5%) of victims were 18 years old (Table 2).

The most common cause of death was septicaemia 66 (42.6%) (Table 3). Other causes

of death associated with circumcision were blunt trauma (6 - 3.9%), dehydration (4 - 2.6%), renal failure (3 - 1.9%), hypothermia (2 -1.2%), pulmonary thrombo-embolism (2-1.2%), pneumonia (1 - 0.64%), congestive heart failure (1 - 0.64%), pulmonary obstructive disease (1 - 0.64%), empyema (1 - (0.64%) and epilepsy (1 - 0.64%). No underlying or contributory cause of death was reported among (67- 43.22%) victims of traditional circumcision (Table 3).

The highest number of deaths (58 - 37.41%) was recorded in the Libode area, followed by Mthatha (48 - 30.96%) (Table 4). Seventeen (10.96%) deaths were also reported in Ngqeleni, 16 (10.32%) in Tsolo and 8 (5.16%) each in the Qumbu and Engcobo areas (Table 4).

DISCUSSION

The former Transkei region is a former black homeland where most inhabitants are Xhosa. It is an area where a number of national political leaders were born and involved in a fierce struggle against the apartheid regime. There are deep-rooted beliefs in tradition and culture in the region. Several studies have shown that there is a heavy burden of disease and illiteracy and a high level of unnatural deaths in this region.[11] There are two seasons of traditional circumcision practice, summer and winter, when schools and colleges are closed for holidays. Young adults are eager to be circumcised and would like to enter into manhood after the circumcision ceremony. It is shocking that 155 initiates died between 2004 and 2014, as nobody is supposed to die as a result of circumcision (Table 1). This constitutes 1.1% of all unnatural deaths in this region. It simply involves cutting off a nip of prepuce, which is almost equal to biting a tip off a finger. It is difficult to believe and study the problem of botched circumcision, as it is a very sacred religious practice, which makes it difficult to get the real picture of how many men are living with mutilated genitalia in the community. It is a problem in the Eastern Cape Province and in this province, it is mainly in the former Transkei region where Xhosas do not allow any interventions by health professionals to limit the health hazard accompanying traditional circumcision rites.[12]

The country has experienced serious problems associated with the practice of this rite.[13] Death related to circumcision cannot be compared with any other kind of unnatural death, but unfortunately, it is very prevalent in this region. An occasional case of death as a result of circumcision is reported in the literature, but it is considered a safe procedure rarely associated with significant complications.[14] The average death rate related to traditional circumcision is (14-9%) deaths per year. It is really surprising to study how a society can tolerate such a high number of deaths and how politicians can turn a blind eye to such a tragedies. The highest number (21-13.5%) of circumcision-related deaths occurred in 2009 (Table 1). If such deaths of children and young adults occurred anywhere else in in this country or in the world, the government would have to explain to the citizens and the public might ask the responsible minister to explain from his/her position. The deaths related to circumcision in the Transkei region are unacceptable; the right to life cannot be sacrificed at the altar of culture and politics.[10]

Over the last two decades, following the ritual of male circumcision, thousands of youths have been admitted to hospitals, hundreds have undergone penile amputations and hundreds have died.[4] Of the 155, who died as a result of circumcision, the youngest was an 11-year-old victim and 76 were below the age of 18, who were all not supposed to have been admitted for circumcision (Table 2). The age in terms of the Circumcision Act should be 18 years and above. The highest number (41 - 26.45%) of victims were 18 years of age (Table 2). Parents do not allow the boys to go for circumcision so early and they have to be sure that the boys are mature before they go to initiation schools. The boys tend to short-circuit the process by going to traditional surgeons without the knowledge of their parents. Informed consent of the parents is a requirement in terms of the Circumcision Act

of the Eastern Cape (2001). Surprisingly, the traditional surgeons accept them without any permission or consent of their parents. This is a recipe for disaster, as the scenario above seeks to illustrate.[10] The oldest victim was 35 years of age (Table 2). Circumcision is the gateway to manhood. Not being circumcised after a certain age is considered inferior in Xhosa culture.[15]

A mixture of underlying, contributory or associated causes of death among initiates was recorded in the post-mortem register, such as septicaemia with pneumonia and renal failure. Several external factors also played a role in causing death, among others dehydration, hypothermia and trauma, which could be the sole cause of death in some cases, but contributory or underlying in most cases. It is also difficult to recognise autopsy. Sixty-six (42.6%) of the initiates died of causes either directly or indirectly related with infection such as septicaemia (Table 3). The most common finding on autopsy is a gangrenous penis as a result of septic circumcision. The traditional surgeon pulls the skin covering the glans penis, and then a tight bandage is applied to maintain haemostasis.[3] This results in gangrene of the distal part of the penis, and subsequently, wet gangrene, septicaemia and death of the individual. A study carried out by Wilcken (2010) showed that infection was the most frequent cause of hospitalisation. [2]

External factors also play a role in the death of initiates, for example dehydration 4 (2.6%) (Table 3). Cold weather is also associated with lung infections and has led to death as a result of pneumonia 1 (0.64%) (Table 3). Three (1.9%) deaths were recorded on autopsy as caused by renal failure (Table 3). The boys are not allowed to drink water freely or eat salty foods, including meat, in the first seven days after circumcision. 12 Deaths occurred as a result of hypothermia (2 - 1.2%) were recorded in this study (Table 3). Circumcision is usually performed in winter, and therefore initiates are exposed to fatal hypothermia.3

Six (3.9%) deaths were recorded as a result of trauma by blunt weapons; such practices are approved by the community traditional schools (Table 3). The initiates are attacked by uncircumcised or improperly circumcised men or ones with mutilated penises. This happens deep in the mountains as they reflect on the virtues of manhood and how to become upstanding men in the community.[3] The SABC news recently (July 2015) reported that a boy had been burnt with plastic, stabbed in the arms and beaten up all over the body, yet the people who were present claimed that they had not noticed any of the torture. [16] One mother said that she was a supporter of culture, but if culture was going to kill their children, she would say "No, it cannot be." [16]

Initiates are supposed to be examined before they join the circumcision school. Any diseases they may have must be diagnosed. In this study natural causes of death recorded on autopsy were epilepsy (1 - 0.64%), empyema (1 - 0.64%), congestive heart failure (1 - 0.64%) and chronic obstructive lung disease (1 - 0.64%) (Table 3). Unqualified surgeons, negligent nurses, irresponsible parents and youth medically unfit for the hardships of initiation continue to contribute to the tragic outcomes.[5]

There are several legal or illegal traditional surgeons in this region who are looking for their livelihood through this practice of circumcision. The generation of income for traditional surgeons, inspired by greed, is the driving force in all this. The traditional surgeons share in part of the money paid for traditional initiation, including circumcision, which can cost a family between R3,500 and R5,000.[17] Circumcision in Western Cape of South Africa is much safer, and even in Western part of Eastern Cape is safer than Eastern region.[18] Death due to septic circumcision is unethical and unaccepted medical conduct to unacceptable cultural practices. The same as the binding of feet in ancient China. This practice was banned.[19] Surely, one must advocate that this practice must be banned in South Africa; it is totally unacceptable in a civilized society.

Poverty, illiteracy and deep beliefs in culture and tradition have complex and vicious

relationships leading to the death of initiates. The situation is compounded by violence and HIV/AIDS in this region.

The death rate related to traditional circumcision is shocking and terrifying in the Mthatha region of South Africa. This practice must be banned. Widespread criticism published in the scientific and lay press has made no difference in the mortality rate. Conflict between government and traditional leaders is the major hurdle to overcome if the problem of circumcision-related deaths is to be solved. Community education and poverty alleviation are cornerstones in finding a solution to this problem. IJFMP

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Conflict of Interest:

The authors declare that there is no commercial or financial links that could be construed as conflict of interests.

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ORIGINAL ARTICLE

A Study of Inheritance Pattern of Palatal Rugae among Two Generations

Priyanka Verma[1], Rajvinder Kaur[2]

ABSTRACT

CONTEXT: Palatal rugae plays very important role in identification of individual. It is important dental evidence as it remains unchanged during lifetime. Palatal rugae are roof of hard palate on anterior portion. Studies have been done that no two palates are alike in their layout. Many factors, such as chemical treatments, heat, or disease do not effect on outline and shape of pattern. **AIMS:** To study of inheritance of palatal rugae pattern among two generation 60 dental casts were selected of father, mother and off springs. They are examined for any similarity and dissimilarity in palatal rugae pattern. Examination of rugae pattern was done according to Thomas and kotze classification. **CONCLUSION:** No significant difference was seen in rugae pattern from father to offspring and mother to offspring. This study shows the percentage of inheritance on the basis of total number of rugae pattern in among from father to offspring is 30% and from mother to offspring is 25% and dissimilarities from father to offspring is 70% and mother to offspring is 75%. Palatal rugae are unique to every individual. Palatal rugae can be used as an ancillary tool in identification of individual in forensic science.

KEYWORDS | dental casts, inheritance, odontology, palatal rugae, rugoscopy

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INTRODUCTION

INDIVIDUAL RECOGNITION IS THE MAIN KEY FOR forensic science especially when they are dealing with some kind of offense that has gone through harm behind belief.[1] The particular technique in identification is DNA fingerprinting, forensic radiography, retinal examination, fingerprint detection and odontology. DNA testing is commonly used but it is costly and cannot be conducted by everyone. Individual identification focused on differentiation within antemortem and postmortem.[2] The study of palatal rugae is known as palatoscopy or rugoscopy. It is useful in sex determination.[3] Palatal rugae formation is not changed throughout growth. It is stable throughout life. Palatal rugae are uneven, asymmetrical and they exist on all edge of mid palatine and in the back of incisive papilla of the incisive papilla.[4]

Overall rugae pattern is applicable in individual identification have been considered relevant for human identification because it is stable throughout life and it is equal to the fingerprint that is unique to each and every individual. Rugae pattern do not increase after ten years of age. Rugoscopy is also significant in orthodontic and in the identification of diseases.[5] Palatal rugae formation towards 3 months of intrauterine life. Maturation of palatal rugae is maintained by the epithelial-mesenchymal cells. In human embryos, the first rugae are distinguished 32mm next to incisive papilla. Palatal rugae are organized in transverse direction coming from palatine raphe situated in the mid sagittal plane.[6] Chemical, heat, or disease does not affect on outline and shape of the pattern. If palatal rugae destroyed then they are reproduced exactly on the same site. Rugae pattern are protected by the inside place in the head from trauma, heat.[7] Palatal Rugae required in oral swallowing, Palatal rugae involve in the production of speech particularly in "S" and "SH" and involve suction in children.[8]

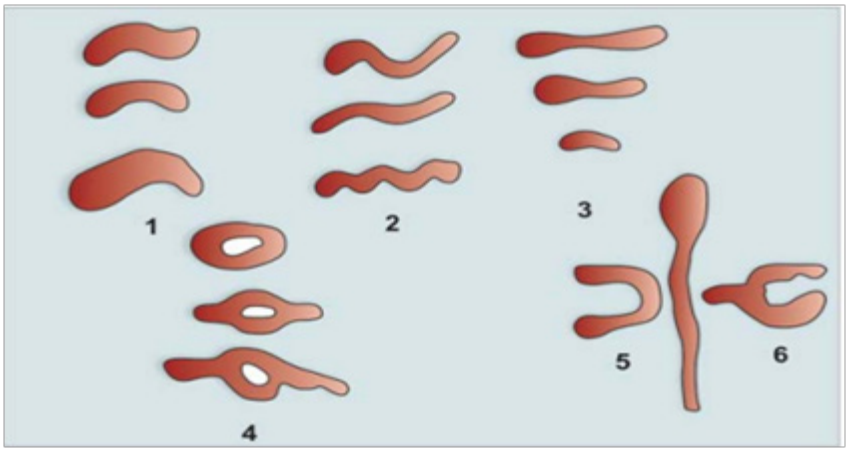

Figure 1: Shapes of palatal rugae patterns [9]

METHOD

This study was conducted on selected individuals of Punjab population. The materials for this study included 20 families. Selected individuals of families like Father, Mother and offspring were taken for the study. 60 dental casts of father, mother and offspring's were taken for the study. All casting samples were free from bubbles. This involves study of shape, number, length and unification of palatal rugae. Dental perforated tray was used for sample collection. Alginate powder mixed with water and maxillary impression were taken. Dental impressions were taken within 2 minutes. After impression taken dental stone powder were poured on impressions. Dental cast was prepared within 45 minutes. On caste sample marking of rugae pattern was done with help of pencil by using hand lens under sufficient light. Examination of rugae pattern was done according to Thomas and kotze classification. Rugae pattern measurement was done with the help of caliber in milimeters. Palatal rugae length was measured from each side and according to length it was divided into primary, secondary and fragmented rugae.

RESULT

Parameter 1: Inheritance on the basis of whole rugae pattern

The palatal rugae pattern sample was collected from 20 families (20*3=60 individual). This study shows the percentage of inheritance on the basis of Total number of rugae pattern in among from father to offspring is 30% and from mother to offspring is 25% and dissimilarities from father to offspring is 70% and mother to offspring is 75%. This study shows the percentage of inheritanceon the basis of primary rugae from father to offspring is 40% and from mother to offspring is 15% and dissimilarities from father to offspring is 60% and mother to offspring is 85%.This study shows the percentage of inheritanceon the basis of secondary rugae from father to offspring is 25% and from mother to offspring is 15% and dissimilarities from father to offspring is 75% and mother to offspring is 85%. This study shows the percentage of inheritance on the basis of fragmented rugae from mother to offspring is 5% and dissimilarities from father to offspring is 100% and mother to offspring is 95%.

Parameter 2: Inheritance on the basis of right side Rugae: This study shows the percentage of inheritance on the basis of total number of rugae from father to offspring is 20% and from mother to offspring is 30% and dissimilarities from father to offspring is 80%

TOTAL NO. OF FAMILIES (SAMPLE: 20*3=60)	(20)	INHERITANCE PERCENTAGE
Number of families showing similarities from father to offspring	6	30%
Number of families showing similarities from mother to offspring	5	25%
Number of families showing dissimilarities from father to offspring	14	70%
Number of families showing dissimilarities from mother to offspring	15	75%

Table 1: Testing Water body distribution of drowning.

TOTAL NO. OF FAMILIES (SAMPLE: 20*3=60)	(20)	INHERITANCE PERCENTAGE
Number of families showing similarities from father to offspring	8	40%
Number of families showing similarities from mother to offspring	3	15%
Number of families showing	12	60%
Number of families showing dissimilarities from mother to offspring	17	85%

Table 2: Inheritance on the basis of primary rugae in percentage

TOTAL NO. OF FAMILIES (SAMPLE: 20*3=60)	(20)	INHERITANCE PERCENTAGE
Number of families showing similarities from father to offspring	5	25%
Number of families showing similarities from mother to offspring	3	15%
Number of families showing dissimilarities from father to offspring	15	75%
Number of families showing dissimilarities from mother to offspring	17	85%

Table 3: Inheritance on the basis of secondary of rugae in percentage

TOTAL NO. OF FAMILIES (SAMPLE: 20*3=60)	(20)	INHERITANCE PERCENTAGE
Number of families showing similarities from father to offspring	Nil	Nil
Number of families showing similarities from mother to offspring	1	5%
Number of families showing dissimilarities from father to offspring	20	100%
Number of families showing dissimilarities from mother to offspring	19	95%

Table 4: Inheritance on the basis of fragmented rugae in percentage.

TOTAL NO. OF FAMILIES (SAMPLE: 20*3=60)	(20)	INHERITANCE PERCENTAGE
Number of families showing similarities from father to offspring	4	20%
Number of families showing similarities from mother to offspring	6	30%
Number of families showing dissimilarities from father to offspring	16	80%
Number of families showing dissimilarities from mother to offspring	14	70%

Table 5: Inheritance on the basis of total number of rugae on right side in percentage

TOTAL NO. OF FAMILIES (SAMPLE: 20*3=60)	(20)	INHERITANCE PERCENTAGE
Number of families showing similarities from father to offspring	8	40%
Number of families showing similarities from mother to offspring	10	50%
Number of families showing dissimilarities from father to offspring	12	60%
Number of families showing dissimilarities from mother to offspring	10	50%

Table 6: Inheritance on the basis of primary rugae on right side in percentage

TOTAL NO. OF FAMILIES (SAMPLE: 20*3=60)	(20)	INHERITANCE PERCENTAGE
Number of families showing similarities from father to offspring	6	30%
Number of families showing similarities from mother to offspring	5	25%
Number of families showing dissimilarities from father to offspring	14	70%
Number of families showing dissimilarities from mother to offspring	15	75%

Table 7: inheritance on the basis of secondary rugae on right side in percentage

TOTAL NO. OF FAMILIES (SAMPLE: 20*3=60)	(20)	INHERITANCE PERCENTAGE
Number of families showing similarities from father to offspring	Nil	Nil
Number of families showing similarities from mother to offspring	Nil	Nil
Number of families showing dissimilarities from father to offspring	20	100%
Number of families showing dissimilarities from mother to offspring	20	100%

Table 8: Inheritance on the basis of fragmented rugae on right side in percentage.

TOTAL NO. OF FAMILIES (SAMPLE: 20*3=60)	(20)	INHERITANCE PERCENTAGE
Number of families showing similarities from father to offspring	6	30%
Number of families showing similarities from mother to offspring	6	30%
Number of families showing dissimilarities from father to offspring	14	70%
Number of families showing dissimilarities from mother to offspring	14	70%

Table 9: Inheritance on the basis of total number of rugae on left side in percentage

TOTAL NO. OF FAMILIES (SAMPLE: 20*3=60)	(20)	INHERITANCE PERCENTAGE
Number of families showing similarities from father to offspring	6	30%
Number of families showing similarities from mother to offspring	5	25%
Number of families showing dissimilarities from father to offspring	14	70%
Number of families showing dissimilarities from mother to offspring	15	75%

Table 10: Inheritance on the basis of primary rugae on left side in percentage

TOTAL NO. OF FAMILIES (SAMPLE: 20*3=60)	(20)	INHERITANCE PERCENTAGE
Number of families showing similarities from father to offspring	4	20%
Number of families showing similarities from mother to offspring	5	25%
Number of families showing dissimilarities from father to offspring	16	80%
Number of families showing dissimilarities from mother to offspring	15	75%

Table 11: inheritance on the basis of secondary rugae on left side in percentage

TOTAL NO. OF FAMILIES (SAMPLE: 20*3=60)	(20)	INHERITANCE PERCENTAGE
Number of families showing similarities from father to offspring	2	10%
Number of families showing similarities from mother to offspring	Nil	Nil
Number of families showing dissimilarities from father to offspring	18	90%
Number of families showing dissimilarities from mother to offspring	20	70%

Table 12: inheritance on the basis of fragmented rugae on left side in percentage

and mother to offspring is 70%. This study shows the percentage of inheritance on the basis of primary rugae from father to offspring is 40% and from mother to offspring is 50% and dissimilarities from father to offspring is 60% and mother to offspring is 50%. This study shows the percentage of inheritance on the basis of secondary rugae from father to offspring is 30% and from mother to offspring is 25% and dissimilarities from father to offspring is 70% and mother to offspring is 75%. This study shows the percentage of inheritance on the basis of fragmented rugae shows dissimilarities from father to offspring is 100% and mother to offspring is 100%.

Parameter 3: Inheritance on the basis of left side rugae. This study shows the percentage of inheritance on the basis of Total number of rugae from father to offspring is 30% and from mother to offspring is 30% and dissimilarities from father to offspring is 70% and mother to offspring is 70%. This study shows the percentage of inheritance on the basis of primary rugae from father to offspring is 30% and from mother to offspring is 25% and dissimilarities from father to offspring is 70% and mother to offspring is 75%. This study shows the percentage of inheritance on the basis of secondary rugae from father to offspring is 20% and from mother to offspring is 25% and dissimilarities from father to offspring is 80% and mother to offspring is 75%.This study shows the percentage of inheritanceon the basis of fragmented rugae from father to offspring is 10% and dissimilarities from father to offspring is 90% and mother to offspring is 100%.

CONCLUSION

For identification of human there are various techniques like DNA fingerprinting, forensic radiography, retinal examination, fingerprint detection and odontology. Palatal rugae auspiciously used for personal recognition due to its uniqueness. Palatal rugae are unique in each and every individual and it is remain unchanged throughout the life. The position of rugae pattern is unchanged and not effected by any disease, trauma or chemical. Due to its low cost it is used in personal recognition. The study of palatal rugae is reliable and simple. IJFMP

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Analysis of Pattern of Medico Legal Cases Registered in the Casualty Department of a Teaching Hospital, Karimnagar (Telangana state)

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CONTEXT: A medicolegal case is any medical case with legal implications. These medico-legal cases differ among regions based on socio-economic status, cultural diversities, capability of law enforcing agencies and the prevailing standards of health care services available in the community.

AIM: This study was aimed to know the pattern and magnitude of medico legal cases.

MATERIAL & METHODS: It is a record based analytical cross sectional study in which all the MLC cases registered in MLC record book of Chalmeda Anand Rao Institute of Medical Sciences, Karimnagar between January to June 2017 were included. Cases found non medico -legal were excluded. Variables considered were gender, age, time of arrival. Findings were expressed in numbers and percentages.

RESULTS: Total cases were 464, of which 355 (76.50%) were males and 109 (23.50%) were females. Maximum cases were from the age group of 21-40 years i.e., 206 (44.39%). Most of the medico-legal cases registered were due to Road Traffic Accidents (53.67%) followed by machinery (factory) injuries (20.25%), poisoning (8.84%), fall from height (6.26%), assault (4.52%), thermal injuries (4.52%), injuries by animals (0.86%), self-inflicted injuries (0.64%), injuries due to violent asphyxia (0.22%), railway injuries (0.22%).

CONCLUSIONS: Most of the victims were males, young adults. Most common cases reported as medico legal cases were road traffic accidents followed by machinery injuries and poisoning cases, etc.

KEYWORDS | casualty, tertiary care hospital, road traffic accidents, assault, poisoning

INTRODUCTION

MEDICO-LEGAL CASE CAN BE DEFINED AS A case of injury or ailment etc. in which investigations by the law enforcing agencies are essential to fix the responsibility regarding the causation of the said injury or ailment. In simple language, it is a medical case with legal implications for the attending doctor where the attending doctor, after eliciting history and examining the patient, thinks that some investigation by law enforcement agencies is essential.[1, 2]

It is the responsibility of a registered medical practitioner to judge each and every case properly and in doubtful cases, it is mandatory to inform the police as required by law. This saves the doctor from unnecessary and needless allegations later.[3]

Any failure to report the occurrence of an MLC may invite prosecution under sections 176 and/or 202 of IPC.[4]

All the medico-legal cases are registered in casualty. Casualty department is very crucial

to any hospital as all the medical and surgical emergencies first report there. Further, it serves as an outpatient department after the routine outpatient department hours.

Profiling of medicolegal cases is an integral aspect to the prevention of preventable causalities in future and to study the crime rate in area.[5]

In the present study an attempt is made to know the pattern and magnitude of medico legal cases in aspect of types of cases, age and sex, time of arrival in casualty department and analyze the data and find out suggestion for improvement of medicolegal work in casualty.

Material and Methods

This is a record-based analytical, and cross-sectional study involving medicolegal cases which reported to the casualty of Chalmeda Anand Rao Institute of Medical Sciences, Karimnagar from 1st January to 30th June 2017. All the reported MLC cases in the medicolegal case register were included in this study. Cases found as non-medicolegal and those with incomplete entry were excluded. Information regarding gender, age and time of arrival was collected from the medico legal case register. The collected data was analyzed, observations discussed, tabulated and compared with other studies.

RESULTS

A total of 464 cases were selected for the present study from medico legal case register and the following observations were made. Out of 464 medico legal cases studied, 355 (76.50%) were male and 109 (23.50%) were female. Male to female gender ratio being 3.25:1. (Figure -1)

From the present study it is observed that more number of victims in this study population are of 31-40 years age group 105 (22.63%), followed by 21-30 years age group 101 (21.76%). The minimum number of cases were reported in the age group of >70 years 13 (2.80%) followed by 1-10 years age group 16 (3.45%). (Figure -2)

It is also observed that maximum number of cases were reported between 12 p.m. to 6 p.m. (40.08%) followed by 6 p.m. to 12 p.m. (31.25%), 6 a.m. to 12 p.m. (18.31%). Time of arrival of cases was the time mentioned in medicolegal register, it was observed that minimum cases were reported at night time i.e. 12 a.m. to 6 am (10.34%). It was also observed that maximum numbers of cases were reported between 12 p.m. to 12 a.m. (71.33%) in comparison to 12 am to 12 p.m. (28.65%). (Table -1)

Present study showed that most of the medico legal cases registered were due to RTA (53.67%) followed by machinery injuries (20.25%) and poisoning (8.84%). Fall from height accounted for 6.26% cases and assault cases accounted for 4.52%. Cause of MLC was thermal injuries in 4.52% cases, injuries by animal in 0.86% cases and self-inflicted injuries in 0.64% cases. Minimum numbers of cases were due to railway injuries (0.22%), violent asphyxia (0.22%). The male to female ratio varied with the type of medico legal case. Males were predominantly involved in most of the medico legal cases. (Table -2)

DISCUSSION

A case is made in medico legal by the Medical officer whenever an injured, poisoned, burnt cases are brought to the casualty for treatment irrespective of the history of the case. This is done on the presumption that it is the duty of the doctor to assist the police in the proper investigation of the case, to help catch the accused, and also to prevent any untoward incident in society. In every case of injury all observations and details of examination of the injured person must be entered into the accident register by the medical officer with appropriate sketches and diagrams.[6]

A similar study done at a tertiary care hospital in Bareilly, U.P., showed that males were the dominant group (81.44%). Most of the victims were of the age group 21 – 30 years (30.68%). Most of the medico legal cases registered were due to RTA (64.39%)[7]. These findings are similar to our study findings.

A study done by researchers in Bengaluru, has shown that assault (50.3%) constituted

TYPE	DISTRIBUTION	RTA	MACHINERY	POISONING	FALL FROM HEIGHT	ASSAULT	THERMAL INJURIES	INJURIES BY ANIMAL	SELF-INFLICTED	VIOLENT ASPHYXIA	RAILWAY INJURIES
AGE GROUPS	0-10Yrs	3(1.20%)	5(5.32%)	2(4.88%)	3(10.35%)	1(4.76%)	2(9.52%)	NIL	NIL	NIL	NIL
	11-20Yrs	47(18.87%)	11(11.70%)	12(29.26%)	3(10.35%)	1(4.76%)	4(19.06%)	1(25%)	NIL	NIL	1(100%)
	21-30Yrs	56(22.49%)		11(11.70%)	15(36.58%)	5(17.24%)	7(33.34%)	5(23.81%)	NIL	2(66.67%)	NIL NIL
	31-40Yrs	55(22.09%)		25(26.60%)	6(14.63%)	5(17.24%)	7(33.34%)	5(23.81%)	2(50%)	NIL	NIL NIL
	41-50Yrs	41(16.46%)	20(21.28%)	1(2.45%)	6(20.67%)	1(4.76%)	3(14.28%)	1(25%)	1(33.33%)	1(100%)	NIL
	51-60Yrs	28(11.25%)	16(17.02%)	4(9.75%)	5(17.24%)	3(14.28%)	2(9.52%)	NIL	NIL	NIL	NIL
	61-70Yrs	11(4.42%)	2(2.13%)	NIL	2(6.91%)	1(4.76%)	NIL	NIL	NIL	NIL	NIL
	>70Yrs	8(3.22%)	4(4.25%)	1(2.45%)	NIL	NIL	NIL	NIL	NIL	NIL	NIL
GENDER	MALES	199(79.92%)	71(75.50%)	21(51.21%)	26(89.65%)	18(85.72%)	13(61.90%)	3(75%)	2(66.67%)	1(100%)	1(100%)
	FEMALES	50(20.08%)		23(24.50%)	20(48.79%)	3(10.35%)	3(14.28%)	8(38.10%)	1(25%)	1(33.33%)	NIL NIL
TIME OF ARRIVAL	MORNING (6AM-12PM)	43(17.27%)	20(21.28%)	8(19.52%)	3(10.35%)	6(28.57%)	2(9.52%)	1(25%)	2(66.67%)	NIL	NIL
	AFTERNOON (12PM-6PM)	105(42.16%)	33(35.11%)	16(39.02%)	12(41.37%)	8(38.10%)	8(38.10%)	1(25%)	1(33.33%)	1(100%)	1(100%)
	EVENING (6PM-12PM)	79(31.73%)	29(30.85%)	12(29.26%)	12(41.37%)	4(19.05%)	8(38.10%)	1(25%)	NIL	NIL	NIL
	NIGHT (12AM- 6AM)	22(8.84%)	12(12.76%)	5(12.20%)	2(6.97%)	3(14.28%)	3(14.28%)	1(25%)	NIL	NIL	NIL

Table 1: Pattern of Medicolegal cases.

PATTERN OF MEDICOLEGAL CASES	FREQUENCY(PERCENTAGE)
Road traffic accidents	249(53.67%)
Machinery	94(20.25%)
Poisoning	41(8.84%)
Fall from height	29(6.26%)
Assault(manual/weapon)	21(4.52%)
Thermal Injuries	21(4.52%)
Injuries by animal	4(0.86%)
Self-inflicted injuries	3(0.64%)
Violent asphixial injuries	1(0.22%)
Railway injuries	1(0.22%)
Total	464(100%)

Table 2: Distribution of medico legal cases according to their pattern (n=464)

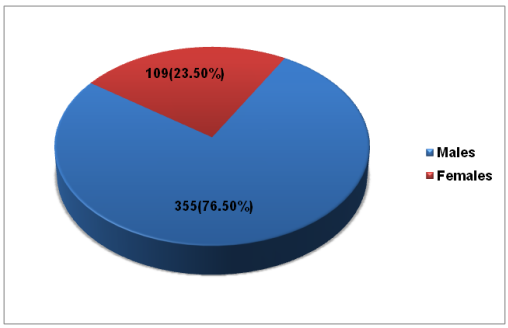

Figure 1: Distribution of medico legal cases according to their Gender (n=464)

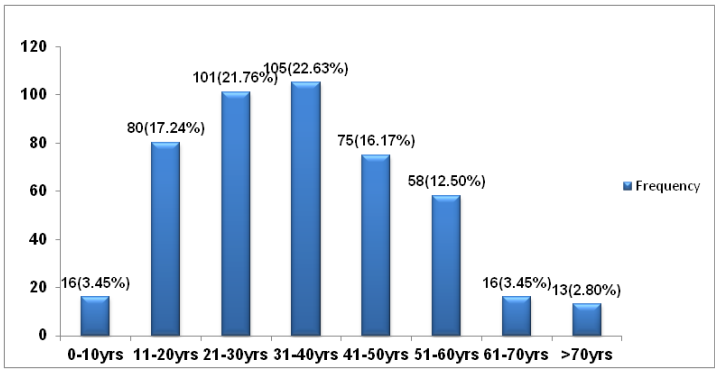

Figure 2: Age wise distribution of medico legal cases reported (n=464)

the majority of medico legal cases followed by poisoning (18.43%). This finding is in contrast to our findings. In their study, majority of the victims were males (68.74%) and maximum number of cases were in the age group of 21 – 30 years (43.22%).[8] These are consistent with our study findings.

In our study it was observed that most of the victims were males (76.50%). Our findings are consistent with study conducted by Trangadia MM *et al.,*[9] (males 72.77%), Hussaini SN *et al.,*[10] (males 74.03%). The predominance of males over females may be attributed to the male dominance in the society and males who work outside to earn their daily bread are more vulnerable, while females usually stay at home and look after the household work.

In our study maximum numbers of cases reported to casualty were from age group 31-40 years (22.63%) followed by 21-30 years (21.76%) and 11-20 years (17.24%), almost similar to other authors studies.[7,8,9,10] This may be due to fact that individual of these age group lead more active life, involved more in the outdoors, sports and recreational activities and take risk, which leads to more injuries and accidents among these group.

Maximum incidence of medico legal cases took place between 12 pm to 6 pm (40.08%), this is similar to other author studies[7], as during this time of day most of people are involved in their activities. This is because as the day progressed the frustration of the person increased and the temperature, humidity environment also increased during this time period of day. Our study also showed that minimum number medico legal cases reported to casualty between 12 am to 6 pm (10.34%), because people usually remain asleep.

Present study showed that maximum cases reported to casualty were RTA (53.67%). This finding in consistent with other study Atul saxena *et al.,*[7], contrast with Karhik SK *et al.,*[8] showing that assaults were maximum, in our area assault cases most of the time referred to Govt. District Hospital. Next to RTA other medico legal cases reported casualty were machinery injuries (20.25%) noted in our study but it differed with other studies[7,8], because in our study place granite industries and agriculture works were more so injuries were more with machinery.[11] after machinery injuries, poisoning cases (8.84%) were commonly reported. Malik Y[12] and Yadav A[13] studies observed that maximum cases reported to casualty were of poisoning which differ to our study.

CONCLUSION

The casualty department of any hospital is not only deal medical and surgical emergencies but also carry out legal responsibilities to examine documentation and certify medico-legal cases, this puts a lot of burden on casualty department and on first contact doctor, most of time they are MBBS only. The doctor those are involved in handling medico legal cases need to be more trained.

The present study shows that majority of the victims are males as compare to females. Younger age group (21-40 years) is more commonly affected. RTA cases were highest in number among all registered medico-legal cases. This can be reduced by implementing strict road traffic rules as well as by improving the road condition by concerned authorities, at the same time giving proper education, awareness and training of safety standards by administrators, health officials, social workers and NGOs to the general population. IJFMP

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Article in supplement or special issue

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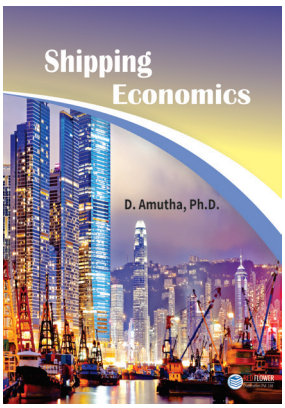

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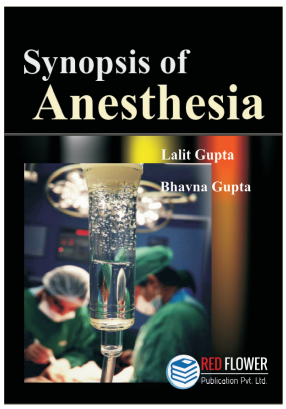

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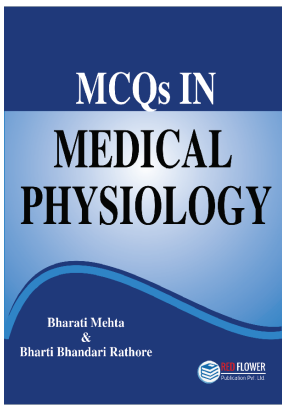

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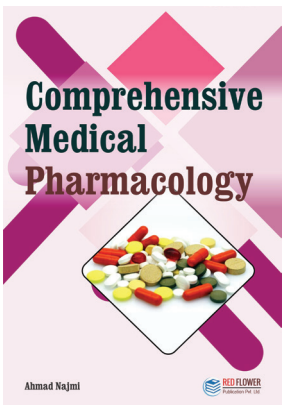

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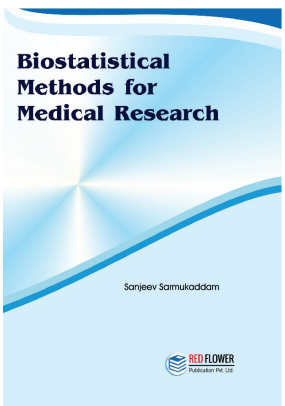

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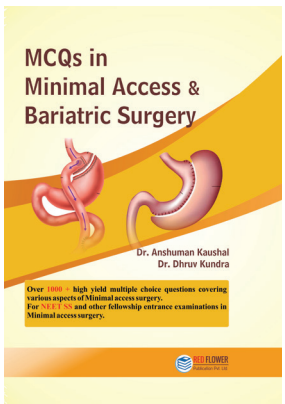

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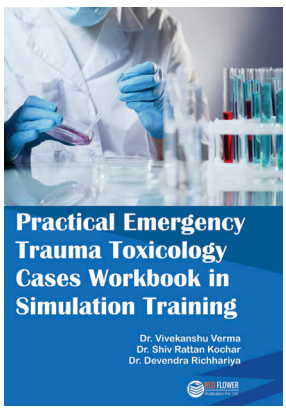

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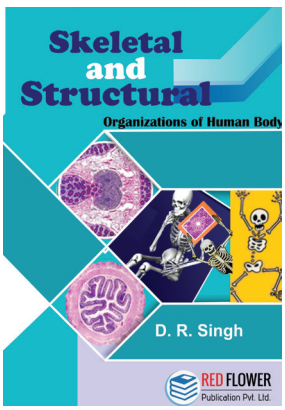

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