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Estimation of Correlation between Length of Middle Finger and Stature in Maharashtra Region

Anita S. Fating[1], Sudhir E. Pawar[2]

Abstract

Context: Measurement of stature and middle finger lengths are part of studies in anthropology. *Aims:* To evaluate correlation between length of middle fingers and stature of college students in both males and females of medical and paramedical fields of Maharashtra which would be beneficial for Anatomists, Anthropologists, Forensic experts and in ergonomics. *Setting and Design:* Department of Anatomy, Dr Vithalrao Vikhe Patil Foundation's Medical College, Vilad ghat Ahmednagar, Maharashtra. *Material & Methods:* Measurements were taken for stature and middle finger length of both hands of 150 males and 150 females. *Statistical analysis used:* Pearson correlation coefficient and linear regression analysis. *Results:* For males, Pearson correlation coefficient (r) between stature and right middle finger was 0.598 and between stature and left middle finger was 0.591. For females, Pearson correlation coefficient (r) between stature and right middle finger was 0.569 and between stature and left middle finger was 0.551. P values for both genders were highly significant. *Conclusion:* Stature and middle finger length of both hands were significantly correlated with each other irrespective of gender. These strong correlations were further utilized to derive regression equations.

Keywords: Stature; Middle Finger Length; Correlation; Regression Equation.

Introduction

Basic and major component of anthropological research is the estimation of stature which is useful for identification of an individual and is of immense importance to medicolegal experts, forensic examiners and anatomist [1]. It is quite easy to estimate stature of an individual if whole body is available, but it is too difficult to estimate stature if only few parts of the body or skeletal remains are available [2].

Human beings are considered as bilaterally symmetrical; however there may be an asymmetry in the length of middle finger irrespective of gender or handedness.

Subjects and Methods

The present study was conducted in the department of Anatomy at DVVPF's Medical college and Hospital, Vilad ghat, Ahmednagar, Maharashtra after obtaining ethical acceptance. It was carried over 300 students (150 males & 150 females), between 18 to 25 years, of medical & paramedical fields of various regions of Maharashtra. Prior informed consent was taken. It excludes the non-Maharashtrian students, those below 18 years & above 25 years, having congential/accidental absence/ malformed middle finger. Stature was measured in morning time by measuring tape in cm as distance between vertex to heel in standing posture of subject with bare feet on a horizontal plane and head in Frankfurt plane. (Figure 1) Length of middle fingers of both hands in cm was measured by vernier caliper as distance between proximal crease to tip of middle finger with palm facing upward on a horizontal plane. (Figure 2) Correlation between these parameters were obtained using SPSS software [version 16.0]. Further this strong correlations were used to derive regression equations for estimation of stature for both gender.

Results

Maximum and minimum stature for males was 190cm and 155cm respectively. Mean stature for males was 173.68cm. Maximum and minimum length of right middle finger for males was 9.2cm and 6.6cm respectively. Maximum and minimum length of left middle finger for males was 9.1cm and 6.7cm respectively. Maximum and minimum

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stature for females was 179cm and 144cm respectively. Mean stature for females was 157.89cm. Maximum and minimum length of right middle finger for females was 8.2cm and 6.0cm respectively. Maximum and minimum length of left middle finger for females was 8.1cm and 6.0cm respectively. For males, Pearson correlation coefficient (r) between stature and right middle finger was 0.598 and between stature and left middle finger was 0.591. For females, Pearson correlation coefficient (r) between stature and right middle finger was 0.569 and between stature and left middle finger was 0.551. P value for both genders was < 0.001. Stature and middle finger length of both fingers were significantly correlated with each other irrespective of gender. Regression equations for stature from middle fingers of both hands in males & females were derived. Also regression equations for stature from middle fingers of both hands irrespective of gender were derived.

Fig. 1: Measurement of stature

Fig. 2: Measurement of length of middle finger by vernier calliper

Table 1: Descriptive statistics for stature and middle finger length in males and females

	Males [N=150]			Females[N=150]		
	Stature (cm)	**RMFL (cm)**	**LMFL (cm)**	**Stature (cm)**	**RMFL (cm)**	**LMFL (cm)**
Maximum	190	9.2	9.1	179	8.2	8.1
Minimum	155	6.6	6.7	144	6.0	6.0
Mean	173.68	7.964	7.961	157.89	7.199	7.191
Standard deviation	6.625	0.471	0.463	6.200	0.397	0.401
Standard error of mean	0.541	0.038	0.038	0.506	0.032	0.033

RMFL—-Right middle finger length, LMFL—Left middle finger length

Table 2: Regression statistics for stature, RMFL and LMFL in males [N=150]

Regression statistics	**RMFL**	**LMFL**
Pearson correlation coefficient (r)	0.598	0.591
R square	0.358	0.349
Slope	8.412	8.458
Intercept	106.690	106.343
Standard error of estimation	5.326	5.363
P value	< 0.001	< 0.001

Regression equations for males:
Stature = 106.690 + (8.412 x RMFL)
Stature = 106.343 + (8.458 x LMFL)

Table 3: Regression statistics for stature, RMFL and LMFL in females [N=150]

Regression statistics	RMFL	LMFL
Pearson correlation coefficient (r)	0.569	0.551
R square	0.323	0.304
Slope	8.880	8.521
Intercept	93.969	96.613
Standard error of estimation	5.117	5.191
P value	< 0.001	< 0.001

Regression equations for females:
Stature = 93.969 + (8.880 x RMFL)
Stature = 96.613 + (8.521 x LMFL)

Table 4: Regression statistics for stature, RMFL and LMFL in all subjects [N=300]

Regression statistics	RMFL	LMFL
Pearson correlation coefficient (r)	0.790	0.786
R square	0.624	0.618
Slope	13.859	13.811
Intercept	60.718	61.153
Standard error of estimation	6.253	6.298
P value	< 0.001	< 0.001

Regression equations for all subjects:
Stature = 60.718 + (13.859 x RMFL)
Stature = 61.153 + (13.811 x LMFL)

Discussion

To estimate stature from middle finger length is of utmost importance in medicolegal cases where only complete hand or middle finger is available. In the events of natural disasters, accidents or murder prediction of stature of an individual from skeletal remains or mutilated, amputated limbs or some parts of body have special significance. Present study revealed significant correlation between length of middle fingers of both hands and stature irrespective of gender.

Stature of an individual depends upon multiple factors like age, race, nutritional factors, genetic make up, environment etc. Kerley is of opinion that every body parts bears a more or less constant relationship with stature [3]. Formulae designed to estimate stature in one population from various anatomical dimensions do not apply to another [4]. Relevant formulae are needed for population of various geographical areas as environmental and nutritional factors play major role in growth of individuals [5].

Some researchers studied about correlation between stature and length of different fingers mainly middle, ring, index and some studied all fingers, out of which few derived regression equation for specific population.

Shivakumar et al. [6] studied 100 male students of South India between 17 to 22 yrs and found statistically highly significant correlation between right middle finger length and stature. They revealed that right middle finger length can be used to predict stature among males of that region. A study by Verghese et al. [7] revealed significant correlation between length of middle finger of both hands and stature in males and females in Mysore and surrounding regions of Karnataka, South India and opined that those equations could be used for estimation of stature in the region of south India**.** A study of 260 students, 130 males & 130 females of central India by Shroff et al. [8] concluded that middle finger length was positively correlated with both hand length and height of person. Rahule et al. [9] estimated good correlation between right middle finger length and stature of tribal district population of India by studying 100 subjects, 23 male and 77 female and concluded that height of an individual could be predicted by regression equation. A study of 200 subjects between 18 to 25 years by Katwal et al. [10] indicated that middle finger length could be efficiently used for estimation of stature. Rastogi et al. [11] found good correlation between stature and middle finger length while studying North and South Indian population The present study revealed highly significant correlation between length of middle fingers of both hands with stature

Table 5: Regression equations derived by researchers

Researchers	Population	Sample size			Regression equations	
		Total	Males	Females	Males	Females
Present	Maharashtra	300	150	150	S=106.690 + (8.412 x RMFL) S =106.343+ (8.458 x LMFL)	S = 93.969 + (8.880 x RMFL) S = 96.613 + (8.521 x LMFL)
Shivakumar AH[6]	South India	100	100	NIL	S=152.02+1.47(RMFL)	----------
Verghese AJ[7]	Mysore, Karnataka	260	130	130	S=120.20+4.95 x RMFL S=117.11+5.27 x LMFL	S=117.55+4.26 x RMFL S=115.77+4.43 x LMFL
Rahule AS[9]	Tribal Andhra Pradesh, India	100	23	77	S=120.74+0.457 x RMFL	S=93.56+0.636 x RMFL
Katwal B[10]	Nepal	200	100	100	S=131.29+0.442 x RMFL	S=115.65+0.442 x RMFL
Pooja A[13]	Gujrat	200	100	100	S=99.84+9.11 x RMFL S=122.02+6.34 x LMFL	S=79+10.86 x RMFL S=83.35+10.21 x LMFL

irrespective of gender, thus it was correlated with the above studies by various researchers.

After studying 200 subjects, 100 male and 100 female, Suseelama et al. [12] showed significant relationship between finger lengths and stature and as per their opinion middle finger length would give exact height of an individual among five fingers. In a study by Pooja et al. [13] of 200 subjects between 18 to 25 years of Gujrat, it was concluded that among ten fingers of both right and left hands left index and left middle finger were found to be more reliable for estimation of stature.

After observing the table 5 it could be predicted that regression equations for stature is different for different populations, so the regression equation for a particular population could not be applied for the other populations.

Some researchers studied correlation between length of index finger and stature, some between length of ring finger and stature while others between hand length and stature. A study by Bardale et al. [14] over 195 students and by Raju et al. [15] over 250 students in Davangere district found a significant correlation between both index finger and ring length and stature of male and female subjects. A study of 200 subjects of Uttarakhand by Lalit et al. [16] and of 400 subjects by Ravindra et al. [17] shown highly significant correlation between index finger length and stature of male and female. While Nilofer et al. [18] found strong correlation between stature and hand length. They also provided regression equation for accurate estimation of stature in both gender after a study of 200 subjects of Maharashtra. According to Girish et al. [19] there was weak positive correlation between height and hand length after studying 220 subjects, 132 males and 88 females.

Limitations

The present study was conducted for a limited age group and for a particular population, so it cannot be applied to all. The regression equations could be applied only when complete middle finger is available.

Conclusion

Stature and middle finger length of both hands were significantly correlated with each other irrespective of gender. Regression equations for stature from middle fingers of both hands in males & females were predicted. Also stature could be estimated even if gender is not known as the regression equations were derived for all subjects including both males and females.

Thus the present study is helpful to predict the stature of individuals from middle finger length of either hand irrespective of gender.

Key message

Stature and middle finger lengths of an individual were highly correlated with each other.

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Original Article

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Study of Morphology of Interatrial Septum in 40 Fetuses in Ahmedabad, Gujarat

Ashish E. Khokhariya[1], Kuldeep N. Suthar[2], Pankaj B. Maheria[3]

Abstract

Introduction: Knowledge of morphological features of the fetal heart is necessary to achieve an accurate diagnosis of possible malformations as well as other conditions that may cause physiological alterations in the fetal heart progressing to cardiac failure and fetal death, if not opportunely corrected. Clinical anatomy of the true interatrial septum is treacherous, difficult and its unfamiliarity can cause many serious complications. *Materials and Methods:* 40 formalin preserved fetal hearts at gestational age from 14 to 40 weeks were dissected through midline thoracotomy and cutting open the pericardial sac. Foramen ovale diameter and septum primum excursion in the left atrium were measured in millimeter. *Result:* In gestational age group of 14-20 weeks (14 fetuses), foramen ovale diameter (FOD) was 2.3 mm in male and 2.2 mm in female while septum primum excursion (SPE) was 2 mm in both. In 21-30 weeks (16 fetuses), FOD was 2.5 mm in both while SPE was 2.2 in male and 2.1 in female. In 31-40 weeks (10 fetuses), FOD was 32 mm in male and 3.8 mm in female while SPE was 4 mm in male and 3.6 mm in female. *Conclusion:* A sound knowledge about the normal anatomy and development of the fetal heart has become absolutely necessary to know the fetal echocardiography and new surgical techniques for correction of prenatally diagnosed cardiac malformations.

Keywords: Foramen Ovale; Septum Primum; Interatrial Septum; Fetal Heart.

Introduction

Embryonic development of the human heart depends on cell-cell interaction, particularly myocardial and mesenchymal cells [1-6]. This interaction accounts for the differentiation and morphogenesis of specific areas in the heart [7-10]. The endocardial cushion, a clustering of endocardial and mesenchymal cells, plays a direct role in cardiac septa and atrioventricular valve formation [7, 11]. With the development of fetal echocardiography and new surgical techniques for correction of prenatally diagnosed cardiac malformations, a sound knowledge about the normal anatomy and development of the fetal heart has become absolutely necessary [12]. During intrauterine life, the foramen ovale allows most oxygenated blood entering the right atrium from the inferior vena cava and ductus venosus to pass into the left atrium. It also prevents blood from flowing in the opposite direction, because the septum primum closes against a relatively rigid septum secundum. After birth, the foramen ovale usually closes, and the interatrial septum completely separates atrial chambers [13].

It is absolutely necessary to know the morphometric features of the fetal heart to achieve an accurate diagnosis of possible malformations as well as other conditions that may cause physiological alterations in the fetal heart progressing to cardiac failure and fetal death, if not opportunely corrected [12]. Clinical anatomy of the true interatrial septum is treacherous, difficult and its unfamiliarity can cause many serious complications. Thus, the aim of our study was to assess the regional morphology of the interatrial septum for a deeper understanding [14].

Materials and Methods

This study is conducted in the Department of Anatomy, B.J Medical College, Ahmedabad, after obtaining permission from the ethical committee. These fetuses of both the sexes were collected from

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the Department of Obstetrics & Gynaecology (Obs & Gyn), B.J Medical College, Ahmedabad with due permission from concerned parties & authorities. 24 female & 16 male fetuses were included in the study. The heart specimens were preserved by injecting 10% formalin into Umbilical vein. Age of the fetuses was determined from last menstrual period (LMP) & Ultrasonography (USG) report of Mother. 40 Fetal Hearts at gestational age from 14 to 40 weeks were dissected. Hearts were removed with a midline thoracotomy and cutting open the pericardial sac.

Inclusion Criteria

Aborted fetuses of gestational age 14 to 40 weeks.

Exclusion Criteria

- Patients refusing to give consent
- Aborted fetuses below the gestational age of 14 weeks & above 40 weeks
- Macerated fetuses

The following parameters were studied:

a. Foramen ovale (FO)
b. Septum primum (SP)
c. Compare septum primum excursion with foramen ovale diameter

Method of Parameter Measurement

The heart was cut transversely to the interventricular septum from the apex to the base, allowing ventricular cavities to be visualized by opening the atrial wall and exposing the septum primum, septum secundum, and foramen ovale. Septum primum maximal excursion and foramen ovale diameter were measured by using an adapted measurement device (a caliper with two sharp metal ends).

Septum primum excursion was measured by fixing one of the ends of the measurement device in the septum secundum and the other in the middle of the free edge of the septum primum, which was pushed toward the left atrium as far as its maximal excursion, without deforming neighbouring structures.

Foramen ovale diameter was measured at a 90° angle in relation to the septum primum excursion measurement, corresponding to a line between septum primum implantation sites.

Results

The anatomical measurements of the formaldehyde preserved fetal hearts are presented in [Table 1].

Study carried out on 3 groups: (1) 14-20 weeks, (2) 21-30 weeks, (3) 31-40 weeks.

We observed that there is no much difference in foramen ovale diameter and septum primum excursion of male and female fetuses. Increasing the size is obvious as age of fetus is increasing [Table 1].

Age groups of fetuses were 14-40 weeks. From them, I am depicting some important figures. Figure 1 showing interatrial septum of heart from left side of 31 weeks. Figure 2 showing heart of 31 weeks measurement of foramen ovale and Figure 3 showing heart of 31 weeks measurement of septum primum.

Fig. 1: Showing interatrial septum of heart from left side of 31 weeks

Table 1: Foramen ovale diameter & Septum primum excursion

S. No.	Gestational age (Weeks)	Sex	No. Of Fetus	Foramen Ovale Diameter (mm)	Septum Primum Excursion (mm)
1	14-20	M	6	2.3	2
		F	8	2.2	2
2	21-30	M	6	2.5	2.2
		F	10	2.5	2.1
3	31-40	M	4	3.2	4
		F	6	3.8	3.6

Fig. 2: Showing heart of 31 weeks measurement of foramen ovale

Fig. 3: Showing heart of 31 weeks measurement of septum primum

Discussion

During fetal life, septum primum acts as a valve that closes the foramen ovale when atrial contractions occur. During diastole, septum primum bulges into the left atrium, allowing maximal opening and right-to-left flow [15,16]

With the use of groups of fetuses of diabetic mothers with septal myocardial hypertrophy as a model for decreased left ventricular compliance and relaxation it was noted that, in this situation, septum primum excursion is reduced. Septum primum may also develop hypertrophy [17]. Such type of result was not found in our study as there was no any fetus from diabetic mother.

Conclusion

Septum primum mobility has proved to be an indicator of left diastolic function. Taking into account that septum primum mobility may reflect changes related to left atrial pressure, alterations in left ventricular relaxation and/or compliance may affect the behavior of the former. It may be suggested that septum primum is active in character, and this behavior may influence the blood flow through the foramen ovale. Moreover, septum primum mobility itself, as well as its excursion into the left atrium, depends not only on left atrial pressure, but also on its muscle fibres [17].

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Ultrasonographic Evaluation of Fetal Gestational Age in Different Trimesters from Various Anatomical Biometric Parameters

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Abstract

Introduction: Ultrasound has become the essential tool of modern obstetric practice. Ultrasound dating along with LMP provides more accurate gestational age assessment than menstrual dating alone. Aim: To estimate gestational age in second & third trimesters using ultrasonographic imaging, by fetal biometry parameters i.e Femur Length (FL) and Humerus Length (HL). *Materials and Methods:* The present study was carried out in 100 normal pregnant women with singleton uncomplicated pregnancy, with the known last menstrual period (LMP). *Results:* FL was found to be more reliable parameter as compared to HL in both second and third trimester of pregnancy. *Conclusion:* HL can also be used one of the reliable parameter next to femur length in assessing gestational age.

Keywords: Gestational Age **(**GA); LMP; Femur Length (FL); Humerus Length (HL).

Introduction

Determination of age of an unborn baby is known as the gestational age, defined in weeks as beginning from first day of last menstrual period (LMP) prior to conception [1]. Trimester is period of three calendar months during a pregnancy. Estimation of gestational age and thereby forecasting expected date of delivery (EDD) is not only concern of the individual but it is invaluable in the diagnosis of intrauterine growth retardation of fetus and obstetric planning. But significant number of females (20-30%) either fails to remember LMP or report inaccurately. The matter becomes complicated when conception occurs during lactational amenorrhoea or soon following withdrawal of contraceptive pills in which ovulation may be delayed for 4-6 weeks [2].

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Ultrasonography is non-ionising, non-invasive, safe and accurate method of objectively evaluating the fetal growth in utero. Ultrasound has become the essential tool of modern obstetric practice. Doopler ultrasound has become crucial for making management decisions in some high risk settings [3]. Added advantage of it being evaluation of multiple parameters in one procedure.

The real-time ultrasound scanners have given a number of ultrasonic biometric parameters to determine gestational age. The most commonly used fetal biometric parameters are head circumference (HC) [4], abdominal circumference (AC) [5] and femur length (FL) [6] to determine gestational age, fetal weight & growth in different trimester. In cases where LMP or fundal height does not agree with dates, then this anatomical biometric parameter are valuable in estimating the gestational age of fetus [7].

The present study was undertaken in the second & third trimesters with the help of sonographic measurement of two fetal biometric parameters (i.e. FL and HL) in the local population of Indore region of Madhya Pradesh & to compare these values with western normograms.The study also aimed to find out the predictive accuracy of gestational age determined by ultrasongraphy (USG) with menstrual age determined by the LMP method in local population.

Aims

To record various fetal biometry parameters like Femur Length (FL) and Humerus Length (HL). To estimate gestational age in second & third trimesters using ultrasonographic imaging.

Objectives

1. To assess fetal growth.
2. To observe mean growth rate pattern of the fetus.

Materials & Methods

The study "Ultrasonographic evaluation of fetal gestational age in different trimesters from various anatomical biometric parameters." was carried out in 100 pregnant women.

The subjects were females attending ANC clinic for ultrasonographic screening at CHL hospital of indore. Subjects of the study mainly include urban as well as rural areas in the vicinity.

Inclusion Criteria

i. Women with known LMP.
ii. Women with regular menstrual cycle.
iii. Women with singleton pregnancy.
iv. Women with uncomplicated pregnancy

Exclusion Criteria

i. Women with multiple pregnancies.
ii. Women with irregular menstrual cycles.
iii. Women with diseases like hypertension, chronic renal disease, heart diseases and diabetes mellitus.
iv. Women having Foetus with congenital anomalies.

The subjects were informed regarding the nature and purpose of the study. For collection of the Data proper permission was obtained from ethical committee and fetal medicine department. The subjects were given prior appointment in morning hours and were screened under guidance of sonologist throughout the study.

In this study various particulars of the subjects like age, menstrual and Obstetric history had been recorded in the Performa. (Annexure II). The routinely used Ultrasonography Machine in the obstetric practice, i.e Sequina L & T with 3-5 MHz macro convex probe was used.

Subject was asked to lie in supine position on the ultrasound screening table with her abdomen exposed. To ensure an airless contact between the tissue and the transducer probe Sonogel, a mineral jelly was applied all over the abdominal surface.

a. Diphyseal length of Femur (FL) can be reliably used after 14 weeks of gestational age. The long axis of the femoral shaft is most accurately measured with the beam of insonation being perpendicular to the shaft, excluding the distal femoral epiphysis [8].

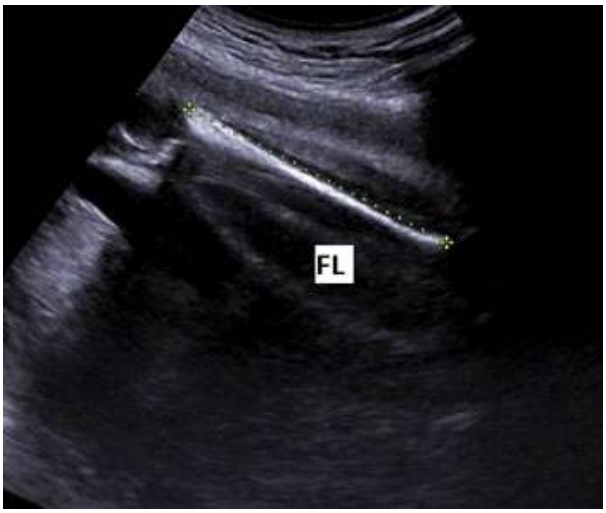

Fig. 1:

b. The fetal Arm (humerus) length technique: After visualizing the heart, the transducer is moved to image the scapular spine which is dorsal to the humerus head. The full length of the humerus was then obtained in a plane as close as possible to right angles of the ultrasound beam. A straight measurement was made from the center of one end of the diaphysis to the other, disregarding any curvature [9].

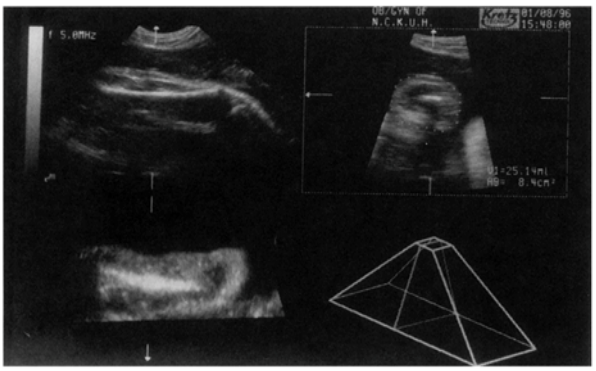

Fig. 2:

Interpretation of the measurements of Femur length and Humerus length were done with the help of computer assembled along with the Ultrasound machine. Date of ultrasonography of subject is recorded and Gestational age of the fetus in terms of weeks was calculated from last menstrual period in the Proforma.

Results

The present study was carried out in a Private Hospital of Indore on a total of 100 pregnant females.The data collected was formulated according to the menstrual weeks from 13 to 42 weeks. All the observations of the fetal growth parameters were taken in centimeters. Standard deviation of each parameter for each week was calculated. Similarly the statistical mean of each parameter for each week was calculated. The weeks of gestation were defined as completed week. For e.g. 13th week refers to 13.00 to 13.86 weeks of menstrual age. 7 days = 1 week, hence 1day = 0.14 weeks. Like this subsequently for each day.

The mean, SD of femur length was 5.76 and 1.2 and range is 3.04–8.8 and mean & SD of humerus length was 4.92 and 1.0 and the range is 3.0–7.6. (Table 1).

Frequency distribution of gestational age were, gestational age of 29 subjects was between 15 to 20 weeks, GA of 21 subjects was between 21–25 weeks, GA of 19 subjects was between 26 to30 weeks, GA of 20 subjects was between 31-35 weeks, whereas GA of 11 subjects was between 36-40 weeks (Table 2).

Simple Linear Regression

Simple linear regression analysis of the observations was done for estimating gestational age from the measurements of Femur length and Humerus length.

Simple linear regression for the observations from the Femur Length.

Regression equation for total cases (15-40 weeks)

G.A = 8.02+ 3.56 x FL

From the above equation it is clear that, for every 1cm increase in FL, the gestational age (G.A) increases by 3.56 weeks.

Coefficient Of determination (R) = 0.9516

The value of R is highly significant $p<0.0001$ showing that there is statistically highly positive association between Gestational age and Femur Length.

Simple linear regression for the observations from the Humerus Length.

Regression equation for total cases (15-40 weeks)

G.A = 7.89+ 3.02 x HL

From the above equation it is clear that, for every 1cm increase in HL, the gestational age (G.A) increases by 3.02 weeks.

Coefficient Of determination (R) = 0.9285

The value of R is highly significant $p<0.0001$ showing that there is statistically highly positive association between Gestational age and Humerus Length.

Discussion

Researchers from Anatomical background in the past worked on the correct estimation of gestational age by measuring different anatomical biometric parameters by Ultrasound. So, here also by using two anatomical biometric parameter (i.e FL & HL)

Table 1: Ultrasonic Biometric Parameters

Parameters	N	Minimum	Maximum	Mean	Std. deviation
Femur length (cm)	100	3.04	8.8	5.76	1.2
Humerus length (cm)	100	3	7.6	4.92	1.0

Table 2: Frequency distribution of Gestational age

GA in weeks	Frequency	Percent
15-20 weeks	29	29
21-25 weeks	21	21
26-30 weeks	19	19
31-35 weeks	20	20
36 -40 weeks	11	11

to determine gestational age using ultrasonography, we found that each parameter increases as age advances from second trimester to third trimester & also found to be statistically significant.

These finding were supported by Hadlock [10] et al. but were in contrast to Sumit [7] et al . Hadlock [11] et al. stated that a combination of multiple fetal parameters (HC, AC, FL) provided age estimates that were significantly better (p=0.05) than alone using single parameter. In fact Hohler [12] found that the measurement of more than one parameter, in a sense, prevents over-reliance on any single measurement which by itself might mislead the clinician. Therefore it proves that the estimate using the mean fetal gestation period is accurate as well as precise than single measurement.

Hadlock [13] et al. stated that the regression equation developed from white middle class population appeared to be applicable to the populations of racial & socioeconomic groups. Ruvolo [14] et al. found no statistically significant difference in FL versus gestational age in racially mixed population of Blacks, Asians & Caucasians while Present study shows that FL is reliable parameter in determining the gestational age & also it is statistically significant.

Yeo [15] et al. conducted a study on Chinese, Malaysian & Indian population which showed that fetal FL of Chinese and Malaysian, are apparently shorter than Indian FL. Lai [16] & Yeo demonstrated Slightly smaller FL- more pronounced over the course of gestation in Asians compared with white fetuses. Patre [6] et al. found that in the management of the patient with premature labour, to accurately predict GA , FL can be used in conjunction with HL Supported by Tahmasebpour [17] AR et al. Thus proving the existence of similarities & differences in ultrasound measurement of FL & HL in different ethnic groups.

Anatomical dimension of fetus vary according to the race, nutritional status, build & geographic location of the origin of the parents. As the growth trend of our fetuses increases, all fetal biometric parameters predict precise gestational age, more so as pregnancy advances.

Sonographic measurement of the ossified shaft humerus is possible after the 12th week of gestation. Humerus is difficult to define accurately, because of its proximity to the chest wall &its apparent continuity with the scapula & clavicle. The relationship between HL & GA has been studied by only few workers [9]. They stated that HL is also a useful parameter for assessing GA. In present study, the coefficient of correlation was found to highly significant & shows that with increase in GA & HL also increases. Hence it can be used to asses GA.HL recorded in present correlated well with the normograms suggested by Jeanty [18] (1983).

Conclusion

The present study describes the use of two fetal biometric parameter (FL and HL) to determine the accurate gestational age in the population of Indore region of M.P. Present analysis reveals that fetal anthropometric parameters significantly differ among different population groups due to racial, genetic & ethnic regions. Therefore biometric curves of one population may overestimate gestational age when used for other racial or ethnic groups. Also accurate determination of gestational age is required for many aspects of antenatal care. Clinical history may have value in determining gestational age. Thus a need for large-scale study at national level Indian population to generate population –specific tables & regression equations for more precise reporting of gestational age by sonography on the basis of various fetal biometric parameters.

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An Assessment of Dermatoglyphic Patterns in Primary and Secondary Amenorrhea

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Abstract

The systematic study of the skin ridge patterns on the varied places such as fingers, toes, palms of the hands and soles of feetis so-called Dermatoglyphics. Although various dermatoglyph studies are reported in primary amenorrhea from time to time with reference to numerous clinical and non-clinical conditions.There is a shortage of knowledge associated with study of dermatoglyphic patterns with reference to primary as well as secondary amenorrhea. This present prospective study was designedto check at the same time finger and palmar dermatoglyphic patterns in amenorrhea patients. An attempt was made to seek out whether or not a particular dermatoglyphic trait exists in amenorrhea. Palmar and finger prints of patients with primary and secondary amenorrhea were collected and qualitative analysis of fingertip patterns was carried out by recordingwhorls (simple vs.composite), loops (ulnar vs. radial) and arches (plain vs. tented). The Fingertip pattern was done by total finger ridge count. We observed a significant increase in fingertip pattern (whorl, arches, and loop), as well as total finger ridge count in primary amenorrhoea patient as compare to control. There was not any significant variation was seen in secondary amenorrhea patients as compared to controls. This finding may be quite useful as a supportive investigation, and could be used in amenorrheic subjects for further referral for karyotyping and counseling in the Indian sub-continent furthermore as globally.

Keyword: Amenorrhoea; Dermatoglyph; Fingertip Patterns; Total Finger Ridge Count.

Introduction

The epidermal ridge configuration (dermatoglyph) and its component ridges enlarge with growth, however their essential characteristics are stable similar throughout life [1] and rely upon the distribution of epidermal ridges and dermal papillae, unique to the individual and vital as for identification [2]. Dermatoglyphics is used as a supportive diagnostic tool in genetic or chromosomal disorders in addition as in clinical conditions with genetic disorders like Down's syndrome [3], Klinefelter's syndrome [4], and breast carcinoma[5]. Additionally to genetically determined, dermatoglyphsare influenced or changed by environmental factors [6]. Amenorrhea or the absence of menstruation could be a symptom, not awellness, andhas a variety of causes since its occurrence is also connected with deviation from function of hypothalamus, pituitary gland, gonads and genital ducts [7]. In women, amenorrhea is one amongst the major problems and it is the 6th major reason for female infertility [8,9]. Primary amenorrhea is the absence of menstruation by 16 years of age with normal secondary sexual characters or no menstruation by the age of 14 years, with the absence of secondary sexual characters expression [10]. Patients with secondary amenorrhea have had a minimum of one spontaneous bleeding episode followed by a minimum of 12 weeks absence of menstruation [11]. In India, solely a few studies are done ondermatoglyphs in amenorrhea. Frequency of digital patterns, finger ridge counts and interdigital ridge counts, frequency of patterns in thenar, hypothenar and inter digital areas and frequency of axial triradii were evaluated in 70 cases of primary

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amenorrhea perceptive that there have been increased ulnar loops and arches, decreased ridge counts and increased number of accessory triradii along with elevation of axial triradii [12]. An assessment of correlation between 100 amenorrheic patients and 100 controls with normal karyotype had shown predominant arch pattern on the second finger, loop pattern on the fifth finger and whorl pattern on the fourth finger in addition as increased loop pattern with in the hypothenar area. There was a major difference within the patterns in the left first interdigital area between subjects with normal karyotype and controls, and in the patterns in the left second and third interdigital areas between subjects with abnormal karyotype and controls [2]. The current prospective study was designed to see whether or not any specific dermatoglyph features would emerge as marker in amenorrheic subjects.

Material and Method

Ethicalclearance

The study was approved by the local research advisory committee of Jawaharlal Nehru Medical College, India. The study was carried out in the Department of Obstetrics and Gynaecology, Jawaharlal Nehru Medical College, Wardha, India, and performed in accordance with the Declaration of Helsinki. Detailed written consent of all the participants was taken in their local language along with detailed medical history before starting the procedure.

Participants

Females of age 16 to 25 years, attending the Obstetrics and Gynaecology OPD and admitted to the Obstetrics and Gynaecology wards participated to this study. The total number of amenorrhea subjects was 60, of which 40 had primary amenorrhea and 20 had secondary amenorrhea. Females resulted healthy (n=60), with normal menstrual cycle and normal clinical examination by specialist,were selected as controls. Females who were (a) before puberty (b) lactating, (c) with known chromosomal abnormalities were excluded from study.

All selected applicants were divided into following groups:

Group I – Healthy control individuals,

Group II – Individual's having amenorrhea (primary and secondary) Study protocol

As per guidelines by American Association of Dermatoglyphics [13], dermatoglyphic prints were obtained by using ink [14]. Subjects were asked to clean both hands with soap and water to remove any oil or dirt, and dry with clean towel. The required amount of ink was placed over a glass inking slab and uniformly spread by means of a roller to get a thin, even film. Cleaned and dried palms of each subject were pressed from proximal to distal end over the inked slab. Care was taken to gently press between inter digital grooves at the roots of figures as well as on the dorsum of thenar and hypothenar eminences. Right hand of the subject was then placed on the sheet of paper (kept over the pressure pad) from the proximal to distal end. The palm was gently pressed between interdigital grooves at the root of fingers and on the dorsum of thenar and hypothenar regions. The palm was then lifted from the paper in reverse order from the distal to proximal end. The finger tips were printed separately below the palmar print by rolled finger print method. The fingers were rolled from radial to ulnar side to include all the patterns. The same procedure was repeated for left hand using a separate sheet of paper. These printed sheets were coded with name, age, gender and study group of the subject. Detailed dermatoglyphic analyses of the prints were done with the help of magnifying hand lens. Ridge counting was done with a sharp needle. The details were noted on the same paper with lead pencil.

Parameters

The print of fingertip were taken by rolling the finger from radial to ulnar side and detailed were done with the help of magnifying lens.Qualitative analysis of fingertip patterns (Figure 1A to C) was done by examine whorls (simple vs. composite), loops (ulnar vs. radial), and arches (plain vs. tented). Quantitative analysis of fingertip patterns was done by total finger ridge count (TRFC) and this TRFC is the sum of ridge counts of all ten digits, and only the larger count was used on those digits with having more than one ridge count. It states size of pattern.

Statistical Analysis

Quantitative data are expressed as mean. Association among the study groups was assessed with the help of chi-square test by using statistical software SPSS Version 17.00 and $p \leq 0.05$ was taken as significant.

Results

Fingertip Patterns

The data for the right and left hands and for the different groups of subjects are summarized in

(Tables 1). We observed that whorls and arches were significantmore frequent in primary amenorrhea patients as compared to control individuals. Conversely, loops (radial and ulnar) were significant more numerous in primary amenorrhea patients as compared to control individuals. In cases of secondary amenorrhea there were no significant differences in the fingertip pattern (whorls, arches and loops) when compared to control.

Total Finger Ridge Count

The data are summarized in (Figures 2 and 3). We observed that there were significantly higher counts in either hand and in both hand together of primary amenorrhea patients as compared to control individuals. On the contrary, there was no significant difference for any count between patients with secondary amenorrhea and controls.

Table 1: Percent frequency of fingertip pattern (for both right and left hand) in primary and secondary amenorrhea patients and control individuals.

Pattern	Control (n=40)			Primary amenorrhea (n=40)			Secondary amenorrhea (n=20)		
	Right (%)	Left (%)	Mean (%)	Right (%)	Left (%)	Mean (%)	Right (%)	Left (%)	Mean (%)
Whorls	23.5±2.3	26.0±2.6	24.75±2.45	35.0±3.0*	38.5±3.5*	36.75±3.25*	26.0±3.7	24.0±3.5	25.0±3.6
Arches	11.0±1.5	6.5±0.83	8.75±1.16	15.5±1.8*	11.5±1.3*	13.5±1.55*	10.5±1.20	6.5±1.32	8.5±1.26
Ulnar Loops	53.0±6.7	54.5±4.2	53.75±5.45	62.5±5.5	60.5±6.3	61.5±5.9*	54.0±3.6	55.0±1.7	54.5±2.65
Radial Loops	1.0±0.03	0.50±0.01	0.75±0.02	3.5±0.80	4.0±1.1	3.75±0.95*	1.0±0.94	0.60±0.55	0.80±0.74

*Significant at the level of $p \leq 0.05$

Fig. 1A: Arch pattern

Fig. 1B: Loop pattern

Fig. 1C: Whorl pattern

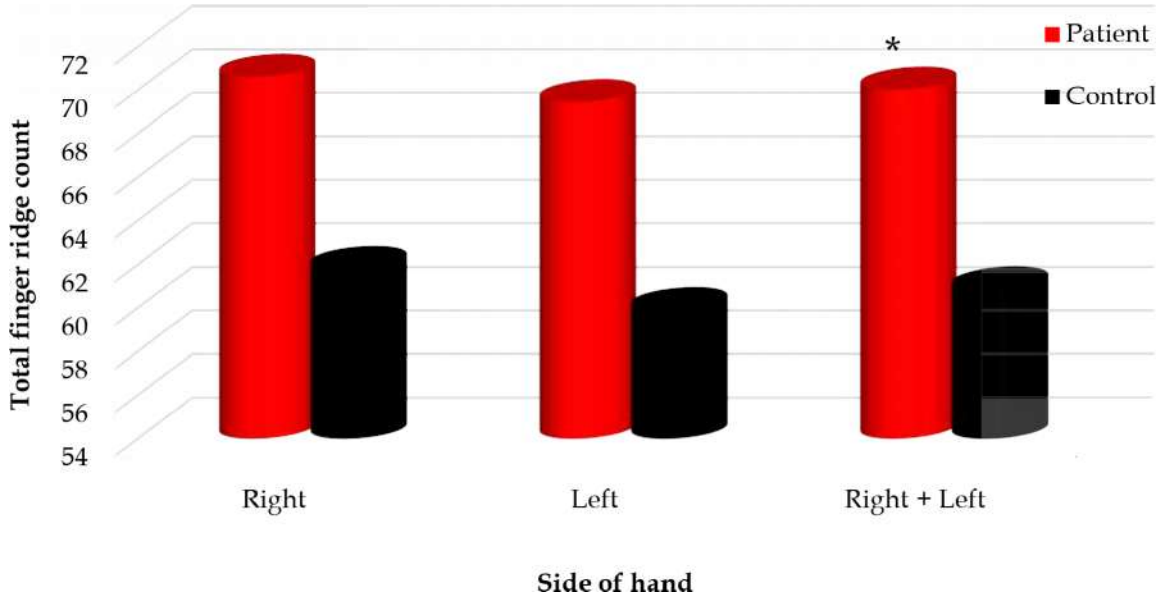

Fig. 2: Total finger ridge count (TFRC) of right hand, left hand and both together (right and left) hand in primary ammenorrheapatients and control. * Significant at the level of $p \leq 0.05$

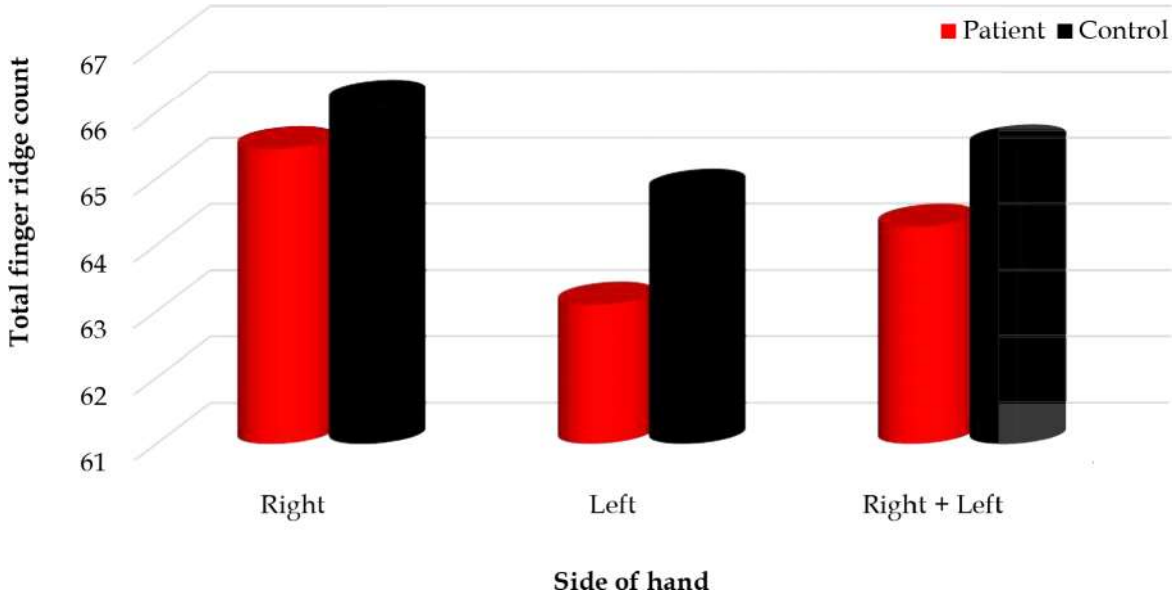

Fig. 3: Total finger ridge count (TFRC) of right hand, left hand as well as both together (right and left) hand in secondary ammenorrheapatients and control. No difference was significant

Discussion

Dermatoglyphics is that the systematic study of the skin ridge patterns on the various places like fingers, toes, palms of the hands and soles of feet. In the present study, the finger dermatoglyphic patterns were studied in primary and secondary amenorrhea to find out whether or not a particular dermatoglyphic trait exists in amenorrhea condition and whether or not it is statistically significant. Features that may well be applied as markers for amenorrhea were the presence of arch pattern in the 2nd left finger, loop pattern on the 5th right finger, hypothenar pattern within the left palm and sydney line in the 1st inter digital area of the left palm [2]. We observed a considerably higher total finger ridge count in either hand or both hand together of subjects with primary amenorrhea. This finding is analogous to a previousone,in which additionally some abnormal karyo types were found in primary amenorrhea. However, finger ridge count and frequency of total arches, radial and ulnar loops and whorls in the previous study were not significantly different between subjects with amenorrhea and controls [15]. In another study, there was significant increase in frequency of arches on the left second finger in patients of primary amenorrhea as compared to control [2]. We have got additionally discovered that arches on each left and right side of finger in the patients of primary amenorrhea was significantly higher, when compared to control individuals. The number and frequency percentage of whorl was significantly increased on both left and right sides of finger in patients with primary amenorrhea as compared to control individuals. This correlates with aprevious findingin patients of primary amenorrhea [16]. More over the incidence of arches in secondary amenorrhea patients and controls was found to be statistically non-significant in the present study. A previous study had observed that the number and frequency percentage of radial as well as ulnar loops was significantly increased on the right side, typically on the fifth finger, in the patients of primary amenorrhea as compared to controls [2]. This finding is similar with observations in the present study, in which the number and frequency percentage of radial loops as well as ulnar loops is found to be significantly increased in both right sidesas well as left sidein patients of primary amenorrhea as compared to controls. However, in patients of secondary amenorrhea radial loop as well as ulnar loops pattern is found to be statistically non-significant, when compare to control. We have discovered that TFRC was increased considerably in patients of primary amenorrhea as compared to controls, while in cases of secondary amenorrhea no significant differences were found from controls. This finding is parallel to previous finding within which total finger ridge count in each hands (right and left) was increased significantly in patients of primary amenorrhea when compared to control [16].

Limitation of the Study

Karyotyping has not been performed because of lack of funding. However to assign a statistical significance to anyobservation concerning karyotype a much larger number of samples would are required.

Conclusion

Although numerous dermatoglyphic studies have been reported from time to time with relevance to various clinical and non-clinical conditions. However, there is shortage of information ondermatoglyphic patterns in each primary and secondary amenorrhea within the Indian sub-continent further more as globally. The most important finding in the present study was a significant increase in fingertip pattern (whorl, arches, and loop), and total finger ridge count in primary amenorrhoea patient as compared to controls. There was no significant variation in secondary amenorrhea patients as compared to controls.This finding may be quite useful as a supportive investigation, and will be employed in amenorrheic subjects for additional referral for counseling.

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Conflict of Interest

The authors declared no conflict of interest.

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Original Article

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The Study of Morphological Variations of Liver in Human Cadavers

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Abstract

Background: Liver is the largest gland and second largest organ in the human body. Anatomically, it consist of two lobes right and left seperated from each other by ligaments. Two additional lobes caudate and quadrate lobe are seen on the posterior and inferior surface of liver respectively. *Aim:* To observe and analyse the type and frequency of variations in liver morphology. *Study Design:* Observational study. *Materials and Methods:* The study was conducted on 80 liver specimens obtained during routine dissection of undergraduate students. *Statistical analysis used:* Descriptive statistics. *Results and Conclusions:* Out of 80 specimens, 56 specimens showed normal fissures and lobes. The rest of the 24 specimens showed morphological variations. The findings of the present study will be helpful for the radiologist, surgeons and anatomists.

Keywords: Liver; Lobes; Morphology.

Introduction

Liver is the largest gland in the human body. It is located in the right hypochondriac, epigastric and left hypochondriac region of the upper abdominal cavity under the right dome of diaphragm. Anatomically, it is divided in to right and left lobe by the attachment of falciform ligament anterosuperiorly, fissure for ligamentum venosum posteriorly and fissure for ligamentum teres hepatis inferiorly. Apart from right and left lobe, liver has two additional lobes namely caudate lobe with caudate process and papillary process on the posterior surface and a rectangular quadrate lobe on the inferior surface [1]. A sound knowledge of normal and variant livers is mandatory for the surgeons in planning and performing surgical procedures, for the radiologist to prevent possible misdiagnosis and for the anatomists to find out new variants.

The major fissures of liver are important landmarks for interpreting the lobar anatomy and locating the liver lesions. Although the segmental anatomy of the liver has been extensively researched, very few studies have dealt with the surface variations of the liver [2]. Hence, this comprehensive study was conducted to observe and note the variations on the surface of the liver.

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Materials and Methods

Specimens were obtained from cadavers utilized for routine dissection of medical undergraduate students in the anatomy dissection hall and then preserved in 10% of formalin. This was an observational study conducted on 80 liver specimens. Apparently normal livers which were free from any disease were included in the present study. Livers with any pathology or damage were excluded. The morphological variants were observed and photographed. Morphological variations of liver include presence of accessory fissures, presence of accessory lobes, abnormal size and shape of lobes and absence of lobes. Data was analysed using descriptive statistics. Frequency was calculated in terms of percentage.

Results

In the present study, out of 80 liver specimens, 56 specimens showed normal fissures and lobes. The

rest of the 24 specimens showed morphological variations. A very interesting observation was that many livers had more than one surface variation.

Table 1: Showing frequency of variations in different lobes of liver

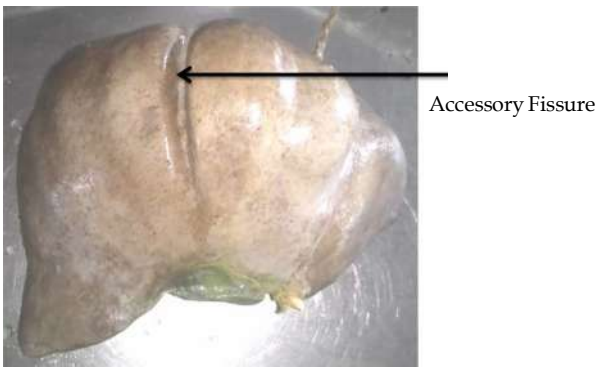
Lobe	Frequency
Right lobe	12.5% (10 specimens)
Left lobe	10% (8 specimens)
Caudate lobe	3.75% (3 specimens)
Quadrate lobe	3.75% (3 specimens)

Accessory fissures were observed on the right lobe of liver in 10 (12.5%) specimens.

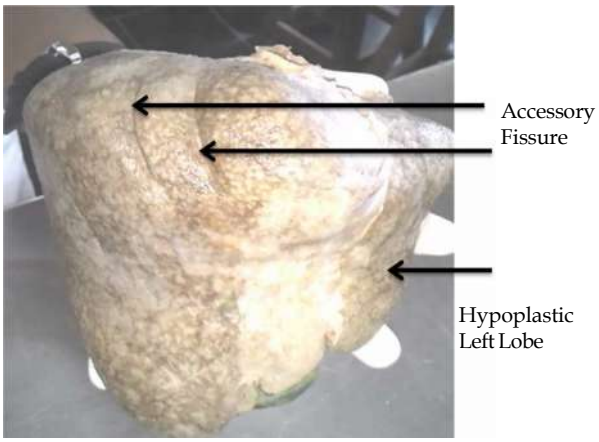
The fissures were localized on the anterior and superior surface of the right lobe.

They were narrow with variable depths ranging from 0.5cm to 2cms & variable in number (1–5 fissures) (Picture A, B).

An accessory fissure separating caudate process from papillary process was observed in 1 (1.25%) specimen (Picture C).



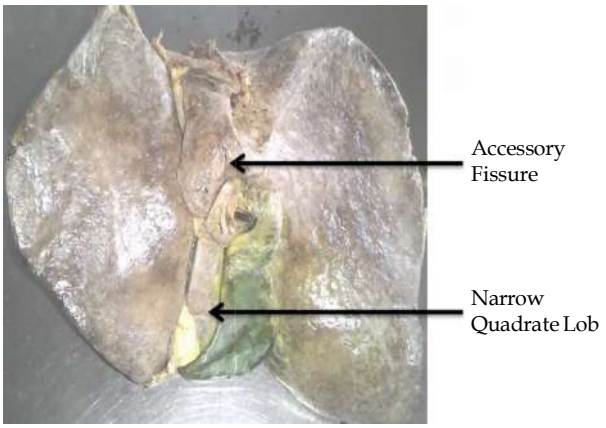
Picture A: Showing accessory fissure in right lobe of liver



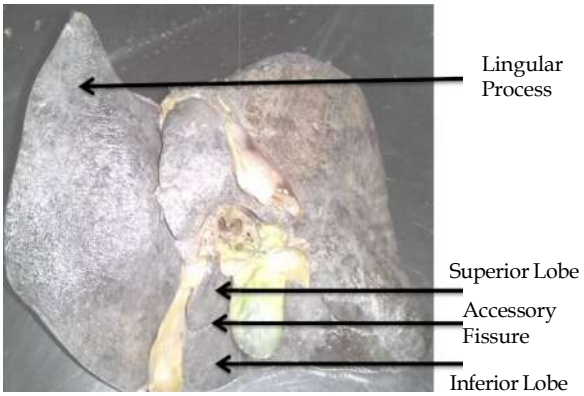
Picture B: Showing accessory fissures in right lobe and hypoplastic left lobe of liver

An accessory fissure dividing quadrate lobe into superior and inferior lobe was observed in 1 (1.25%) specimen (Picture D).

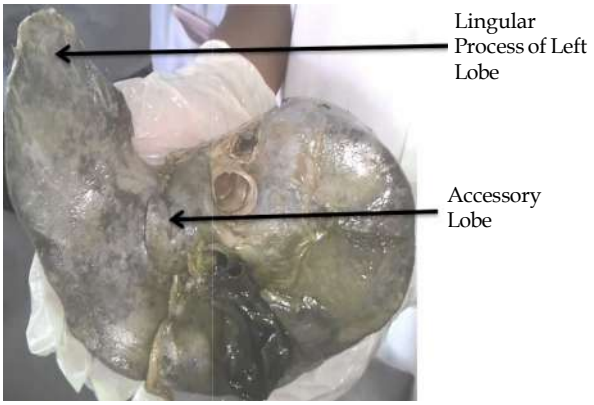
An accessory lobe was observed in connection with the caudate lobe of liver in 1 (1.25%) specimen (Picture E).



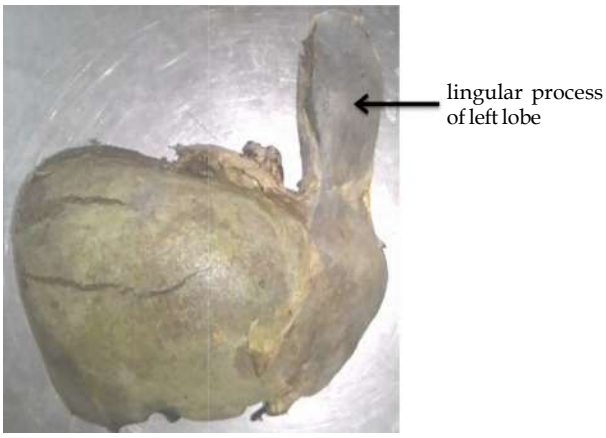
Picture C: Showing an accessory fissure separating caudate process from papillary process and narrow quadrate lobe



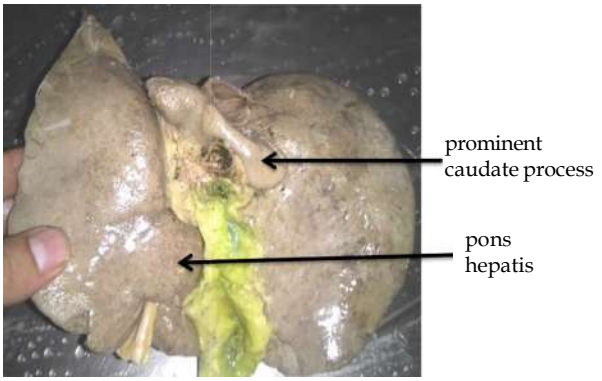
Picture D: Showing an accessory fissure in quadrate lobe dividing it into superior and inferior lobe and lingular process of left lobe of liver



Picture E: Showing accessory lobe connected with caudate lobe of liver and lingular process of left lobe



Picture F: Showing lingular process of left lobe of liver



Picture G: Showing prominent caudate process and pons hepatis

Table 2: Showing Netter's classification of liver variations [3]

	Type of Variation	Present study
Type I	(Very small left lobe, Deep costal impressions)	5%
Type II	(Complete atrophy of left lobe)	------
Type III	(Transverse saddle like liver, relatively large left lobe)	------
Type IV	(Tongue like process of right lobe/Reidel's lobe)	1.25%
Type V	(Very deep renal impression and corset constriction)	------
Type VI	(Diaphragmmatic grooves)	15%

Tongue like lingular process of left lobe was observed in 4 (5%) specimens (Picture D, E, F).

Hypoplastic left lobe was present in 4 (5%) specimens (Picture B).

Abnormal shape caudate process was observed in 1 (1.25%) specimen each (Picture G).

Narrow quadrate lobe was observed in 1 (1.25%) specimen (Picture C).

Pons hepatis which is a segment of hepatic tissue joining quadrate lobe to the left lobe of liver was observed in 1 (1.25%) specimen (Picture G).

In the present study, Type I, Type IV and Type VI variations were observed with Maximum frequency of Type VI variation.

Discussion

Of all the digestive organs, the liver is the one which starts its organogenesis early during 3rd week of intrauterine life and develops most rapidly [4].

The morphological variations in the surface anatomy of the human liver can be classified as congenital or acquired. The congenital anomalies of liver can be divided into anomalies due to defective development and anomalies due to excessive development [5].

Furrowing on the surface of the liver caused by the invaginations of the muscular diaphragm and peritoneum is termed as accessory fissure.

Table 3 : Showing the frequency of the accessory fissures reported by various studies

Name of Authors (Year wise)	Accessory Fissures
Joshi S et.al (2009)[2]	30%
Vinnakota S et.al (2013)[6]	53.44%
Patil S et.al (2014)[7]	10%
Saritha S et.al (2015)[8]	30%
Saxena A et.al (2016)[9]	20%
Chaudhari H et.al (2017)[10]	35%
Shashikantha K et.al (2018)[11]	30%
Present Study	15%

T. Sreekanth [12] observed accessory fissures on the right lobe in 26.66% livers. In the present study, accessory fissures were observed in the right lobe in 12.5% specimens. Sunitha V [6] et al. observed accessory fissure between the caudate process and papillary process in 3.22% specimens. In the present study, similar case was seen in 1.25% specimens. Patil S et al. [7] observed a complete transverse fissure dividing quadrate lobe into superior and inferior lobes in 4% of specimens. In the present study, it was seen in 1.25% specimens. According to Schafer and Symington (1896) and DeBurlet (1910) (as quoted by Macchi et al.), diaphragmatic sulci result from uneven growth of the hepatic parenchyma caused by variable resistance offered by different bundles of the diaphragm muscle. But more recently, radiological and corrosion cast studies have attributed the formation of sulci to the existence of weak zones of hepatic parenchyma, represented by the portal fissures between the adjacent sagittal portal territories. These weak zones offer a lower resistance to external pressure of the diaphragm [2]. According to Auh et al. [13], the accessory hepatic fissures are potential sources of diagnostic errors during imaging. Any collection of fluid in these fissures may be mistaken for a liver cyst, intrahepatic haematoma or liver abscess.

An accessory lobe in connection with the caudate lobe of liver was observed in the present study in 1.25% specimen. The excessive development of liver results in formation of accessory lobe. Accessory liver lobes are composed of normal liver parenchyma in continuity directly with the main mass of liver by mesentery or by a pedicle. A small sized accessory lobe is very important surgically and radiologically as it might be mistaken as lymph node and can be accidentally removed during the surgery or while dissection around the porta hepatis. This might lead to excessive bleeding in abdomen [10].

Vinnakota S et al. [6] observed lingular process of left lobe in 1.72% liver specimens and hypoplastic left lobe in 3.44% specimens we observed lingular process of left lobe and hypoplastic left lobe in 5% specimens each. The lingular process of left lobe may reach up to the spleen and may be mistaken for splenomegaly [14]. In the initial development, the right and left lobes of the liver are equal in size, but due to the development of neighboring organs on the left side, the left lobe regresses. The cause of the reduced size i.e. hypoplastic left lobe in the present study was not known as the neighboring organs were found to be normal in size [15]. Defective development of the left lobe of liver can lead to conditions like gastric volvulus [16].

Prominent caudate process was observed in 9% specimens by Sarala HS et al. [17] whereas in the present study it was observed in 1.25% specimens.

Narrow quadrate lobe was observed in the present study in 1 (1.25%) specimen. A very narrow or absence of quadrate lobe may create confusion in the mind of the radiologist, as the fissure for ligamentum teres in such cases would be very near to the left margin of the gall bladder fossa [18].

Joshi et al. [2] observed the presence of the pons hepatis of variable dimensions, joining the quadrate and the left lobes in 30% cases whereas in the present study, the frequency of pons hepatis was observed in 1.25% specimens. In cases of the pons hepatis bridging the fissure for ligamentum teres, normal visualisation of the fissure would not be possible and dimensions of the right and the left lobes may be mistaken.

Conclusion

In the present study, accessory fissures were observed in 15% specimens, accessory lobes in 1.25% specimens, abnormalities in size and shape of lobes in 13.75% specimens.

As per Netter's classification, maximum frequency of Type - VI variation was reported in the present study. The present study will provide a background knowledge for extensive studies on morphological variations of liver in both cadaveric as well as living subjects.

Strength of the present study

Some of the morphological variants like hypoplastic right lobe, absence of left lobe, abnormal shapes of quadrate lobes which have been described in the literature were not seen in the present study. Every year, as the cadavers are routinely used for dissection of medical undergraduate students in our department, we can further extend this study to find out these variants .

Limitations of the present study

Present study was limited up to adult livers. Pediatric livers were not taken into consideration for the present study. Detailed history of the cadavers in terms of previous diseases which may have impact on liver morphology was not available.

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Original Article

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A Study of Sexual Dimorphism and Age Related Differences in Awareness and Willingness regarding Organ and Body Donation

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Abstract

Background: Human Anatomy is the fundamental subject for medical student and teaching fac-ulties. In recent years, demand of cadavers has drastically increased which remains unfulfilled almost everywhere in the country. The purpose of our study is to assess the awareness and willingness regarding organ/body donation based on gender, different age groups and their familarity with cadaveric dissection. *Aim:* To study the awareness and willingness for organ and body donation with respect to gender, different age groups and familiarity with Cadaveric dissection. *Material and Methods:* A cross-sectional studyusing a specially designed, validated questionnaire containing mcq's was done amongst Medical, Dental, Ayurveda and Nursing students, staff and patients of ESIC Institute Gulbarga after taking their informed consent. It was followed by a counseling session where queries regarding organ and body donation were solved and procedure of registration for the same was explained. *Results:* Amongst the 1000 study participants, questionnairessubmitted by 194 participants were found incomplete, hence those participants were removed from the study. After analyzing duly signed and filled questionnaire collected from the 806 participants, following observations were seen. 1. Female participants showed more awareness (66.4%, 73.3%) and willingnesss (41.3%, 15.2%) for organ and body donation. 2. Younger age group particpiants were found to be more aware (76.3%, 84.24%) and showed more willingness (47.43%, 20.03%) to donate organ and body respectively. 3. Acquainted participants comprising of medical, dental and ayurvedic students who were familiar with cadaveric dissection showed more awareness (87.0%, 92.41%) towards organ and body donation compared to other participants. 4. Lesser acquainted participants showed more willingness (54.6%, 30.76%) to donate organ and body for academic purpose compared to other participants. *Conclusions*: 1. Female participants showed more awareness and willingnesss for organ and body donation than their male counterparts. 2. Younger age group particpiants were found to be more aware and willing to donate organ and body than older and middle sge groups. 3. Acquainted participants showed more awareness but actual willingness to donate organ and body was shown by lesser acquainted group.

Keywords: Awareness; Organ Donation; Body Donation; Acquainted.

Introduction

Human Anatomy is the fundamental subject for medical student and teaching fac-ulties. In recent years, demand of cadavers has drastically increased which remains unfulfilled almost everywhere in the country. The need of the hour is to spread awareness for body donation to meet the requirements of a medical student to become compatible doctors. The best way of spreading this message is through our students, staff and patients and later we can include respondentsbelonging to other professions. Already Body Donation Society is established in Department of Anatomy in ESIC Medical College Gulbarga. The purpose of our study is to assess the awareness and willingness regarding organ/body donation based on gender, different age groups and familiarity with cadaveric dissection.The conclusions emerging from this study will help us to set goals for our Body donation society towards changing the perspective of population of Kalaburagi towards body donation, eventually leading to improvement in medical training and services.

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Aim and Objective

1. To study sexual dimorphism in awareness and willingness for organ and body donation.
2. To study the awareness regarding organ and body donation in different age groups.
3. To study the awareness regarding organ and body donation based on familarity with cadaveric dissection.

Materials and Methods

The present study is a specially designed, self-administered questionnaire based cross-sectional study, containing 18 points testing the awareness, attitude, knowledge and willingness towards body / organ donation followed by counseling session conducted in Kalaburagi region within 1000 participants. The questionnaire (prepared in English and Kannada) was circulated among the participants. This study was conducted in Department of Anatomy of ESIC Institute of Gulbarga from 1st February 2018 to 31st May 2018. The target population included students, staff and general public/patients. The questionnaire comprised of multiple choice questions and option for personal reason/opinion was given for almost every question. The questionnaire was pilot tested previously amongst 40 random people for :

i. The clarity of the questions included in it and

ii. Time period required to fill it.

Time duration of 15 minutes was given for completing the questionnaire. No discussion amongst each other was allowed. Our questionnaire thus got validated after minor modifications. Our research team, after taking informed consent distributed the pretested/validated questionnaire to students at counseling room. One of the researcher always accompanied the participants during filling of questionnaire. Duly filled and signed questionnaire were collected.

The participants were categorized in three groups as follows:

1. Based on Age [2]:
- Young age group : 15-24 yrs
- Middle age group : 25-44 yrs
- Older age group : 45 yrs and above.
2. Based on Familarity with Cadaveric dissection:
- Acquainted group
- Lesser acquainted group
- Not acquainted group
3. Based on Sex:
- Male
- Female

Sampling Technique

From all the categories of population i.e. Student, Staff, Patient and General public; taken together, 1000 participants after taking informed consent were selected through Simple random sampling method.

Sample Selection

Inclusion Criteria

1. Those who are born and brought up in Gulbarga region.
2. Above 18 years of age.
3. Those who have given consent.

Exclusion Criteria

1. Doctors and faculty members of ESIC Medical, Dental and Ayurveda colleges were excluded.
2. Those born and brought up outside Gulbarga.
3. Those who refused to give consent.

Data Collection Procedure

A specially designed, self-administered questionnaire containing 18 multiple choice questions testing the awareness, attitude, knowledge and willingness. It has been prepared in English and Kannada.

Data Analysis Procedure

Parameters which were studied were age, gender, acquainted and non-acquainted participants. Analyzed with SPSS software. Percentage was calculated. Chi square test was used. Data was represented graphically.

Results

Amongst the student, staff and patient/public group, 1000 participants, were randomly selected for the study. Duly filled and signed questionnaires were collected from them after taking informed consent. This was followed by counseling session. Out of 1000,

194 questionnaires were found to be incomplete. During the counseling session, these 194 participants withdrew their consent and their questionnaires were discarded from the study. After analyzing the questionnaires, the data was collected and as a whole, the observations were as follows:

The data collected from 806 participants was classified into various categories and the observations were tabulated and graphically represented.

Study observed that, among 806 participants, 360 (44.7%) were male and 446 (55.3%) were female. there were 320 (39.7%) general public and patients, 201 (24.9%) medical students, 118 (14.7%) ayurveda students, 80 (9.9%) non-medical staff, 50 (6.2%) nursing students and 37 (4.6%) dental students.

Study reveals that, there was statistical significant difference of male and female participants in awareness about body donation ($p<0.05$)

Awareness about body donation had significantly more in females as compare to males There was no statistical significant difference of male and female participants in awareness about organ donation, Willingness about organ and body donation ($p>0.05$).

Study observed that, among 806 participants, 584 (72.4%) were young age group, 110 (13.6%) were middle age group and there were 112 (14.0%) older age group (Table 3).

Table 1: Sex and faculty wise distribution of study participants

Faculty of Study participants	Male		Female		Total	
	No.	%	No.	%	No.	%
Medical students	86	42.7	115	57.3	201	24.9
Dental students	09	24.3	28	75.7	37	4.6
Ayurveda students	33	27.9	85	72.1	118	14.7
Nursing students	18	36.0	32	64.0	50	6.2
Non-medical Staff	54	67.5	26	32.5	80	9.9
General public / patient	160	50.0	160	50.0	320	39.7
Total	360	44.7	446	55.3	806	100.0

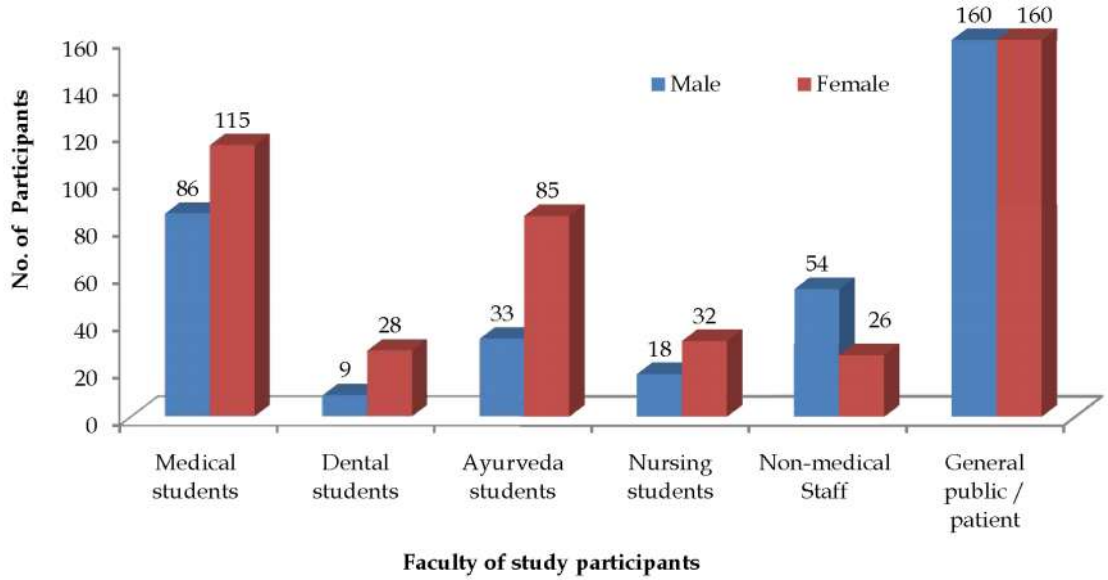

Fig. 1: Multiple bar diagram represents Sex and faculty wise distribution of study participants

Table 2: Sex wise comparison of awareness, willingness about organ and body donation in study participants

Variables	Male Number (%) (N=360)	Female Number (%) (N=446)	Chi-square test P-value & Significance
Awareness about organ donation	215 (59.7%)	296 (66.4%)	$\chi^2 = 3.79$, P>0.05, NS
Awareness about body donation	238 (66.1%)	327 (73.3%)	$\chi^2 = 4.93$, P<0.05, S
Willingness about organ donation	133 (36.9%)	184 (41.3%)	$\chi^2 = 1.55$, P>0.05, NS
Willingness about body donation	69 (19.2%)	68 (15.2%)	$\chi^2 = 2.17$, P>0.05, NS

Table 3: Age wise distribution of study participants

Age groups	Male	Female	Total	Percentage
Young age group (15-24 yrs)	300	284	584	72.4
Middle age group (25-44 yrs)	54	56	110	13.6
Older age group (45 yrs and above)	6	106	112	14.0
Total	360	446	806	100.0

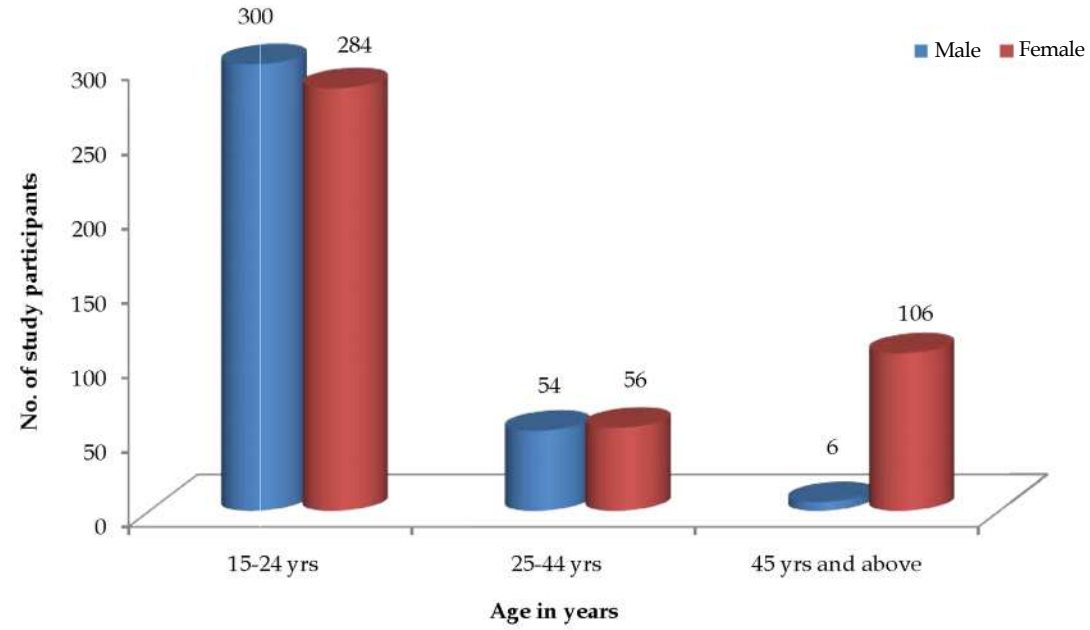

Fig. 2: Multiple bar diagram represents Gender and Age wise distribution of study participants

Table 4: Comparison of awareness and willingness of organ/body donation with different age groups

Sl. No	Study participants	Acquainted group			
		Acquainted	Lesser acquainted	Non-acquainted	Total
1	Medical students	201	0	0	201
2	Dental students	37	0	0	37
3	Ayurveda students	118	0	0	118
4	Nursing students	0	50	0	50
5	Non-medical Staff	0	80	0	80
6	General public / patient	0	0	320	320
	Total	356	130	320	806

Table 5: Comparison of awareness and willingness of organ/body donation with different age groups

Sl. No	Age group	Awareness for organ donation	Awareness for body donation	Willingness for organ donation	Willingness for body donation	Total
1	Younger age group	446 (76.3%)	492 (84.2%)	277(47.4%)	117 (20.0%)	584 (72.4%)
2	Middle age group	56(50.9%)	57(51.8%)	37 (33.6%)	17(2.72%)	110 (13.6%)
3	Older age group	09(8.03%)	16(14.28%)	03 (2.67%)	03 (2.67%)	112 (13.8%)
	Total	511 (63.39%)	565 (70.09%)	317 (39.33%)	137 (16.99%)	806 (100%)

Table 3 shows that amongst 806 participants, 356 (44.16%) were medical, dental and ayurvedic students which come in acquainted group. 130 participants (16.12%) belong to nursing students and non-medical staff which come in lesser acquainted category and 320 participants (39.70%) belonged to non-acquainted group.

Table 4 shows that participants belonging to younger age group showed more awareness and willingness for organand body donation than other age groups.

Table 5 shows that acquainted group comprising of professional students showed more awareness towards organ and body donation. But actual

willingness to donate organ and body for academic purpose was shown more by lesser acquainted group.

Discussion

To overcome the deficiency of supply of cadavers for academic purpose, Body Donation Society was established in Department of Anatomy in ESIC Medical College Gulbarga in the month of February this year. The drive to spread more awareness about organ/body donation led us to conduct this study to understand the thoughts of general public, patients, staff and students in Kalaburagi region about organ/body donation. In present study, which is a part of original study done at ESIC Institute Gulbarga, amongst total 806 participants, overall awareness for organ donation was 63.39% and for body donation was 70.09%. This finding match with studies of Dope et al. [3] (68%), PradnyeshPanshewdikar et al. [4] (76.84%) and VaishalyBharambe et al. [5] (78%).

In present study, Medical students who were more acquainted with cadaveric dissection showed more awareness about organ donation (91.86%) and body donation (94.18%) than staff (lesser acquainted) and general public / patient (non- acquainted group). This finding match findings from older studies of Chung CK, Ng CW et al. [6]. 2008 and P Burra, M De Bona et al. [7] 2005.

Female medical students (19.13%) surprisingly showed more willingness towards body donation compared to other female dental (07.14%), nursing (09.37%) and ayurvedic (17.64%) students. Overall, female study particpants showed more awareness and willingness for organ and body donation compared to their male counterparts. This finding match with that of Bilgel H, Sadikoglu G et al. [8] (2006).

From the present study it is clear that acquainted group were not agree to donate their body for dissection purpose despite being nicely aware. Older study among medical professionals showed that only 22% physicians are willing to donate their bodies for medical education, 85% believed that donated bodies were misused [9]. A study among Turkish anatomist is reported that 63.9% would not consider themselves to donate their bodies as they were not prepared. So, shortage of organ or body is not due to ignorance or misconception only, but it is the thought of getting self -dissected as a cadaver. Practice of honouring the cadaver by students and teachers from the commencement of medical course session should be followed as in Korea and Thailand [10,11].

Conclusions

1. Female participants showed more awareness and willingnesss for organ and body donation than their male counterparts.
2. Younger age group particpiants were found to be more aware and willing to donate organ and body than older and middle sge groups.
3. Acquainted participants showed more awareness but actual willingness to donate organ and body was shown by lesser acquainted group.

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Original Article

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A Study of Anatomical Congenital Anomalies in Newborns in a Teaching Hospital of India

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Abstract

Background and Introduction: Congenital malformations may be defined as any anatomical defect, single or multiple, present at birth, attributable to fault in development. The severity of such a defect may vary from symptomless and regressible capillary naevi to lethal multiple system defects. A combination of genetic, biologic and environmental factors is considered to be responsible for many of these conditions. *Materials and Methods:* The study was carried out in the Obstetrics & Gynecology department of a tertiary care hospital in Southeastern India. The period of study was taken as per the protocol of the project. It was a hospital based observational study not involving any surgical intervention. *Observation and Results:* A total of 7268 babies were delivered during this period in the Department of Obstetrics and Gynecology, (both live and still born). Out of these 116 (one hundred and sixteen) babies were found to have congenital malformations including both major and minor malformations. In the present study, the commonest system involved was the musculoskeletal system (22.4%). The commonest malformations of the musculoskeletal system observed in the present study were talipes (15cases) and polydactyly (8 cases). *Conclusion:* Congenital malformations constitute one of the important causes of morbidity and mortality in the neonatal period, affecting nearly 1.59% of the newborns and contributing to many of the prenatal deaths.

Keywords: Congenital; Malformations; Neonates; Defects; Newborns.

Introduction

Advances in medicine have led to decline in diseases like infection and malnutrition. In The present scenario, congenital malformations have emerged gaining great importance in perinatal mortality [1]. Congenital malformations represent defects in morphogenesis during early fetal life. It is recognized that maldevelopment is the result of subtle interplay between gene and environment. Also it has been observed that better maternal care and improved standards of living have very little effect on overall frequency of congenital malformations [2].

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Congenital malformations affect 2.5% infants at birth and are responsible for about 15% perinatal mortality in India [3]. According to some authors [4], the incidence of congenital malformations is approximately 2% of total births. A biologic phenomenon which has never been explained is noted by the fact that the incidence of congenital malformations is similar for all populations although the frequency of specific malformation differs from country to country [5].

The causes of majority of congenital anomalies are not currently understood. A combination of genetic, biologic and environmental factors is considered to be responsible for many of these conditions. However, the cause is not known in about 40-60% of cases [6].With all this in view the present study was undertaken to evaluate a spectrum of congenital malformations in a teaching hospital in southeastern India.

Materials and Methods

The present study was conducted in the Department of Obstetrics and Gynecology, in a teaching hospital in southeastern India. The study

was done from July 2007 for a period of 3 years. A total of 7268 babies were delivered during this period (both live and still born). Out of these 116 (one hundred and sixteen) babies were found to have congenital malformations which included both major and minor malformations

Babies were examined within the first 3 days of delivery for congenital malformations. All live born babies born during this period and stillborns after 28 weeks of gestation or whose weight was about 1 kg were included in the study. Products of conception expelled by mid-trimester, abortion were not included in the study. A thorough physical examination was done within 24 hours of delivery. The live borns with congenital malformations, who survived at the time of discharge were again examined at 3 days of life and prior to discharge and were followed up when possible. The still borns were autopsied as and when consent from parents was obtained. Despite best efforts few still borns could not be studied properly due to lack of consent for autopsy by parents.

Every newborn baby was subjected to a detailed examination from head to toe within the first 24 hours of birth and again at 3 days of life. All macroscopic anatomical defects detected were recorded in a pre-designed Performa. Major congenital malformations included those defects which caused serious structural, cosmetic and functional disability and required surgical or medical intervention. Minor malformations were defined as those that were not lethal like skin tags, capillary hemangioma, preauricular sinuses, nevi, accessory nipples, tongue-tie, congenital teeth etc. Although these were not so important, the presence of these minor abnormalities often alerted for undertaking a more thorough clinical search to unearth associated major malformations.

Congenital malformation like pyloric stenosis could not be studied as it does not present within 7 days of life. The clinical diagnosis was complemented by investigations as and when necessary like radiological investigations. Chromosome studies could not be done. Only gross anatomical study was done. Histopathological study was not done.

Ethical Statement

Ethical clearance was taken from the institutional ethical committee. Consent forms were duly completed by the parents and the only the cases were documented. It was an observational study done in hospital settings.

Statistical Analysis

The data was collected and tabulated. They were then statistically analyzed by the ANOVA test and Probability test [7]. The software used was MSTATC. The website referred was www. graphpad.com.

1	Baby of _____	7	Weight_____
2	Regd No_____	8	Single or twin_____
3	Sex of Baby _____	9	Live or still born_____
4	Date & time of birth_____	10	Season of the year____
5	Date of Examination_____	11	Gestational age _____
6	Mode of Delivery_____		

1. Examination of various systems: -

A. CNS and Spine
B. CVS
C. Alimentary system
D. Genitourinary system
E. Respiratory system
F. Musculoskeletal system
G. Orofacial (including ocular, auricular, nasopharynx, palate, nose, lip)
H. Skin
I. Others

2. Baby is having single cong./Multiple congenital anomalies.
3. Investigation done in live born.
4. Whether baby survived the first 7 days of life
5. Autopsy finding in still born.

Observations

The present study was carried out in the above teaching hospital in Southeastern India for a period of three years. A total of one hundred sixteen (116) babies were (Table 1) found to have congenital malformations. During this period 7258 women delivered 7268 babies. Ten pairs of twins were delivered. Out of the twins, two babies had congenital malformations.

Table 1: Shows incidence of congenital malformation during the period of study

		Total cases	Malformed No.	Percentage
1.	Total births	7268	116	1.59
2.	Live births	7108	100	1.4
3.	Still births	160	16	10.0*

Central Nervous defects were seen in 31 babies. Hydrocephalus was the commonest anomaly observed having an incidence of 1.4/1000. Sacrococcygeal teratoma and facial palsy each had an incidence of 0.3/1000.Among babies with nervous defects 8 had anencephaly and were born dead.

Musculoskeletal defects were seen in 32 babies. Talipes equinovarus was most common and seen in 15 cases. Polydactyly was the 2nd most common abnormality and was seen in babies with other associated defects. 25 babies showed orofacial defects out of which cleft lip with cleft palate was seen in 16 with an incidence of 2.2/1000. Both hypo plastic nose and pre-auricular skin tags showed an incidence of 0.14/1000. Gastrointestinal defects were seen in 6 babies in our study. Out of them 1 rare case of gastrointestinal atresia having esophageal and duodenal atresia was also observed. 3 babies were born with congenital varicella and had vesicles all over the body. Urogenital defects were observed in 21 babies with as many as 7 showing hypospadias.

An interesting case of conjoined twins was also reported having a fused heart. It was a case of thoracopagus and one of them had cleft lip. They had a single anterior placenta with a succenturiate lobe. Cardiovascular defects as they do not present within 3 days of delivery were not commonly seen within our observation period. Table 2 shows the percentage incidence of malformations of various systems, in relation to total number of babies with malformations. In this table, individuals with malformation of a single system are entered for that particular system. Those with multiple malformations are grouped together in a single group of multiple malformations.

Table 2: Shows the percentage incidence of malformations of various systems, in relation to total number of babies with malformations

Sl. No.	System	No. of babies	% of total malformed babies
1.	CNS	21	18.1
2	Musculoskeletal	26	22.4
3	Orofacial	19	16.4
4	Ear	3	2.6
5	Eye	2	1.7
6	GIT	4	3.4
7	Urogenital	19	16.4
8	Skin	6	5.2
9	CVS	0	0
10	Down's syndrome	4	3.4
11	Multi system involvement	12	10.4

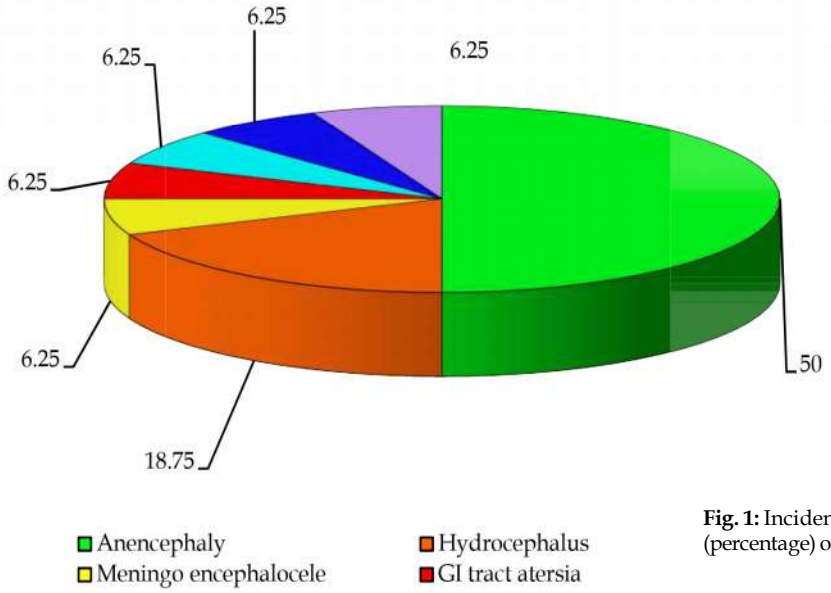

Fig. 1: Incidence of major malformations (percentage) of total malformed still borns

In this period of study, a total of 160 babies were still born of which16 were malformed. From Fig. 1, it is seen that 81.25 % of still born infants had congenital malformations of the central nervous system, the incidence of which is quite high when compared with incidence of CNS.

Malformations of total malformed babies which was 18.1% (p value<0.01). 72 babies showed major malformations and 44 had minor malformations.

Table 3: Shows the distribution of male and female babies born with congenital malformations

Sl. No.	Total cases	No	Percentage
1.	Male	68	58.6
2	Female	48	41.4

As seen in above table the % incidence of male malformed babies is 58.6 while (Table 3) that of females is 41.4(p<0.05). M:F ratio is 1.4:1 which is significant. There were no babies below 1 kg because midtrimester abortions were not included in our study. Majority of malformed babies (72.4%) were low birth weight; their weight ranging from 1-2.5 kg. Malformations were seen only in 10 babies with birth weight>3 kg (8.6%). In our period of study 10 pairs of twins were delivered out of which 2 had some or other malformations accounting for 10% which is significantly high compared to single births where it was 1.57% (p<0.05%). 18 babies died during their hospital stay of 3 days. Among these 10 died due to (Table 4) malformations and 8 died due to extreme prematurity. Also, surgical intervention was done in a few cases and was successful.

Table 4: Shows the number of deaths among the babies born with malformations

Sl. No.	Malformation	No. of deaths
1	Conjoint twin with fused heart	1
2	Hydrocephalus	6
3	Encephalocele	1
4	Fetal ascitis	1
5	Gastroschisis	1
	Total	10

* Total live born 100

Discussion

The present study revealed that the incidence of congenital malformation per thousand total birth is 15.9/1000 or 1.59%. The incidence in different studies can vary depending upon the source of malformation, population sampled, selection of study material, astuteness of clinician and availability of laboratory aids. In fact, only 43% of malformations could be diagnosed at birth as reported by some authors [8]. The incidence in the present study which was found to be 15.9/1000 births agrees with authors [9] from other countries who found it to be 13.5/1000 and authors from north India [10] who observed 20/1000. Chinara from BHU [11] observed a gradual decline of incidence of congenital malformation from west to east India (Figure 2 and 3) from about 3.6 in Chandigarh to about 0.2 in Kolkata.

Fig. 2: A baby with Gastroschisis

Fig. 3: A baby showing congenital varicella

Fig. 4: A newborn baby with accessory nipples

It has also been noted that congenital malformation in a birth cohort in an urban population increase from 26.22/1000 to 40.37/1000 at 5 years. This occurs because many malformations present themselves in late childhood [12]. In the present study, the commonest system involved was the (Figure 4) musculoskeletal system (22.4%). This system as the commonest system involved was also noted in other studies [13] conducted by the team of Chaturvedi et al.

Malformations of the central nervous system were reported to be commonest by most of the Indian researchers and workers. The incidence of multiple malformation involving different systems was found to be 10.4%. In our study out of 12 cases of multisystem involvement, CNS malformations presented as the principal malformation [14]. Authors across the world have found central nervous system abnormalities in 80% of stillborn malformed babies. The relative higher incidence of neural tube defects in our study (2.3/1000) is in keeping with few other north Indian studies [15-16]. Malformation of the orofacial area (excluding eye and ear) was found to have a high incidence (16.4%) in the present study. Mathur et al. [17] reported an incidence of 3.8/1000 for cleft lip (Figure 5) and cleft palate.

Fig. 5: A baby with Cleft lip, cleft Palate and anencephaly

Malformations of the gastrointestinal system in the present study accounted for only 3.4% of cases. However, malformation of this system was found to be commonest by some authors in community-based studies [18]. In the abnormalities of the genitourinary system (16.4%), hypospadias was found to be the commonest (0.96/1000). Hypospadias was also reported to be the commonest anomaly by one study by Mittal et al. [19]. The incidence of cardiovascular system anomaly is low at birth relatively because many are not detected till school age.

There were 4 babies born with Down's syndrome showing typical features. If we compare the still born children in our study it was 2.3% whereas other reports show it 3.7%, 4.4% and 2.4% in various other studies. A total of 72.4% malformed babies were low birth weight. It has been noted that 70% of infants with internal anomalies had birth weight less than 50th percentile for their gestational age [20-21].

Conclusion

So, to conclude congenital malformations constitute one of the important causes of morbidity and mortality in the neonatal period, affecting nearly 1.59% of the newborns and contributing to many of prenatal deaths.

One of the major steps in reducing the incidence and proper management would be early detection. Medical termination of pregnancy for uncorrectable severe malformation should be done and provision of antenatal diagnosis by use of ultrasonography, amniotic fluid studies and other methods are important.

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Conflict of Interest: None declared

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Original Article

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A Study of the Origin of Superior Thyroid, Lingual and Facial Arteries

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Abstract

Background: The information on the branching pattern of external carotid artery helps clinicians during arterial imaging studies and surgeries of neck.There is increased possibility of iatrogenic injury to carotid arterial system if there is high level of unpredictability. These variations of external carotid artery are important during surgeries like thyroidectomy, laryngectomy, tonsillectomy, faciomaxillary, glossectomy and other neck surgeries. *Materials and Methods:* 42 (30 male and 12 female) human cadavers allotted to first M.B.B.S students at Government Mohan Kumaramangalam Medical College during the years 2012-2017 were studied to examine individual differences in external carotid arterial branching pattern. The origin of superior thyroid, lingual and facial arteries were noted. *Results:* Superior thyroid artery arises mostly from external carotid artery in right side when compared to left side. Variant origin of superior thyroid from common carotid artery is most common in left side. Linguofacial trunk is occurring more on the right side when compared with the left side. *Conclusion:* Head and neck surgeons must be cautious about the variable anatomy of the external carotid artery because of its clinical importance. Radiologists, while interpretation of various imaging studies, should be aware of these possibilities in the branching pattern of external carotid artery.

Keywords: Variations; Superior Thyroid Artery; Lingual Artery; Facial Artery.

Introduction

The external carotid artery begins lateral to the upper border of thyroid cartilage, level with the intervertebral disc between the third and fourth cervical vertebrae. At its origin, it is in the carotid triangle and lies anteromedial to the internal carotid artery. As it ascends, it gives off the following branches-Superior thyroid artery, Ascending pharyngeal artery, lingual artery, facial artery, occipital and posterior auricular arteries. In the substance of the parotid gland behind the neck of the mandible, it divides into its terminal branches-the superficial temporal and maxillary arteries.

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The superior thyroid artery is the first branch of the external carotid artery and arises from the anterior surface of the external carotid just below the level of the greater cornu of the hyoid bone.

The lingual artery provides the chief blood supply to the tongue and the floor of the mouth. It arises anteromedially from the external carotid artery opposite the tip of the greater cornu of the hyoid bone, between the superior thyroid and facial arteries. It often arises with the facial, or less often, with the superior thyroid artery. It may be replaced by a ramus of the maxillary artery.

The facial artery arises anteriorly from the external carotid in the carotid triangle, above the lingual artery and immediately above the greater cornu of the hyoid bone1.

The information on the branching pattern of external carotid artery helps clinicians during arterial imaging studies and surgeries of neck.

There is increased possibility of iatrogenic injury to carotid arterial system if there is high level of unpredictability. These variations of external carotid artery are important during surgeries like thyroidectomy, laryngectomy, tonsillectomy, faciomaxillary, glossectomy and other neck surgeries.

Materials and Methods

Fourty (42) (30 male and 12 female) human cadavers allotted to first M.B.B.S students at Government Mohan Kumaramangalam Medical College during the years 2012-2017 were studied to examine individual differences in external carotid arterial branching pattern. Dissection was performed bilaterally. The following parameters were noted:

1. The origin of superior thyroid artery from external carotid artery or common carotid artery or carotid bifurcation.
2. The origin of Lingual and Facial arteries, either individually or from a common trunk .
3. The level of origin of facial artery .
4. The position of external carotid artery-lateral or medial to internal carotid artery .

Results

The following results were obtained in 84 specimens.

It is seen from the results that superior thyroid artery arises mostly from external carotid artery in right side when compared to left side. Variant origin of superior thyroid from common carotid artery is most common in left side. Linguofacial trunk is occurring more on the right side when compared with the left side.

Further, on the right side of a cadaver, the external carotid artery ran lateral to internal carotid artery (Figure 6) after bifurcation and a common linguofacial trunk emerged from it. The linguofacial trunk crossed internal carotid artery and ran for 2 cm, divided into lingual and facial arteries.

Table 1:

Observation	Total	Right Side	Left Side
Origin of superior thyroid artery from external carotid artery(fig 1)	5(5.95%)	4(4.76%)	1(1.19%)
Origin of superior thyroid artery from common carotid artery(fig 2)	6(7.14%)	2(2.38%)	4(4.76%)
Origin of superior thyroid artery from Carotid bifurcation(fig 3)	73(86.9%)	36(42.85%)	37(44.04%)
Origin of lingual artery and facial artery separately(fig 4)	70(83.33%)	33(39.28%)	37(44.04%)
Occurrence of linguofacial trunk(fig 5)	14(16.66%)	9(10.71%)	5(5.95%)

Fig. 1: Superior thyroid artery from External carotid artery
1- Common carotid artery
2- External carotid artery
3- Internal carotid artery
4- superior thyroid artery

Fig. 2: Superior thyroid artery from common carotid artery
1- Common carotid artery
2- External carotid artery
3- Internal carotid artery
4- Superior thyroid Artery

Fig. 3: Superior Thyroid Artery from carotid bifurcation
1- Common carotid artery
2- Carotid bifurcation
3- External carotid artery
4- superior thyroid artery

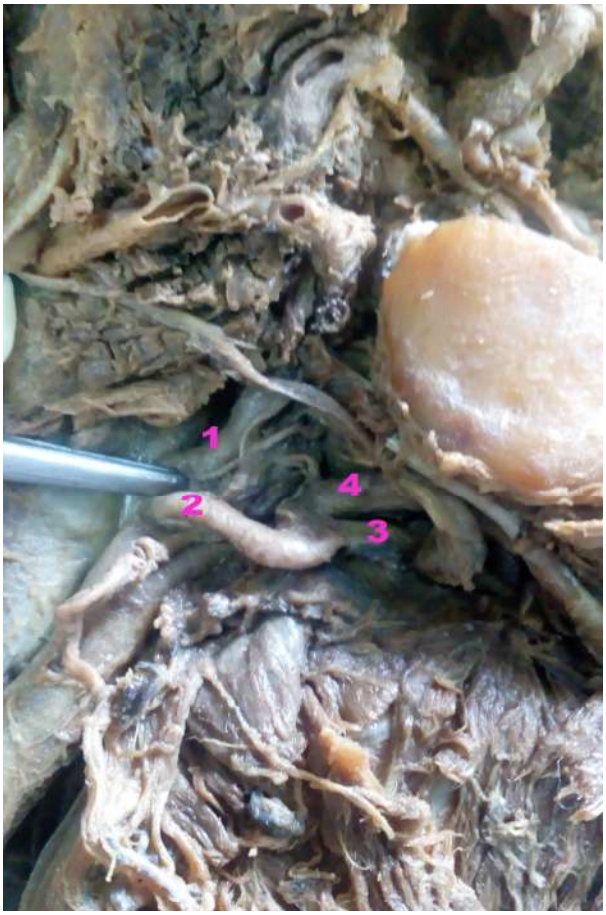

Fig. 5: Linguofacial trunk from external carotid artery
1- External carotid artery
2- Linguofacial trunk
3- Lingual artery
4- Facial artery

Fig. 4: Original of Lingual Artery and facial artery separately from Exernal carotid artery
1- External carotid artery
2- Lingual Artery
3- Facial artery
4- Hypoglossal Nerve

Fig. 6: External carotid artery lateral to internal carotid artery
1- Common carotid artery
2- External carotid artery
3- Internal carotid artery

It was further observed that on the left side of a cadaver, the facial artery arose from external carotid artery at the level of angle of mandible. (Fig . 7).

Fig. 7: High origin of facial artery
1- Common carotid artery
2- External carotid artery
3- Internal Carotid artery
4- Facial artery
5- Hypoglossal Nerve

Discussion

Sanjeev et al. [2], in their study have reported the origin of superior thyroid artery from external carotid artery in 64.86% and from common carotid artery in 35.14%, the origin of lingual artery individually in 78.38% and as a common linguofacial trunk in 18.92%,the origin of facial artery individually in 81.08% and as a common linguofacial trunk in 18.92%.

Sara. B. Heltzel [3], in their study have found the origin of superior thyroid artery from carotid bifurcation/external carotid artery in 55% and from common carotid artery in 44%,the origin of lingual and facial artery individually in 79% and as a common trunk in 21%.

Anjalee et al 3 have reported linguofacial trunk in 17 cases (28.33%) on right side and in 18 cases (30%) on the left side-totally 58.33%. Further, superior thyroid artery –the origin of which was from common carotid artery in 2 (3.33%)cases on the right side and in 5 (8.33%) cases on the left side-totally 11.66%.

Padmashree et al. [4], have reported a case of origin of superior thyroid artery from common carotid artery on one side. Further on the other side, Superior thyroid artery, ascending pharyngeal artery and lingual artery arose from common carotid artery.

Abhijeet Joshi et al. [5] have reported that superior thyroid artery arose from external carotid artery in 66.67% cases, from carotid bifurcation in 31.81% cases and from common carotid artery in 1.51% of cases.

Shivaleela C et al. [6] have reported that superior thyroid artery arose from external carotid artery in 76.19%,from carotid bifurcation in 21.43% and from common carotid artery in 2.38%.

Manjunath C.S et al. [7] have mentioned that superior thyroid artery arose from external carotid artery in 60% of cases, from carotid bifurcation in 23.3% and from common carotid artery in 16.66%.

Sung-yoon woo et al. [8] have mentioned the origin of superior thyroid artery from external carotid artery in 20%, from carotid bifurcation in 40% and from common carotid artery in 40%.

Natis K et al. [9] have considered a new classification proposal-the origin of superior thyroid artery is considered at the level of carotid bifurcation and not from external carotid artery as stated in many classical textbooks. Our study strongly supports this fact and to conclude the origin of superior thyroid artery could be reconsidered as from carotid bifurcation or common carotid artery rather than from external carotid artery.

The branches of external carotid artery are the key landmarks for appropriate placement of cross-clamps on the carotid arteries during carotid endarterectomy.Therefore surgical anatomy of the carotid arteries have to be understood well to minimise iatrogenic injuries.

Ashutosh Mangalagiri et al. [10] in their study, in 2 out of 60 specimens have found facial artery to arise at a higher level (within parotid gland).

Mohandas Rao KG et al. [11] have reported a case of high origin of facial artery. The facial artery arose in digastric triangle, passed without grooving the submandibular gland, glandular branch to submandibular gland arose from external carotid artery about 1 cm below the origin of facial artery.

Venugopal Rao et al. [12] in their study have reported in one specimen, the facial artery arising near the angle of the mandible.

Mustafa vali et al. [13] have reported high origin of facial artery at the level of angle of mandible

(much higher than its normal level of origin). We have found the same occurrence in one of our cadaver.

High origin of facial artery should be taken into account in submandibular and parotid gland surgeries.

Kishore P.S et al. [14] reported a case of linguofacial trunk in a 72 year old male cadaver.

Suma Dnyanesh et al. [15] have reported a case of linguofacial trunk in their study in right side. The lingual and facial arteries on the right side arose as a trunk, coursed upwards for about 1.2 cm and then divided into lingual and facial arteries.

In our study, Linguofacial trunk was observed in 14 specimens (16.66%) which is similar to sanjeev et al study.

Annette Kirchgersner 16 have reported a case of lateral external carotid artery and linguofacial trunk.In our study also, we encountered a similar finding in a cadaver. Such occurrence of lateral external carotid artery and liguofacial trunk in a single cadaver is being reported second time after Arnette's observation in our study.

Normally, external carotid artery runs medial to the internal carotid artery. A possibility of laterally placed external carotid artery must be kept in mind when performing arterial ligatures in the carotid triangle, to avoid any haemorrhagic incidents. Surgeons and radiologists must be aware of encountering these variations. Knowledge of linguofacial trunk is essential during oral and faciomaxillary surgeries.

Variation in external carotid arterial branching pattern could be due to the disintegration of arterial precursors (aortic arches 1 and 2) from which it is derived. Aortic arches 1and 2 largely disappear during cardiovascular development while arches 3-6 persist 18. Derivatives of 3-6 arches exhibit less variation in formation and structure (Common carotid artery, Arch of aorta, Brachiocephalic trunk, Pulmonary trunk).

Increased variations observed on the right side due to increased foetal blood flow to right side creating increased flow forces which happened during embryonic vasculature.

The higher occurrence of superior thyroid artery from carotid bifurcation on left side may be due to the lower origin of common carotid artery (from arch of aorta) in comparison to the common carotid artery origin on the right (from brachiocephalic trunk).

Conclusion

Head and neck surgeons must be cautious about the variable anatomy of the external carotid artery because of its clinical importance. Radiologists, while interpretation of various imaging studies, should be aware of these possibilities in the branching pattern of external carotid artery.

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Original Article

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Kugels Artery

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Abstract

Aim of the Syudy: The existence of Kugels artery has been rarely reported in literatures. In this study, I have explained the existence and course of Kugels artery. This will be helpful for the cardiologists to analyse the role of Kugels artery in the pathogenesis of valvulitis and lesions of the commissures and the base of the Heart. Kugels anastomotic artery has been described as a constant circumflex branch usually from its anterior part traversing the interatrial septum to establish direct or indirect anastomosis with the right coronary artery. Its existence has been questioned. *Materials and Methods:* 32 Heart specimens were dissected. The origin course and termination of Kugels artery was traced. *Results and Conclusion:* Out of 32 hearts specimens dissected, Kugels artery was found in 8 hearts. The main supply to the atrioventricular node is from the posterior interventricular branch of right coronary artery. Various studies explain that Kugels artery is an accessory blood supply to the atrioventricular Node. Kugels artery is said to terminate near the crux. Here it acts as a source of collaterals with atrioventricular nodal artery.

Keywords: Kugels Artery; Collateral Circulation; Anastomotic Artery.

Introduction

The existence of Kugels artery is still a controversy. Even the textbook of Gray's anatomy questions its existence. Hence, the present study is to find out, whether such an artery exist. Kugels artery was first reported by Kugel and Gross in their original paper [1]. It may form a Y shaped anastomosis, the stem of the Y is represented by inter auricular septum posteriorly. Two wings of the Y form the anterior wall of both auricles and encloses the roots of pulmonary artery and aorta. The left wing of the Y together with the stem in majority of cases carries the *Arteria AnastamoticaAuricularis Magna* [2].

It presents 3 anastomotic variationsmostly it penetrates the left atrial wall, passes backwards along the inferior border of the atrial septum to the crux. In few cases kugels artery is found to originate from the sinoatrial nodal artery. In few cases a branch from right coronary artery and a branch from left circumflex artery joins to form the Kugels artery close to the level of atrioventricular nodal artery. Very rarely small branches from right coronary artery anastomosis with small branches from left circumflex artery at the level of crux [3]. Occasionally it supplies the aortic cusp of the mitral valve. Mitral valve procedures exposes the mitral valve and sub valvular structures. The superior septal approach of mitral valve, causes damage to sinoatrial nodal artery resulting in cardiac rhythm disturbances, ending in the necessity for pacemaker implantation. Ablation procedures done for treating arrhythmias damages atrioventricular nodal artery ending in complete AV block. Contrast radiograms has been taken and the kugels artery was found to be present anterior to circumflex artery coursing towards the crux. Radiographic identification of coronary artery has been reported in 6 cases with coronary artery disease [4].

As kugels artery might come as a branch from sinoatrial nodal artery or it acts as an accessory blood supply to AV node, it is more likely for the kugels artery to get damaged during mitral valvular surgeries or ablation procedures [5]. Kugels artery has also been reported to form coronary arteriovenous fistula with the coronary sinus [6]. It plays an important role in the pathogenesis of mitral and aortic lesions, commisural lesions and lesions at the root of the aorta [7]. It should be taken into

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consideration in many cardiac surgical procedures involving the aortic root [8]. Obstruction of right coronary arteries and left circumflex arteries reduces the blood flow at the level of crux. This proves the kugels artery as an appropriate collateral channel [9].

So in this study, I have studied about the existence and the course of kugels artery.

Materials and Methods

Thirty Two heart specimens were dissected. Origin of the Left coronary artery was traced. Identified the Circumflex and Anterior interventricular branch, and looked for any branch arising from the circumflex artery. It was traced till the point where it pierces the Interatrial septum.

Results

Out of 32 heart specimens dissected, Kugels artery was found in 8 hearts.

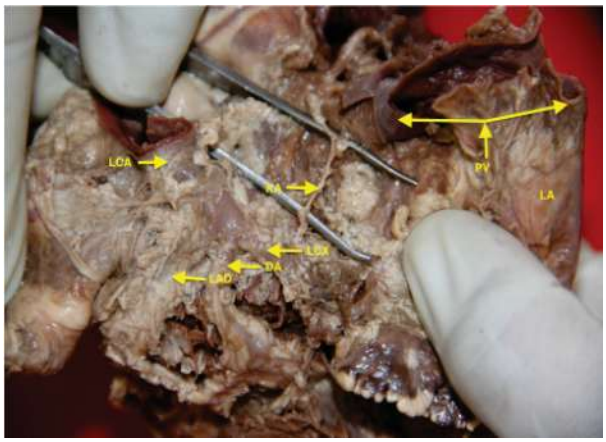

Fig. 1:

A branch from circumflex branch of left coronary artery passed in front of the left auricle and left atrium and at the back of route of pulmonary trunk and ascending aorta.

Then it pierced the interatrial septum.

In the Figure 2 heart specimen also a branch was found to originate from the circumflex branch of left coronary artery.

This branch was also found to pass in front of the left auricle and left atrium and pierce the interatrial septum.

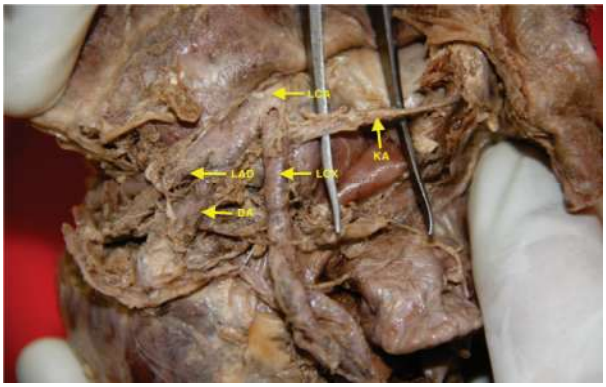

Fig. 2:

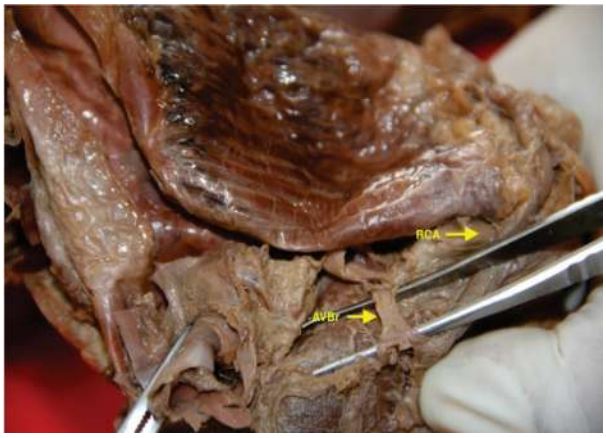

Fig. 3:

Some studies say that it anastomosis with atrioventricular nodal artery.

The AV nodal artery was traced from behind, but the anastomosis was not seen.

Discussion

Various study says that Kugels artery is an anastomotic artery.

Kugel MA and Gross were the first to report kugels artery in his original article, so the artery was named after him. Because of huge caliber and the site of occurrence of the kugels artery in relation to the auricle and the atrial septum, he also named it as Arteria anastamoticaauricularis magna [1]. Text book of Grays Anatomy describes Kugels artery as a constant Circumflex branch from its anterior part traverses the interatrial septum to establish direct or indirect anastomosis with RCA [2]. Christos et al. found Kugels Artery in 6 out of 100 hearts, out of which in 2 hearts it originated from LCA and ended in RCA, in 1 heart from RCA to RCA and in 1 heart

started from RCA through SA nodal Artery and ended in LCA [3].

Kugels Artery is said to terminate near the crux where it acts as a source of collaterals with AV nodal artery (6%) [4]. Subbaraobopana et al have reported the 3 anatomic variations of Kugels artery [7]. Divyaprakash et al have studied about the arterial blood supply to SA node and AV node through coronary angiography. In this study they have reported that the SA node is supplied by Kugels artery in few cases [8].

Kumaari et al. have dissected 41 hearts and studied the existence of Kugels artery in the population of kerala. 20% of the population of kerala showed the presence of kugels artery [9]. Viyamma et al. have done a study on human coronary arteries based on gross anatomy and coronary casts in 115 hearts and have reported the anastomoses of kugels artery with AV nodal artery [10]. Thomas has described in his study that kugels artery links the anterior and posterior ventricular coronary tree. It holds a reasonable value in collateral circulation to the ventricles and serves as an accessory supply to the AV node [11].

In the present study, the origin of the artery was from the circumflex branch of left coronary artery. It took a course behind the root of Pulmonary trunk and ascending aorta, in front of left auricle and left atrium and terminated by piercing the inter atrial septum.

Conclusion

Kugels artery is said to be constant in its existence though it shows variation in its course and anastomoses. It acts as a source of collaterals and its presence might decrease the ischaemic consequence [1]. Various studies have reported the anastomoses of kugels artery with AV nodal artery. This is helpful for the physicians in various diagnostic and therapeutic procedures involving this area of the heart [3]. Radio frequency ablation and biventricular pacemaker insertion has the potential risk of damaging the important anastomotic network [5]. Out of 32 hearts dissected Kugels artery was able to be traced in 6 hearts. In all 6 hearts the anastomoses was not able to be made out. But kugels artery was found to originate from circumflex branch of left coronary artery, courses in front of left auricle and left atrium, behind ascending aorta and pulmonary trunk and was traced till it pierced the interatrial septum. So the kugels artery has proved its existence. The cardiothoracic surgeons and the physicians should always have the presence of Kugels artery in mind while doing valvular surgeries or ablation procedures for arrhythmias, to avoid injuring the kugels artery. The radiologists and physicians should always bear in mind about kugels artery while performing various diagnostic and therapeutic procedures, to avoid complications due to the injury to kugels artery.

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A Study Evaluating Morphology of Placenta and Fetal Outcomes in Hypertensive Pregnancies

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Abstract

Normal formation, full development and functions of the placenta determine the survival and growth of foetus. Study of placenta gives insight into the health condition of fetus. *Materials & Methods:* A total of 500 subjects, each in hypertensive and normotensive group were included in this study conducted in Anatomy Department of SBKS Medical College and Research Centre, Vadodara. *Results:* In the hypertensive groups, 80% females were primigravida while 20% females were multigravida. In the hypertensive group,there was significant increase in the number of deliveries occurring at pre-term (35%) and a significant proportion of deliveries were by lower section caesarean section (45%). Mean birth weight of the babies was 2.82±0.43 in control and 2.33 ± 0.84kg in hypertension group. On examining the morphometry of the placentas, it was observed that mean placental weight was 541.4±30.62g in control group as against 478.4±30.62g in the hypertension group. The mean placental diameter was 19.87±1.47 cm in control group while it was 17.87±1.47cm in another group. In the hypertension group the placental area, volume and thickness were significantly less as compared to control group. Mean number of cotyledons were 18.46±1.54 in control group as against 16.46±1.54 in hypertension group. Fetoplacental ratio and placental co-efficient were 5.23±0.86 and 0.19±0.02 in control group and 4.88±1.79 and 0.17±0.06 in the hypertension group. *Conclusion:* Hypertensive disorders of pregnancy have significant effect on the morphology and morphometry of placenta and also influences the fetal outcomes.

Keywords: Placenta; Fetus; Morphology; Morphometry; Hypertensive Pregnancies.

Introduction

Reproduction has two important aspects: the Fetus and the Mother that are connected to each other by a vital organ "the placenta" [1]. Normal formation, full development and functions of the placenta determine the survival and growth of foetus [2]. As the pregnancy progresses, the placenta undergoes morphological and morphometric changes such as changes in weight, volume, structure, shape and function in order to support the prenatal life [3]. Placenta is a reflection of maternal and fetal status. It is a report of the infant's prenatal experience. Thus the complications of pregnancy that are associated with high perinatal morbidity and mortality are reflected in a significant way in the placenta.

Preeclampsia is an important complication of pregnancy that affects anywhere between 5 and 10% of pregnancies and leads to maternal and fetal morbidity and mortality. It is unique to pregnancy and its origin is unclear and is one of the leading cause of maternal and/or fetal death [2,3].

Pre-eclampsia is associated with hypertension and proteinurea. Its primary cause is cytotrophoblast cells apoptosis as a result of which decidua is penetrated only superficially which causes anywhere between 30 to 50% of spiral arterioles in placental bed to escape remodeling by trophoblast [3,4]. These arterioles have intact myometrial segments, this in addition to unaffected adrenergic nerve supply causes these vessels to remain undilated. Thus the formation of freely communicating sinusoids that is pertinent to adequate blood flow is hampered. It is observed that in women with preeclampsia, the mean luminal diameter of uterine spiral arterioles is less than one third to that seen in normal pregnancies. There is resultant decrease in uteroplacental perfusion and infarction of placenta with progress of gestation and ultimately fetal hypoxia that causes IUGR which

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contributes to premature delivery and fetal death [5,6].

A thorough examination of placenta, gives information that is useful in management of complications in mother and the new born [6-9]. With these aspects in mind, this study was conducted. Present study has been undertaken to assess the morphology and histology of placenta from mothers with PIH and to correlate the findings with those from normal pregnancies.

Materials & Methods

This prospective, observational study was carried out in the Anatomy Department of SBKS Medical College and Research Centre, Vadodara and Department of Obstetrics and Gynaecology of Dhiraj General Hospital Dhiraj General Hospital, Vadodara, a tertiary health care centre after obtaining ethics committee approval. A total of 500 subjects with hypertensive pregnancies (test group) and 500 subjects with normotensive pregnancies (control group) that met following inclusion criteria and none of the exclusion criteria were included in the study:

Inclusion Criteria

Normotensive mothers and mothers with pregnancy Induced Hypertension (Pre-eclampsia and Eclampsia), gestational hypertension.

Exclusion Criteria

All other maternal conditions which lead to small placental size, placental infarcts and Intra-uterine growth retardation.

The subjects willing to participate in the study were explained about the purpose and method of the study in the language they understood and written consent was obtained before including them in the study. Confidentiality of participating mothers was maintained at all levels. Following delivery, on being informed by the department of Obstetrics and Gynaecology, placentae were collected and brought to the Anatomy Department. Placental collection continued till 500 placentae of normotensive mother and 500 placentae of hypertensive mother were collected.

Weighing machine for placenta, vernier caliper, bucket of water, tray, scalpel with surgical blade and graph paper were the materials used.

Placentae with membranes were collected. Amnion and chorion were trimmed from the placenta. Umbilical cord was cut 50mm from insertion site. This was followed by washing and mopping.

Gross assessment:weight of each placenta was measured using a weighing scale, surface area of the maternal surface of placenta was calculated after taking its impression on graph paper. Using a measuring tape, diameters were recorded along the two axes that were at 90 degree to each other (mean of two diameters was obtained); vernier caliper was used in calculating thickness; and area was estimated in cm^2 using the formula described by Davies and Beazley.

Placental volume was calculated using the Archimedes principle (water displacement method). Following parameters were recorded: shape, weight (gram), diameter (cm), site of umbilical cord insertion, number of cotyledons, presence or absence of calcification, fetoplacental ratio (calculated by dividing the fetal weight by the placental weight) and placental coefficient (placental coefficient is obtained when placental weight is divided by fetal weight).

Results

A total of 1000 subjects, 500 in normotensive and 500 in hypertensive groups (Table 1), in the age range 20 to 35 years, were evaluated for placental characters in the labour room of department of Obstetrics and Gynecology, Dhiraj general hospital and in the anatomy department of SBKS MIRC.

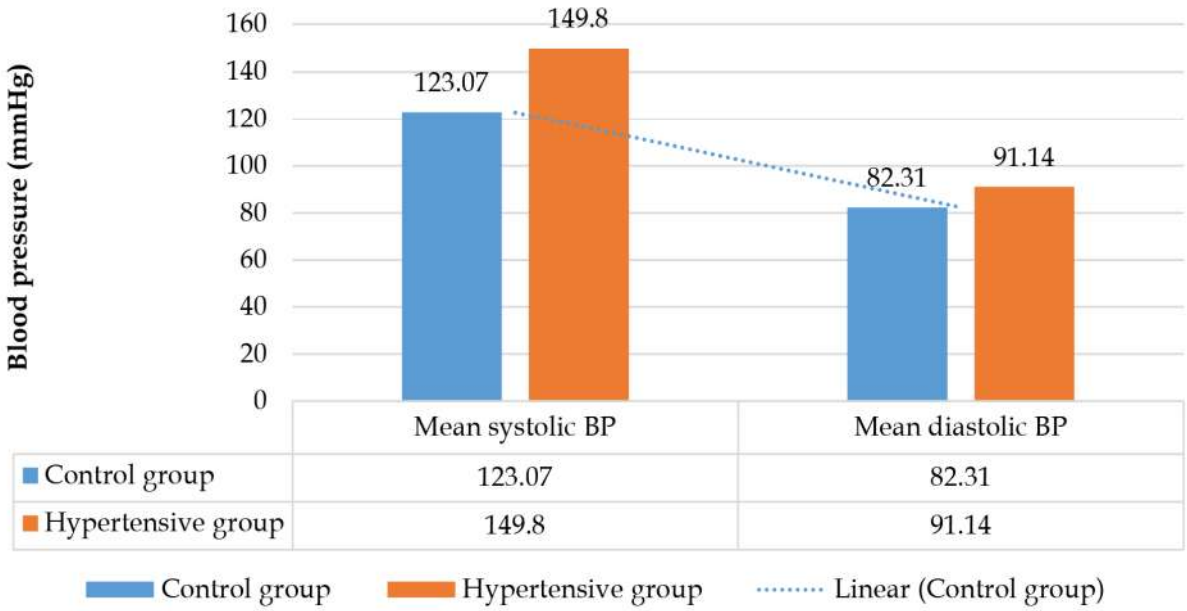
Majority of cases were in the age group of 20-25 years (46.2%) in control, whereas in hypertension group the majority of cases fell in the age group of 26-30 years (42.4%). In the normotensive group, 88.2% (n=441) were primigravida and 11.8% (n=59) were multi gravida. On the other hand in the hypertensive groups, 80% (n=400) females were primigravida while 20% (n=100) females were multigravida (Table 2).

The blood pressure in the control group was in the normal range mean systolic blood pressure was 123.07mmHg±4.14mmHg and mean diastolic blood pressure was 82.31mmHg±4.08mmHg. In the hypertensive group majority patients had both systolic as well as diastolic blood pressure raised, while some patients had only raised systolic pressure and few had only raised diastolic pressure. The mean systolic blood pressure in the

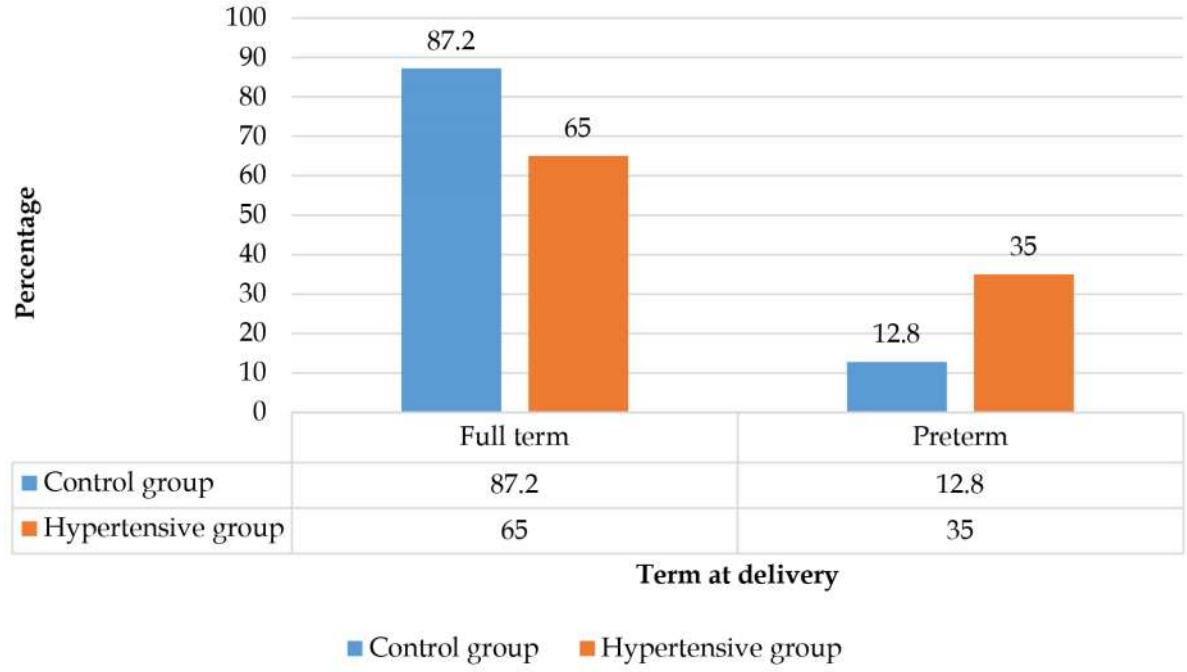
hypertensive group was 149.8mmHg±7.48mmHg, while mean diastolic blood pressure was 91.14mmHg ± 4.14mmHg. (Graph 1). In the control group majority of the deliveries completed full term (87.2%) while in the hypertensive group there was significant increase in the number of deliveries occurring at pre-term (35%) (Graph 2).

In the control group majority of the deliveries (96%) were by vaginal route, while in the hypertensive group a significant proportion of deliveries were by lower section caesarean section (45%) (Grpah 3).

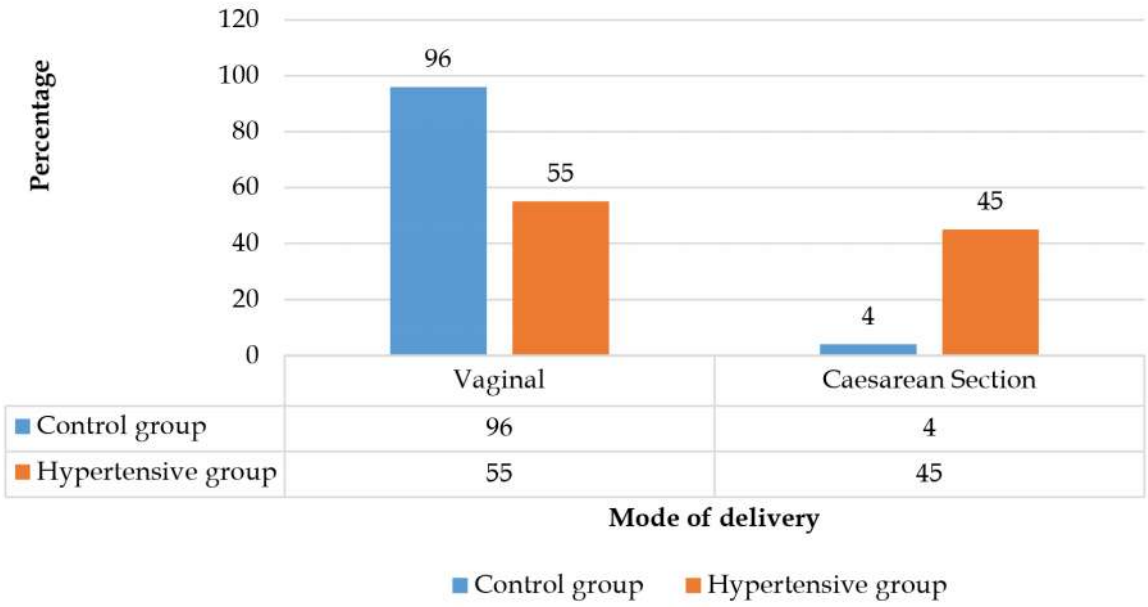
Majority of the patients in both group gave live birth viz., 98.6% in control group and 90% in



Graph 1: Mean blood pressure in Control and Hypertensive group



Graph 2: Term of delivery



Graph 3: Mode of delivery

hypertension group. Intra uterine death was seen in 10% of the deliveries in hypertension group. Fetal outcomes were as show in table III. Mean birth weight of the babies was 2.82±0.43 in control and same was 2.33±0.84kg in hypertension group. Mean APGAR score at birth was 7.7± 1.38 in control group while the same was 6.32± 2.23 in hypertension group; mean APGAR score at 5 minutes was 8.1±2.82 in hypertension group as compared to 9.23±1.38 in control group. A significant proportion of new borns of hypertensive mothers (58.6%) required NICU admission.

In the control group majority of the new born had weight between 2.6 to 3 kg, while in the hypertension group majority of the patients had weight between 2 to 2.5kg.

When the attachment of the placenta was studied, it was observed that in control group majority of the placental attachment was eccentric (51.2%) while in the hypertension group majority of the placentas were attached marginally (46.8%). The data on the location of insertion of umbilical cord in three groups are presented in figure IV.In the control group (71.8%) as well as the hypertension group (59.2%) majority of the placentas were discoid in shape as show in table IV.

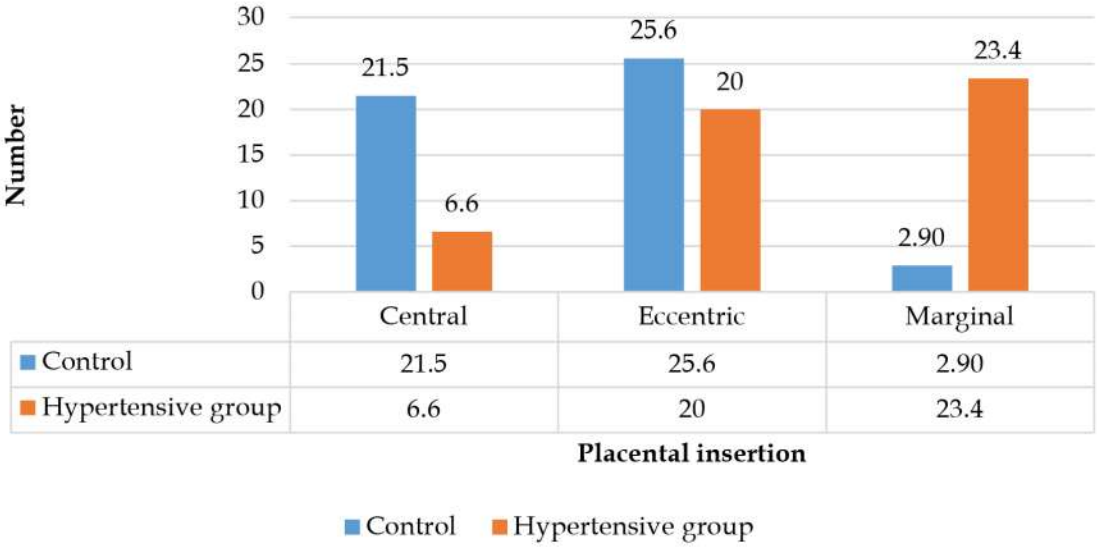
On examining the morphometry of the placentas, it was observed that mean placental weight was 541.4±30.62g in control group as against 478.4± 30.62g in the hypertension group. The mean placental diameter was 19.87±1.47 cm in control group while it was 17.87±1.47cm in another group.

Table 1: Distribution of cases

Normotensive group		Hypertensive group							
		Gestational Hypertension		Pre-eclampsia		Eclampsia		Total	
No.	%	No.	%	No.	%	No.	%	No.	%
500	50	125	12.5	250	25	125	12.5	500	50

Table 2: Gravida status of the patients enrolled

Gravida status	Normotensive group		Hypertensive group	
	No.	%	No.	%
Primigravida	441	88.2	400	80
Multi gravida	59	11.8	100	20
Total	500	100	500	100



Graph 4: Distribution cases according insertion of placenta

In the hypertension group the placental area, volume and thickness were significantly less as compared to control group. Mean number of cotyledons were 18.46±1.54 in control group as against 16.46±1.54 in hypertension group (Table 5).

In the control group majority of the placental weight was between 500 to 550g while in the hypertension group majority of the placental weight was between 451 to 500gm (Table 6).

Table 3: Fetal Outcomes

Parameters	Control group	Hypertensive group
Live Birth	493 (98.6%)	450 (90%)
IUD	7 (1.4%)	50 (10%)
Birth weight (kg)	2.82 ± 0.43	2.33 ± 0.84
Mean Apgar score at birth	7.7± 1.38	6.32± 2.23
Mean Apgar score at 5 minutes	9.23± 1.38	8.1± 2.82
NICU admission required	14 (2.8%)	293 (58.6%)

Table 4: Placental Shape

Shape	Control	Hypertensive group
Discoid	359 (71.8%)	296 (59.2%)
Heart	86 (17.2%)	42 (8.4%)
Oval	52 (10.4%)	85 (17%)
Irregular	3 (0.6%)	77 (15.4%)

Table 5: Placental Morphometry

Parameters	Control group	Hypertensive group	p-value
Mean placental weight (g)	541.4 ± 30.62	478.4 ± 30.62	<0.05
Mean placental diameter (cm)	19.87 ± 1.47	17.87 ± 1.47	<0.05
Mean placental area (cm^2)	266.24 ± 19.75	204.77 ± 16.89	<0.05
Mean placental volume (cc)	425.19 ± 31.53	239.02 ± 19.74	<0.05
Mean placental thickness (cm)	2.16 ± 0.16	2.01 ± 0.11	<0.05
Mean number of cotyledons (n)	18.46 ± 1.54	16.46 ± 1.54	<0.05

Table 6: Distribution of cases according to placental weight

Placental weight	Control group	Hypertensive group
400-450	0	106 (21.2%)
451-500	62 (12.4%)	235 (47%)
501-550	236 (47.2%)	159 (31.8%)
551-600	202 (40.4%)	0

Table 7: Fetoplacental ratio and Placental coefficient

	Control	Hypertension group
Fetoplacental ratio	5.23±0.86	4.88±1.79
Placental coefficient	0.19±0.02	0.17±0.06

Table 8: Gross examination of placenta

Gross examination finding	Status	Normotensive group		Hypertension group	
		N	%	N	%
Calcification	Present	179	36%	269	54%
	Absent	321	64%	231	46%
Infarction	Present	63	13%	212	42%
	Absent	437	87%	288	58%
Placental cyst	Present	28	6%	84	17%
	Absent	472	94%	416	83%
Accessory placental lobe.	Present	34	7%	135	27%
	Absent	466	93%	365	73%

Fetoplacental ratio and placental co-efficient were calculated, in the control group they were 5.23±0.86 and 0.19±0.02 while in the hypertension group they were 4.88±1.79 and 0.17±0.06 respectively which was significantly less as compared to control group. (Table 7) Gross examination of placenta revealed the features shown in table 8.

Discussion & Conclusion

Placenta is the pathway for nutrient flow and gas exchange between the mother and the fetus. Any abnormality of the placenta significantly impacts the fetal growth. Hypertensive disorders of pregnancy exert profound impact on the morphology and morphometry of placenta and thereby have impact on fetal outcomes.

In the current study 500 normotensive and 500 hypertensive females were enrolled. In the hypertensive group, 25% had gestational hypertension, 50% had pre-eclampsia and 25% had eclampsia. In the study by Siva Sree Ranga. M.K et al., 40%, 56.7 and 3.3% for gestational hypertension, pre-eclampsia and eclampsia respectively [10]. In the study by Kambale T et al., maximum of 57.7% cases belonged to mild PIH, 33.3% cases belonged to severe PIH, and minimum of 8.8% cases were of eclampsia [11]. In the study by Kheir AEM, et al., of the patients diagnosed with hypertensive disorder of pregnancy, 29 (42%) were pregnancy induced hypertension while 15 (21.7%) and 3 (4.3%) had preeclampsia and eclampsia respectively [12].

Patients in the age range of 20 to 35 years were selected for the study. Majority of cases were in the age group of 20-25 years (46.2%) in control, whereas in hypertension group the majority of cases fell in the age group of 26-30 years (42.4%). Similar to our study, in the study in Sudan, most of the women affected by hypertensive disorders of pregnancy were aged 26-30 years (36.2%) and 31-35 years (28.9%), indicating that the incidence of hypertension is higher in pregnant women in their 3rd and 4th decades [12]. Our findings were also comparable to the study by Siva Sree Ranga. M.K et al. maximum patients in the hypertensive group were in the age group of 25-29 years (53.33%) and in the normotensive group were in the age group of 20-24 years (50%) [10]. In the study by Kambale T et al., most cases belonged to 20-25 years age group, of which 16 cases were of mild PIH. Minimum numbers of cases were present in the age group of 30-35 years. There

Table 9: Comparison of Placental Morphometry with published literature

	Current study		Keche HA et al [20]		Kishwara S et al [27]		Siva SreeRanga. M.K et al. [10]		Londhe PS et al [22]		Ghodke S et al [28]		Baloch AH et al [26]		B Vijayalakshmi et al [29]		Dadhich A et al [30]		Shevade S et al [31]	
Parameters	Control	Hypertension	Control	Hypertension	Control	Hypertension	Control	Hypertension	Control	Hypertension	Control	Hypertension	Control	Hypertension	Control	Hypertension	Control	Hypertension	Control	Hypertension
Mean placental weight (g)	541.4 ± 30.62	478.4 ± 30.62	464.80 ± 40.21	387.00 ± 72.54	-	-	455.7 ±59.9	516.7 ±25.7	312.93 ± 70.14	401.80 ± 54.62	410.60 ± 67.86	320.00 ± 64.80	520.31± 39.02	307.12 ± 49.13	478.80±292.122	371.70±85. 316	491.44±46.14	326.20±86.93	502±58.42	430 ±50.69
Mean placental diameter (cm)	19.87 ± 1.47	17.87 ± 1.47	18.53 ± 0.87	15.72 ± 0.98	18.80±2.32	16.08±2.08	14.1 ±0.7	19.1± 0.9	-	-	-	-	16.39 ± 1.14	15.82 ± 0.92	20.33±1.446	17.94±1.963	17.77±1.26	16.37±1.37	18.7±1.55	17.2±1.70
Mean placental area (cm2)	266.24 ± 19.75	204.77 ± 16.89	270.89 ± 27.47	194.85 ± 23.86	-	-	-	-	182.80 ± 57.47	212.48 ± 54.51	219.40 ± 40.46	185.04 ± 33.72	269.32 ± 15.87	179.93 ± 38.45	-	-	-	-	-	-
Mean placental volume (cc)	425.19 ± 31.53	239.02 ± 19.74	452.20 ± 44.01	374.40 ± 72.18	389.83±81.45	292.80±71.81	-	-	372.87 ± 150.36	439.48 ± 135.14	268.48 ± 79.01 (ml)	194.70 ± 81.49 (ml)	-	-	420.45±140.816	238.20±93.197	-	-	-	-
Mean placental thickness (cm)	2.16 ± 0.16	2.01 ± 0.11	1.96 ± 0.17	1.57 ± 0.19	1.59±0.39	1.51±0.37	1.9 ±0.9	2.4 ±0.1	-	-	-	-	2.11 ± 0.31	2.04 ± 0.22	2.02±0.199	1.77±0.423	2.10±0.60	1.79±0.27	2.3±0.43	1.8 ± 0.49
Mean no. of cotyledons (n)	18.46 ± 1.54	16.46 ± 1.54	-	-	15.77±2.80	14.30±2.47	16.1± 2.5	19.1 ±1.2					17.10 ± 0.98	16.92 ± 0.91	10-15	16-20	17.72±1.70	14.36±1.82	18.9±1.98	16 ± 2.29

Table 10: Fetoplacental ratio of current study as compared to available literature

Current study		Keche HA et al [20]		Siva SreeRanga. M.K et al. [10]		Londhe PS et al [22]		Salmani D et al [34]		B Vijayalakshmi et al [29]	
Control	Hypertension	Control	Hypertension	Control	Hypertension	Control	Hypertension	Control	Hypertension	Control	Hypertension
5.23±0.86	4.88±1.79	6.05 ± 0.07	5.51 ± 0.18	5.5 ±1.9	5.6± 0.7	6.79± 2.04	7.23± 1.90	5.72 ± 0.93	6.35± 2.05	5.89±0.769	6.40±0.888

Table 11: Calcification and infarction seen in placenta

	Current study		Siva SreeRanga. M.K et al. [10]		Narasimha A et al [35]	
	Control	Hypertension	Control	Hypertension	Control	Hypertension
Calcification	35.8%	53.8%	23.3	56.7	8.10%	77.7%
Infarction	12.6%	42.4%	6.7	36.7	10.8%	22.2%

was only one case of eclampsia above 30 years of age. In the control group, 30 cases belonged to 20-25 age group and three cases were present in the age group of 30-35 years [11].

Primigravida is one of the etiologic factors of PIH. In the current study in the normotensive group, 88.2% were primigravida and 11.8% were multi gravida. On the other hand in the hypertensive groups, 80% females were primigravida while 20% females were multigravida. There was no statistical difference in the two groups. In the study conducted in Kerela, in the hypertensive group 86.6% females were primigravida and in the normotensive group 93.3% females were primigravida [10]. In the study conducted in Grant Medical College, Mumbai the number of cases of PIH were more in primigravida group (24 cases) wherein 14 cases were of mild PIH and seven and three cases of severe PIH and eclampsia, respectively. In the control group, 18 cases were primigravida and 13 were second gravida [11]. In the study by Kheir AEM et al about 58% of the hypertensive women were multiparous [12].

In the study by Kumari P et al., the mean systolic blood pressure was 117.23±2.53mmHg and mean diastolic blood pressure was 69.32±2.48mmHg in the normotensive group and the mean systolic blood pressure was 146.00±2.70 mmHg and mean diastolic blood pressure was 94.83±3.13 mmHg in the hypertensive group [13]. In our study the blood pressure in the control group was in the normal range mean systolic blood pressure was 123.07mmHg±4.14mmHg and mean diastolic blood pressure was 82.31mmHg ± 4.08mmHg. The mean systolic blood pressure in the hypertensive group was 149.8mmHg±7.48mmHg, while mean diastolic blood pressure was 91.14mmHg±4.14mmHg.

In the control group majority of the deliveries completed full term (87.2%) while in the hypertensive group there was significant increase in the number of deliveries occurring at pre-term (35%). In the study conducted at Dr. SM CSI Medical College, Kerala, 33.33% deliveries in hypertensive group were pre-term, while all the deliveries in normotensive group were full-term. In the study by Adu-Bonsaffoh K et al. in Ghana, 80 (21.7%) pregnancies were delivered preterm [14]. In the study by Pokorna V et al, the mean duration of gestation was 37 (24–42; median, range) weeks in hypertensive mothers [15]. In the study by Kheir AEM et al the number of preterm pregnancies was high as 52% babies were preterm [12].

In the control group majority of the deliveries (96%) were by vaginal route, while in the hypertensive group a significant proportion of deliveries were by lower section caesarean section (45%). In the study by Pokorna V et al., 84% deliveries were by Caesarean section in hypertensive mothers [15]. Siva SreeRanga. M.K et al. in their study observed that in the hypertension group 60% deliveries were by vaginal route and 40% deliveries occurred by LSCS while all the deliveries in normotensive group were by vaginal route [10]. While in the study conducted in Sudan, 98.5% pregnancies were delivered by caesarean section [12].

Majority of the patients in both group gave live birth viz., 98.6% in control group and 90% in hypertension group. In the study by Siva

SreeRanga. M.K et al., all the patients in normotensive group gave live birth while in the hypertensive group 93.3% of pregnancies resulted in live birth. Allen VM et al. in their study had shown that women with any hypertension in pregnancy were 1.4 times more likely to have a stillbirth as compared with normotensive women [16]. Similar finding was observed by Ananth CV, et al., they also observed that the increased risk of stillbirth was higher in women having their second or higher order births compared with women having their first birth [17].

In the current study the mean birth weight of the babies was 2.82±0.43 in control and same was 2.33± 0.84kg in hypertension group. Rahman LA in their study had observed that there was a significant association of pregnancy-induced hypertension with low birth weight and that women who delivered low birth weight babies were 5 times more likely to have had pregnancy-induced hypertension [18]. However, on the other hand Xiong X in their study found that there were no differences in mean birth weight between women with gestational hypertension and women with normal blood pressure. Further analysis suggested that pre-eclampsia and gestational hypertension were associated with increased rates of both small-for-gestational-age and large-for-gestational-age infants. The majority of the babies born to mothers with different types of pregnancy-induced hypertension were appropriate-for-gestational-age or even large-for-gestational-age. Most babies born to mothers with severe pre-eclampsia or pre-eclampsia and gestational hypertension had similar fetal growth to those born to normotensive mothers [19]. In another study, the mean birth weight in babies born to hypertensive mothers was 2.5±0.7 kg while that of babies born to normotensive mothers was 2.9± 0.4 kg. [10] In the study by Pokorna V et al, the mean birth weight was 2600 (370–4820)g [15]. In the study by Keche HA et al the mean birth weight was 2813.60 ±258.06 g in control group, while it was 2141.00± 439.69g in hypertensive group [20].

In our study Mean APGAR score at birth was 7.7± 1.38 in control group while the same was 6.32±2.23 in hypertension group; mean APGAR score at 5 minutes was 8.1±2.82 in hypertension group as compared to 9.23±1.38 in control group. In the study conducted in Ghana, One and 5 minute APGAR scores < 7 occurred in 125 (34.0%) and 55 (14.7%) neonates respectively [14]. In the study by Kambale et al., only 6.6% neonates in normotensive group had low APGAR score at birth, while most the neonates in hypertensive groups had low APGAR score [11]. In another study, APGAR score at birth was 6.9±1.8 in hypertensive group while it was 9 in normotensive group; APGAR score at 5 minutes was 8.5± 0.8 in hypertensive group while it was 10 in normotensive group [10]. In the study by Pokorna V et al., observed that Apgar score was negatively correlated to proteinuria, but not to the number of antihypertensives or other parameters [15].

In the present study a significant proportion of new borns of hypertensive mothers (58.6%) required NICU admission. Similar was the observation by Adu-Bonsaffoh K et al. in a study conducted in Ghana wherein 91 (24.7%) neonates were admitted to the Neonatal Intensive Care Unit, 56 (15.2%) had neonatal respiratory distress/ asphyxia with 14 (3.8%) requiring ventilatory support. [14]In a study by Hubli M et al., as compared with normotensive pregnancies, hypertensive pregnancies that delivered at 35 and 36 weeks of gestation had higher rates of neonatal intensive care unit admission (33.3% vs 10.7%). The rate of neonatal intensive care unit admission (25.6% vs 8.7%) and duration of neonatal stay (3.9 vs 2.0 days) were greater in hypertensive pregnancies that delivered at 37 weeks of gestation [21].

In the present study, in the control group majority of the umbilical cord insertion was eccentric (51.2%) while in the hypertension group majority of the placentas were attached marginally (46.8%). This was similar to study by Pretorius where in marginal insertion of umbilical cord was reported in 42% of hypertensive cases as against 11.3% marginal insertion of placenta in hypertensive cases in the study by Londhe PS et al. [22, 23]. This lateral insertion placenta has impact on uterine artery resistance and development of preeclampsia and intrauterine growth retardation [7,24].

In our study in the control group (71.8%) as well as the hypertension group (59.2%) majority of the placentas were discoid in shape. In the study by Kishwara S et al., placenta was circular (43.3%) in majority of the patients in control group while it was oval (40%) in majority of the patients in hypertensive group [25]. While it was discoid in majority of the cases in both the groups in the study by Siva SreeRanga. M.K et al. [10]. This was also the case with study by Baloch AH where in most of the placentas were round to oval [26].

Hypertension during the pregnancy significantly impacts the morphology of the placenta. Decrease blood flow due to increased resistance impacts the overall development of placenta resulting in decrease in placental weight, area, diameter, volume and also number of cotyledons, this was comparable to published literature (Table 9).

In the control group majority of the placental weight was between 500 to 550g while in the hypertension group majority of the placental weight was between 451 to 500gm. In the study by Shevade S et al, majority of the placental weight in the control group was between 500-600g while in the hypertension group same was between 400-500g [31]. In the study by Patil GV et al., majority of the placental weight in the control group was between 500-600g while in the hypertension group same was between 300-400g [32].

In a study by Yadav SK et al. the placental co-efficient was 0.19±0.02 in the hypertensive group, while it was 0.18±0.02 in the control group, while in the current study the placental co-efficient was 0.19±0.02 in control group and 0.17±0.06 in hypertension group [33]. Due to resultant decrease in the fetal weight, there was decrease in feto-placental ratio (FPR) and placental co-efficient in hypertensive group as compared to control group. In the reported literature, FPR was higher in the hypertension group as compared to control group, this was contrary to the findings of our study (Table 10, 11).

Thus a significant impact of hypertension on placental morphometry and morphology and its resultant impact on fetal weight as compared to normotensive patients was observed. This also suggests that study of the placenta can give an insight into the health status of the mother and fetus.

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Case Report

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Unilateral Extra Muscle in the Sole of the Foot: A Case Report and Its Embryological Review

Rohini Motwani[1], Supriya Garapati[2]

Abstract

Presence of accessory muscles in upper or lower extremities is not uncommon. Variations may be in the form of presence of accessory or duplicate muscles or tendons, absence of muscle or tendon. We report a very rare variation, which is not described previously. During routine dissection of cadavers for teaching medical undergraduates at ESIC Medical Vollege, Sanathnagar, we observed an extra small muscle in-between the first and the second layer of the sole of the left foot, with a small belly arising from inter-muscular septa on the medial side of the foot. It was innervated by medial plantar nerve. Muscle belly was running superficial to flexor digitorum longus tendon and flexor digitorum accessorius from medial to lateral side and formed a tendon which was running medial to and in close contact with the tendon of flexor digitorum longus for little toe, to be inserted along with it at the base of distal phalanx of the little toe. The knowledge of these anatomical variations of foot muscle architecture is utmost importance to orthopedic surgeons, radiologist and podiatrist in analysis of foot function, biomechanical modeling of the foot and prosthesis designing. In painful and disabling conditions of foot during differential diagnosis of the presence of accessory muscles of the foot should be kept in mind. On other hand additional muscle slip can be used as replacement flaps in cases of tendon rupture or dysfunction.

Keywords: Accessory Muscle; Flexor Digitorum Longus; Sole; Variation.

Introduction

Variations in the intrinsic muscles of sole are relatively uncommon. There are 18 intrinsic and 4 extrinsic tendons in the sole of foot. These muscles are subjected to variations which are usually encountered during surgery or cadaveric dissections.Variations may be in the form of presence of accessory or duplicate tendons, and absence of a muscle or tendon. Muscle development occurs in the embryo through the formation of myoblasts, which undergo extensive proliferation to form terminally differentiated, postmitotic myocytes. Striated muscle development involves both prenatal and post natal events: primary myogenesis (occurs during the stage of the embryo) and secondary myogenesis (occurs during the stage of the fetus) lay down the muscular system, and satellite cells act in muscle growth postnatally and in response to exercise or muscle damage [1]. Any deviation from normal development leads to variations of the muscle.

The intrinsic muscles, i.e. those contained entirely within the foot, follow the primitive limb pattern of plantar flexors and dorsal extensors. The plantar muscles in the foot can be divided into medial, lateral and intermediate groups. The medial and lateral groups consist of the intrinsic muscles of the hallux and minimus, respectively, and the central or intermediate group includes the lumbricals, interossei and short digital flexors. It is customary to group the muscles in four layers, because this is the order in which they are encountered during dissection. However, in clinical practice and in terms of function, the former grouping is often more useful [2]. First layer includes abductor hallucis (ABH), abductor digiti minimi (ADM) and flexor digitorum brevis (FDB). The second layer consists of flexor digitorum accessorius (FDAc) and four lumbrical muscles. The tendons of flexor hallucis longus (FHL) and flexor digitorum longus (FDL) run

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in the same plane as the muscles of the second layer [3]. Here, we report unilateral presence of an extra small muscle in between the muscles of first and second layer of the sole, which has never been reported yet.

Case Report

During routine dissection of cadavers for teaching medical undergraduates at ESIC medical college, sanathnagar, we observed an extra small muscle in the second layer of the sole of the left foot of a middle aged male cadaver. Dissection steps were followed as per Cunningham's Manual of Practical Anatomy [4]. In this we reflected skin and superficial fascia of the sole from heel to the root of the middle toe. We removed the fat in the superficial fascia to get the planter aponeurosis (PA) and digital nerves and vessels. Planter aponeurosis was cut 2-3 cms proximal to the heel and reflected distally towards the toes to find the flexor digitorum brevis (FDB) muscle. Deep fascia of the abductor muscles of hallux and little toe was removed. Digital nerves were traced proximally to reach medial and lateral planter nerves. FDB was cut in the middle and reflected proximally avoiding injury to the planter nerves.

After reflecting FDB, we observed a muscle with small belly arising from inter-muscular septa or deep fascia (DF) on the medial side of the foot [Figure 1]. Muscle belly was running superficial to flexor digitorum longus (FDL) tendon and flexor digitorum accessorius (FDAc) muscle from medial to lateral side and formed a tendon which was running medial to and in close contact with the tendon of FDL for little toe [Fig. 2,3], to be inserted along with it at the base of distal phalanx of the little toe. This small muscle is present in between the muscles of first and second layer. This new muscle was innervated by medial plantar nerve (MPN), without any other changes in the patterns of neurovascular branching in this region. This variation is quite unusual. In literature we did not find the similar kind of variation. In right sole however, there was no such variation observed.

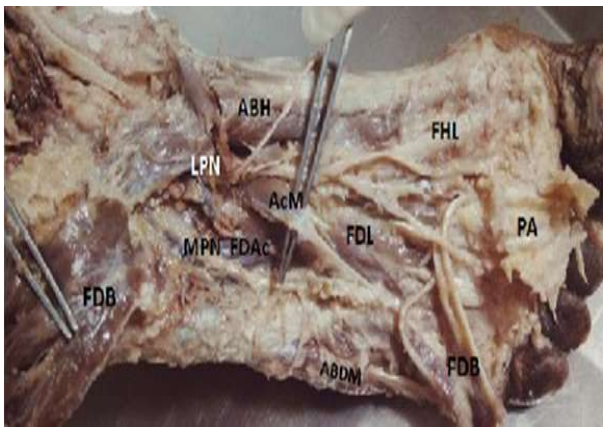

Fig. 1: Sole of left foot showing an Accessory Muscle (AcM), ABH: Abductor Hallucis, FDB: Flexor digitorum Brevis, ABDM: Abductor digiti minimi, FHL: Flexor Hallucis Longus, FDL: Flexor Digitorum Longus, FDAc: Flexor digitorum accessories, PA: Plantar Aponeurosis, LPN: Lateral Plantar Nerve, MPN: Medial Plantar Nerve

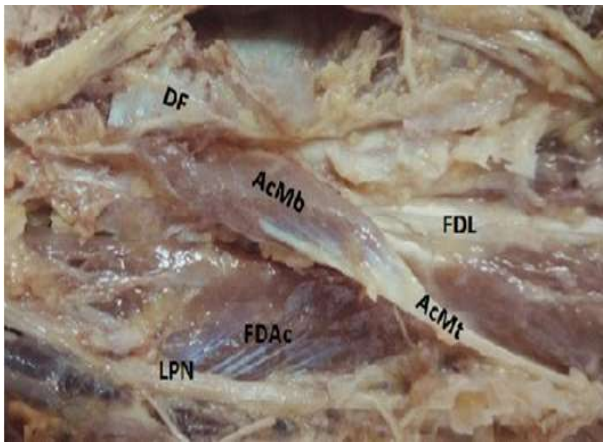

Fig. 2: Sole of left foot showing an Accessory Muscle with a small belly (AcMb) and a tendon (AcMt). DF: Deep Fascia, FDAc: Flexor digitorum accessorius, LPN: Lateral Plantar Nerve

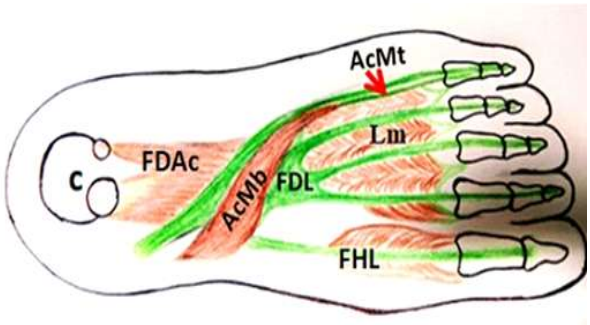

Fig. 3: Diagrammatic representation of sole of left foot showing an Accessory Muscle with a small belly (AcMb) and a tendon (Red arrow, AcMt) inserting along with the tendon of Flexor Digitorum Longus (FDL) for fifth digit, FDAc: Flexor digitorum accessories

Discussion

Human foot has evolved from primarily a grasping organ which was essential for efficient arboreal locomotion and over the course developed to have an elaborate plantar aponeurosis, strong plantar ligaments, longitudinal arches an enlarged muscles flexor accessories, an adducted (non opposable) hallux, a remodeled calcaneocuboid joint, a long tarsus and shortened toes (II to V) [5].

It serves a dual role in bi-pedal locomotion performing as mobile structure and also as a rigid lever. The foot muscles play an important role in positioning of the forces on the foot in both posture and locomotion [6].

Accessory muscles are commonly overlooked at imaging evaluation [7]. Although they are typically asymptomatic and encountered as incidental findings, accessory muscles have been implicated as a potential source of clinical symptoms. Such symptoms are usually due to mass effect of the supernumerary muscle, with the patient presenting with either a palpable swelling or secondary compression of adjacent structures such as nerves, vessels, or tendons [8].

As found in literature, accessory muscles like abductor ossis metatarsi quanta muscle and opponent's digiti minimi muscle can strengthen the parent muscle and used in replacement flaps in tendon injuries [9] and also have anthropological importance. Flexor digitorum braves subjected to variety of variation absence of digitations to little toe [10] or supernumerary slip [11]. There is usually communication between FHL & FDL muscle. Flexor digitorum accessorius might be absent and adductor hallucis, transverse head might be missing [12]. We reported the presence of an extra muscle in the second layer of the sole of the left foot. This appears to be additional slip could be remnant of some of the muscles which were involved during process of movement from quadripedal to bipedal locomotion

Conclusion

The anatomical knowledge of variations of foot muscle is very important to orthopedic surgeons, radiologists and podiatrists for analysing foot function, biomechanical modeling of the foot and prosthesis designing. In painful and disabling conditions of foot during differential diagnosis of the presence of accessory muscles of the foot should be kept in mind. On other hand additional muscle slip can be used as replacement flaps in cases of tendon rupture or dysfunction. Furthermore, accessory muscles may result in compression neuropathies, especially in relation to the anatomical tunnels. Careful evaluation of fibro-osseous tunnels for an accessory muscle may help identify such a muscle as a causative factor, which can easily be overlooked unless accessory muscles are specifically sought out during the review process.

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