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Original Research Paper

Anatomy

MORPHOLOGICAL EVALUATION OF HUMAN FOETAL CLAVICLES IN DIFFERENT GESTATIONAL AGES

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ABSTRACT Clavicle, being a long bone and having intramembranous ossification with earliest appearance of two primary centres of ossification, reflects that nature too supports its importance in gaining early strength so that it can support the developing upper limbs of the foetus earliest to provide them easy movements. The clavicle varies more in shape than most of other long bones, it's thicker and more curved in manual workers and the sites of muscular attachments are more marked. This study was conducted to observe the bilateral growth of clavicles during the intra uterine life. 50 clavicles were obtained from 25 human foetuses ranging from 14 to 40 weeks of gestational age. For the purpose of study, foetuses were divided into five groups on the basis of gestational age. Parameters selected for the study were weight; length; midshaft circumference, AP and Vertical diameter at midshaft; AP and Vertical diameter at medial end; AP and Vertical diameter at lateral end of clavicles. All parameters were measured using vernier calliper. Results were tabulated and evaluated. Clustered bar charts were plotted to compare the findings with other studies.

KEYWORDS : Morphometry, clavicle, human foetuses

INTRODUCTION:

The developmental anatomy is gaining increasing significance, as it constitutes the basic framework of different clinical specialties possessing a foetal, neonatal or paediatric orientation. In fact, the morphology of an organ often sufficiently tells the practicing physicians more than many functions. Hence, there is a continuing need for morphological data. Developmental anatomy and morphometric data provide clinicians of di erent specialties with relevant information.

Schwarzler[1] prepared sex specific antenatal reference growth charts for uncomplicated singleton pregnancies at 15-40 weeks of gestation. Persson[2] assessed the reliability of ultrasound fetometry in estimating gestational age in the second trimester. Odgen[3] worked on 31 pairs of adult human clavicles from human cadavers by means of radiology to know their post-natal development .Shobha[4] , Frutos [5] determined sex of adult human clavicles by morphometric parameters.

Lowrance[6] , Khan and Faruqi[7] on Asian subjects; Nasrat and Bondagji[8] worked on ultrasound biometry of Arabian foetuses. DM Sherer[9] worked on the foetal clavicle length throughout gestation by means of ultrasonography, Yarkoni[10] found that how the clavicular measurements can be a new biometric parameter for foetal evaluation. Fazekas and Kosa[11] used diaphyseal lengths of dried material of foetal skeletons for forensic decision making but it lacked information about human foetal clavicle. Azmi Mohsin[12] found that bilateral variations were not significant in most of the parameters of fetal clavicle.

Very few works have been done in the field of morphometry on human foetal clavicle in actual means. Knowledge of dimensions of fetal long bones is useful in both the assessment of fetal growth and early detection of inherited defects.

This study is conducted to fill the knowledge gap which will ascertain whether there are any variations found in the growth and development of clavicle during the intrauterine life.

MATERIALS AND METHODS:

This study has been done on 50 fetal clavicles.

The dead destitute fetuses were obtained from the Department of Obstetrics and Gynecology, Victoria General Hospital, Visakhapatnam. Fetuses were ranging from 14 weeks to full term measured according to the crown-rump length.

METHODOLOGY:

After the foetuses were received into the Department, they were preserved.

Preservation of foetus: The foetuses were injected with 10% formalin through umbilical vessel and abdominal cavity. After injecting formalin, the embalmed foetuses are kept in formalin tanks containing 10% formalin solution for a minimum period of one month. Then they were thoroughly washed with water and following data was recorded.

1. Sex
2. Weight
3. Crown rump length (CRL)
4. Bi parietal diameter (BPD)

The foetuses were weighed with the help of digital weighing machine and crown-rump lengths were measured with the help of measuring tape. This is to calculate the fetal gestational age according to the crown rump length as per the description of Langman's Human Embryology.[13]

Foetuses of all age groups without congenital craniovertebral anomalies were selected for the study. The parameter used for determining of gestational age was foetal foot length. For the purpose of study, foetuses were divided into 5 groups on the basis of gestational age.

Measurements prior to dissection

Although age determination was done using foot length, but various other parameters were taken into consideration.

1) Weight of foetus (in gm)
2) Head circumference (in cm)
3) Crown -rump length (CRL) (in cm)
4) Foot length (in mm)

Measurements during dissection

1) Interclavicular distance (in mm)

Measurements after dissection

1) Weight of both right and left clavicles (in mg)
2) Length of both right and left clavicles (in mm)
3) Circumference at the mid-shaft of both right and left clavicles (inmm)
4) Height at the acromial end of both right and left clavicles (in mm)
5) Width at the acromial end of both right and left clavicles (in mm)
6) Height at the sternal end of both right and left clavicles (in mm)
7) Width at the sternal end of both right and left clavicles (in mm)
8) Antero-posterior diameter at the midshaft of both right and left clavicles (in mm)
9) Vertical diameter at the midshaft of both right and left clavicles (in mm)

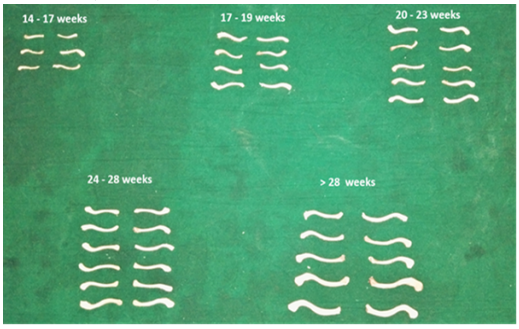


Figure 1: Human foetal clavicles divided into 5 groups on the basis of gestational age

Table 1: Distribution of number of Foetal clavicles according to the weeks of gestation.

Weeks	No. of clavicles
14-17	6
17-19	10
20 -23	10
24- 28	14
>28	10
Total	50

Figure 2: Measuring the inter clavicular distance with the help of a Vernier calliper

Figure 3: Measuring the length of foetal clavicle

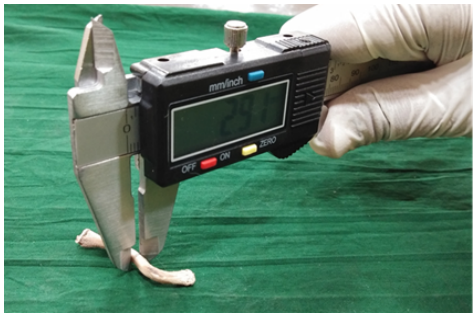


Figure 4: Measuring the antero-posterior diameter at the midshaft of foetal clavicle

RESULTS:

Table 1: Measurement of the Weight of clavicle

weeks	Inter clavicular distance	
	Mean (in mm)	Standard Deviation
14-17	4.55	0.32
17-19	5.57	0.29
20 -23	5.97	0.19
24- 28	8.42	0.69
>28	11.52	0.72

Table 2: Measurement of the Inter clavicular distance

weeks	Weight of Rt clavicle		Weight of Lt clavicle	
	Mean (in mg)	Standard Deviation	Mean (in mg)	Standard Deviation
14-17	12.13	0.09	11.29	0.16
17-19	29.15	0.83	28.85	1.15
20 -23	52.03	17.58	51.27	17.83
24- 28	83.38	4	83.05	3.85
>28	162.6	4.65	162.66	4.33

Table 3: Measurement of the length of the clavicle

weeks	Length of Rt clavicle		Length of Lt clavicle	
	Mean (in mm)	Standard Deviation	Mean (in mm)	Standard Deviation
14-17	13.78	0.68	14.59	0.28
17-19	20.59	1.47	22.17	1.94
20 -23	23.54	2.65	24.09	1.74
24- 28	27.8	1.82	26.57	2.23
>28	34.93	4.69	36.53	3.34

Table 4: Measurement of Mid shaft Circumference

weeks	Mid shaft circumference Rt		Mid shaft circumference Lt	
	Mean (in mm)	Standard Deviation	Mean (in mm)	Standard Deviation
14-17	4.52	0.44	4.74	0.26
17-19	7.7	0.71	8.43	0.62
20 -23	9.38	0.59	9.07	1.6
24- 28	8.85	1.15	9.59	0.88
>28	12.76	1.9	13.56	1.52

Table 5: Measurement of Anteroposterior diameter at midshaft

weeks	Antero Posterior diameter of Midshaft Rt		Antero Posterior diameter of Midshaft Lt	
	Mean (in mm)	Standard Deviation	Mean (in mm)	Standard Deviation
14-17	1.08	0.02	1.1	0.02
17-19	1.75	0.19	1.48	0.19
20 -23	1.88	0.28	2.06	0.32
24- 28	2.1	0.2	2.07	0.18
>28	2.62	0.41	2.65	0.36

Table 6: Measurement of Vertical diameter at midshaft

weeks	Vertical diameter at Midshaft Rt		Vertical diameter at Midshaft Lt	
	Mean (in mm)	Standard Deviation	Mean (in mm)	Standard Deviation
14-17	1.13	0.01	1.15	0.02
17-19	1.43	0.22	1.28	0.18
20 -23	1.53	0.39	1.56	0.32
24- 28	1.93	0.18	1.78	0.16
>28	2.64	0.62	2.53	0.57

Table 7: Measurement of Anteroposterior diameter at medial end

weeks	Antero Posterior Diameter at Medial End Rt		Antero Posterior Diameter at Medial End Lt	
	Mean (in mm)	Standard Deviation	Mean (in mm)	Standard Deviation
14-17	1.45	0.01	1.47	0.01
17-19	2.49	0.34	2.55	0.84
20 -23	2.03	0.37	1.89	0.27
24- 28	2.62	0.72	3.07	0.73
>28	2.89	0.31	3.26	0.91

Table 8: Measurement of Anteroposterior diameter at lateral end

weeks	Antero Posterior Diameter at Lateral end Rt		Antero Posterior Diameter at Lateral end Lt	
	Mean (in mm)	Standard Deviation	Mean (in mm)	Standard Deviation
14-17	1.91	0.07	1.96	0.06
17-19	2.74	0.48	2.82	0.44
20- 23	2.95	0.67	2.87	0.66
24- 28	3.43	0.58	3.28	0.41
>28	5.6	1.03	5.54	1.16

Table 9: Measurement of Vertical Diameter at Medial End.

weeks	Vertical Diameter at Medial End Rt		Vertical Diameter at Medial End Lt	
	Mean (in mm)	Standard Deviation	Mean (in mm)	Standard Deviation
14-17	1.47	0.01	1.48	0.02
17-19	1.7	0.48	1.62	0.55
20 -23	1.59	0.54	2.79	0.3
24- 28	2.56	0.43	1.74	0.35
>28	4.88	1.27	4.82	1.44

Table 11: Measurement of Vertical Diameter at Lateral End.

weeks	Vertical diameter at Lateral end Rt		Vertical diameter at Lateral end Lt	
	Mean (in mm)	Standard Deviation	Mean (in mm)	Standard Deviation
14-17	0.98	0.03	1.02	0.07
17-19	1.2	0.16	1.37	0.21
20 -23	1.28	0.13	1.37	0.27
24- 28	1.42	0.19	1.39	0.19
>28	2.36	0.24	2.13	0.38

DISCUSSION:

Weight of the Clavicle: (Graph 1)

According to Azmi Mohsin, the weight of the right fetal clavicle was more than the left except at 20-23wks and >28wks. In the present study, the weight of the right fetal clavicle is more than the left except at >28wks.

Length of fetal clavicle: (Graph 2)

According to Azmi Mohsin, the length of the left fetal clavicle is more than the right except at 17-19wks and 24-28wks. In the present study, the length of the left fetal clavicle is more than the right except at 24-28wks.

Circumference at midshaft of fetal clavicle: (Graph 3)

The circumference at midshaft of the fetal clavicle is more on the left than the right except at 20-23wks, which coincided with the finding of Azmi Mohsin

Antero-posterior diameter at midshaft of fetal clavicle:

The antero-posterior diameter at midshaft of fetal clavicle is more on the left than the right except at 17-19wks and 24-28wks, which coincided with the finding of Azmi Mohsin Vertical diameter at midshaft of fetal clavicle:

According to Azmi Mohsin, the vertical diameter at midshaft of fetal clavicle is more on the right than the left except at 20-23wks and 24-28wks. In the present study, it is more on right than the left except at 14-17wks and 20-23wks.

Antero-posterior diameter at medial end of fetal clavicle: According to Azmi Mohsin, the antero-posterior diameter at medial end of fetal clavicle is more on the right than the left except at 14-17wks and 17-19wks. In the present study, it is more on left than the right except at 20-23wks.

Vertical diameter at medial end of fetal clavicle:

According to Azmi Mohsin, the vertical diameter at medial end of fetal clavicle is more on the left than the right except at 20-23wks. In the present study, it is more on right than the left except at 14-17wks and 20-23wks.

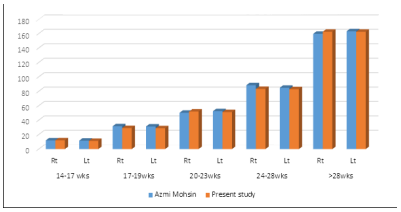
Antero -posterior diameter at lateral end of fetal clavicle:

According to Azmi Mohsin, the antero-posterior diameter at lateral end of fetal clavicle is more on the right than the left except at 14-17wks and >28wks. In the present study, it is more on right than the left except at 14-17wks and 17-19wks.

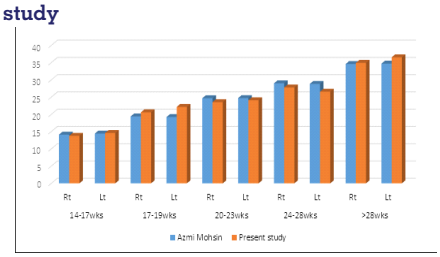
Vertical diameter at lateral end of fetal clavicle:

According to Azmi Mohsin, the vertical diameter at lateral end of fetal clavicle is more on the right than the left except at 14-17wks and 24-28wks. In the present study, it is more on left than the right except at 24-28wks and >28wks.

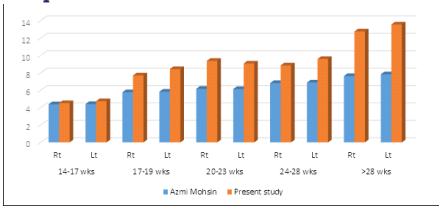
Present study findings on fetal clavicles are nearer to the findings of Azmi Mohsin



Graph 1: Bar chart comparing weight of fetal clavicle with other study



Graph 2: Bar chart comparing length of fetal clavicle with other study



Graph 3: Bar chart comparing circumference at midshaft of fetal clavicle with other study

CONCLUSION:

The fetal clavicle increases logarithmically with respect to its length and width. The obtained morphometric data of the growing clavicle is considered normative for their respective weeks of gestation and may be of relevance in the diagnosis of congenital defects.

In every aspect manual measurement will give the most precise data than by radiography or by sonography so our results will be the most accurate ones in the field of morphometry of human foetal clavicle till date.

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