ORIGINAL ARTICLE

Densities of Foetal Clavicles during Second and Third Trimesters.

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ABSTRACT

Background: Density of bone is directly affected by mineralization, which makes visualization by ultrasonography possible to follow foetal growth from early gestation to term. Clavicle being the first bone to ossify and the only bone to transmit upper limb weight to the axial skeleton, receives special attention by the scientists. **Methods:** Forty-nine foetal clavicles were divided into five groups. Statistically densities of the clavicles were measured and values between groups were compared. **Results:** Density was constant in all the groups and both in males and females. **Conclusion:** It was concluded that matrix formation in clavicles keeps pace with their mineralization during 2nd and 3rd trimesters.

Keywords: *Clavicle, density, foetus, second trimester, third trimester.*

INTRODUCTION

Developmental anatomy gains its importance due to direct influence on clinical problems related to foetuses, neonates, infants and children. Clavicle is one of the long bone often considered for foetal evaluation.[1,2] The clavicle is a long bone that is preformed in connective tissue and starts to ossify before any other bone in the body.[3] Foetal visualisation by ultrasonography enables us to follow foetal growth from early gestation to term. The importance of long bone in such studies is well established.[4]

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Foetal Biometry allows us to evaluate normal and pathological states of foetal growth during pregnancy.[5] Measurement of clavicle is of special interest for many scientists because it permits not only the estimation of gestational age, but also the detection of severe congenital anomalies such as cleidocranial dysplasia, Holt-Oram Syndrome, Goltz Syndrome, Melnick-Neelers Syndrome etc.[6-13]

Ultrasonographic visualization of clavicle is affected by ossification which is also responsible for density of bone. Calcium concentration in adult mandible[14], ribs[15] and teeth[16] are well documented. Reports of calcium concentration in foetal bones are scanty. Some bones considered for this purpose are parietal[17], femur[18] and teeth[19] but none of them included clavicle in their studies. Present research is an attempt to find out the density of foetal clavicles, an indirect evidence of calcium concentration, in different gestational age groups and see patterns of variations, if any.

MATERIALS ANDMETHODS

Forty nine human foetuses of all age groups (21 males and 28 females) were collected from museum of Department of Anatomy, JN Medical College, AMU, Aligarh, UP, India. Foetuses were divided into five groups i.e. 1,2,3,4,5 of < 17 weeks, 17-20 weeks, 21-25 weeks, 26-30 weeks and more than 30 weeks of gestational ages respectively [Table 1]. Clavicle of all foetuses were exposed by making a horizontal incision anteriorly at the junction of the neck and thorax. Clavicular attachments of all the muscles and ligaments on the shaft were severed. Finally clavicles were freed from body detaching them at sternoclavicular and acromioclavicular joints. Clavicles were manually cleaned and kept in incubator at 40°C to make them dry. All the clavicles were weighed in a single pan weighing machine (Anamed Electronic Balance Model No. M-300DR). Their volumes were determined by using the Digital Plethysmometer Model no. PLM-01 PLUS of Orchid Scientifics. Densities of all clavicles were calculated by using the following formula,

Density(g/ml)= weight(g)/volume(ml)

The readings of all the groups of total clavicles were analysed statistically by using ANOVA while those of male and female clavicles were compared by using Student's 't' test to find out significant differences between groups or sexual dimorphism, if any

Table 1: Subgrouping of human foetuses.

Groups	Gestational Age	Number of Clavicles		
		Male	Females	Total
1	<17 weeks	5	4	9
2	17-20 weeks	2	9	11
3	21-25 weeks	2	8	10
4	26-30 weeks	10	4	14
5	>30 weeks	2	3	5
Total number of Clavicles		21	28	49

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RESULTS AND DISCUSSION

Densities of all the clavicles in five groups were compared with each other by using ANOVA but none of the two groups showed statistically significant difference [Table 2a,b]. Similarly, values of densities of male clavicles were compared with female ones by using Student's 't' test but, there was no statistically significant change [Table 3].

Table 2a: Statistical data on densities of total clavicles.
A. Descriptive Statistics

Density	N	Density(g/ml)			
		Minimum	Maximum	Mean	+/- SD
1	9	0.10	1.83	0.909	0.671
2	11	0.13	1.40	1.795	0.253
3	10	1.00	2.20	1.673	0.411
4	14	0.69	2.27	1.393	0.495
5	5	1.11	1.85	1.426	0.304

Evidence of correlation between mineral salts and bone density is well documented, supporting the ability of dual X-ray absorptiometry (DXA) to monitor the bone mineral density.[20] Some of the scientists made an observation on variable change in calcium concentration of foetal parietal bone by comparing the absolute value with a percentage and found that both increase with gestational age.[17] Ghaus et al explored calcium levels in the maxilla of human foetuses and found an increase in the absolute level of calcium

concentration, but reduction in the relative amount of same with gestational age.[21] In our observation, constant clavicular density throughout gestation was an indication that matrix formation and mineralization in this bone are maintained at the same pace.

There is a need to measure the calcium concentration in foetal clavicles to further strengthen our report.

Table 2b: Statistical data on densities of total Clavicles.
B. ANOVA For density.

Density	Sum of square	df	Mean square	F	Sig.
Between groups	4.486	4	1.21	0.121	0.785

Table 3: Statistically data on the densities of male and female clavicles of human foetuses.

Gender	N	Density (g/ml)					t	df	Sig
		Minimum	Maximum	Mean	+/- SD	+/- SE			
Male	21	0.15	2.27	1.286	0.555	0.121	-0.647	47	0.521
Female	28	0.10	1.40	1.581	0.534	0.384			

CONCLUSION

Matrix formation keeps pace with the rate of mineralisation in foetal clavicles during second and third trimesters therefore maintaining the consistency in density of clavicle.

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