

Study of Relationship Between Changes in Size of Posterior Fontanelle with Gestational Age

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Abstract : In this study we have measured size and area of posterior fontanelle and have studied its relations with gestational age in human fetuses. This study is aimed to provide a range of normal posterior fontanelle dimensions and to provide base for further research in Asian population on morphology of posterior fontanelle and see if there exists any significant difference when compared to European & African studies. For this fifty fetuses were arranged in 5 groups according to their gestational age. Mean posterior fontanelle size and area of each group is measured. After statistical calculations it was observed that posterior fontanelle size and area both vary significantly with gestational age.

Key-words: fetus, Posterior Fontanelle, Change in size

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INTRODUCTION: Developmental anatomy is one of the sub-disciplines of anatomy which has attained great significance in the research field. Embryogenesis has been extensively explored but the literature relating to organogenesis appears relatively sparse and inadequate. Fetal research is gaining importance due to usage of invasive and non-invasive procedures in fetal defect correction. Cudithy¹ has performed cranial ultrasonography via posterior fontanelle to obtain middle sagittal views of cerebellum. Anderson² obtained normal brain anatomy by posterior fontanelle ultrasonography. Pooh³ revolutionized the ultrasonographic technique by using trans-vaginal power doppler to obtain angiography. Faix⁴ studied fontanelle size in black and white newborn infants. Philip⁵ studied fontanelle size and epiphyseal ossification in neonatal twins discordant by weight. Tan⁶ studied large fontanelles in newborns. Philip⁷ studied fetal growth retardation by femurs and fontanelles. Adeyemo and Omotade⁸ studied variations in fontanelle diameter with gestational age.

Places in the skull of newborn infants, where contact between bones does not occur and the sutures are wide areas of fibrous tissue are known as fontanelles or fonticulli. Anatomically there are at least six fontanelles in a fetal skull: an anterior, a posterior, two mastoid and two sphenoidal fontanelles Posterior fontanelle is triangular in

shape . It is present at the junction of lambdoid and sagittal, sutures and its time of closure is 2-3 months after Birth

Wull⁹ observed the widely opened posterior fontanelle as one of the most important finding in cases of congenital hypothyroidism during neonatal screening. In this study we will measure size and area of posterior fontanelle and study its relations with gestational age in fetuses. Cephalic indices in Indians are known to vary from those of Europeans¹⁰. In such situations, a study on Indian specimens seems relevant. Posterior fontanelle is considered because it is, important clinically, has proper shape making the measurements feasible and has support of previous literature. Present study is conducted with following aims-

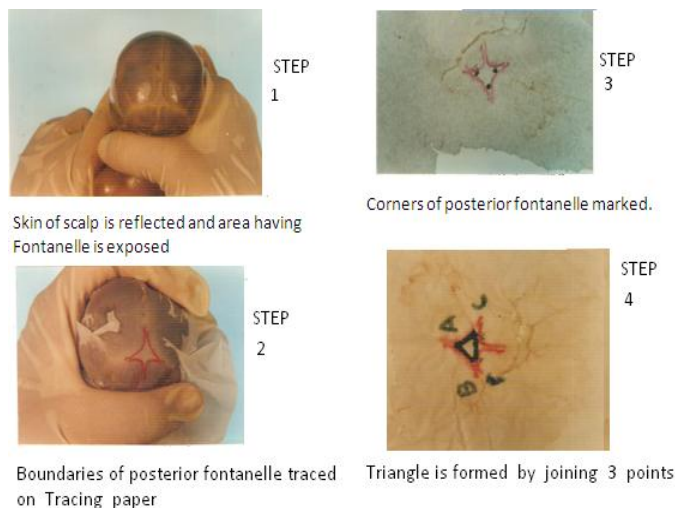
- 1.To provide a range of normal posterior fontanelle dimensions.
2. To find out the alterations in morphogenesis with gestational age.
- 3.To determine the pattern of growth.
4. To collect the informations about the relative growth.

MATERIAL AND METHODS: Fifty fetuses from museum of department of anatomy in SRMS IMS Bareilly was used for study. Fetuses selected for study were without any obvious congenital anomaly. They were preserved museum specimens. They were preserved since many years. Parameter

used for assessment of gestational age is fetal foot length. Fair correlation between foot length and gestational age was documented¹¹ For the purpose of study fetuses were divided into 5 groups :

GROUP	GESTATIONAL AGE	NUMBER OF FETUSES
A	Upto 16 weeks	6
B	16-20 weeks	14
C	21-25 weeks	11
D	26-30 weeks	12
E	More than 30 weeks	7

Following parameters were measured: Fetal Foot Length (in mm), Head Circumference (HC) (in mm), Posterior Fontanelle Size (PFS)-Maximum fontanelle length in sagittal section and Posterior Fontanelle Area (PFA)-Area of triangle is taken as PFA. Method for measuring PFA is shown in figure below



RESULTS: Result is tabulated in following table

Table 1: POSTERIOR FONTANELLE SIZE(PFS):

GROUP	MEAN PFS (IN MM)	S.D.	PERCENT CHANGE #
A	5.10	.4	
B	7.71	.69*	+51
C	8.68	.42*	+13
D	9.63	.16*	+11
E	13.9	1.07*	+45

#percent change shows by how much percent value of PFS is increased from previous group p* $<$ 0.01

Table 2 POSTERIOR FONTANELLE AREA (PFA)

GROUP	MEAN PFA (IN SQ.MM)	S.D.	PERCENT CHANGE
A	12.43	2.12	
B	23.93	2.11*	+93
C	36.23	4.71*	+51
D	45.09	4.64*	+24
E	98.30	12.57*	+118

*p $<$ 0.001

Table 3. Showing HEAD CIRCUMFERENCE (HC)

GROUP	MEAN HC (in mm)	S.D.
A	112.48	6.3
B	147.98	19.1
C	204.8	10.3
D	237.8	9.01
E	315.6	18.1

Table 4. Showing PFS:HC

GROUP	PFS:HC	S.D.
A	0.044	0.0055
B	0.049	0.0029*
C	0.042	0.0014**
D	0.041	0.0014 NS
E	0.044	0.0095 NS

NS NON-SIGNIFICANT *P $<$ 0.05 **P $<$ 0.001

Table 5 Showing PFA:HC

GROUP	PFA:HC	S.D.
A	0.11	0.014
B	0.3	0.23*
C	0.17	0.018 NS
D	0.19	0.19**
E	0.29	0.29*

NS =NON – SIGNIFICANT *P $<$ 0.02 **P $<$ 0.001

IMPLICATIONS OF STUDY: This study is related to embryology so it may pave the way to various researchers. Experimental embryology mainly involves lower animals¹². The studies of human fetuses like present one can merit the scientific world due to their direct applications. As most of available literature as fontanelle morphogenesis is on European and African sources, present study on Indian fontal skulls has great relevance because cephalic indices in Indians vary from those of Europeans.

DISCUSSION : POSTERIOR FONTANELLE SIZE (PFS): Although there was constant increase in posterior

fontanelle size, the rate of growth is not uniform. While there was a spurt of growth in groups B and E, there was a marked reduction in rate between 21-30 weeks of gestation period. The only comparable data available are those of Popich and Smith¹³ and Faix⁴. Former found that majority of full term infants (195 out of 201) had a posterior fontanelle size less than 5mm. In latter report mean PFS in 37-42 weeks white and black infants was reported to be 4.9mm and 7mm respectively. In present study this is very high (14mm). Racial factors and variations may be responsible for the above mentioned differences. However an accelerated osseous maturation around posterior fontanelle in newborns cannot be ruled out.

POSTERIOR FONTANELLE AREA (PFA): There was uniformity in growth PFS and PFA with little difference. Marked spurt of growth in PFA is seen in group E (i.e. more than 30 weeks gestational age) and least in group D (26-30 weeks of intrauterine life). Growth was also very high in group B but only moderately high in group C.

POSTERIOR FONTANELLE SIZE VERSUS HEAD CIRCUMFERENCE (PFS VERSUS HC): Correlation between PFS and HC was interesting. As compared to group A relative growth was markedly enhanced in group B. It slowed down in C. Then in subsequent groups (D and E) till terms both the parameters grew with same pace that is changes observed were statistically insignificant. These findings contradict with those of Adeyemo and Omotade⁸ where PFS in pre terms and neonates did not show significant correlation with occipitofrontal circumference.

POSTERIOR FONTANELLE AREA VERSUS HEAD CIRCUMFERENCE (PFA VERSUS HC): PFA showed relative increase in growth rate as compared to HC in group B (16 – 20 weeks). Though there was apparent reduction in the rate of growth in the next group (C), change in C was statistically non – significant. Interestingly relative growth of posterior fontanelle was steadily increased in subsequent groups. Such reports are not available in previous literature.

CONCLUSION: We can conclude from present study that, 1. There is uniformity in growth of size and area of posterior fontanelle. 2. Posterior fontanelle size and head circumference grow with same pace in later part of fetal life. 3. Rate of growth of posterior fontanelle area as compared to Posterior fontanelle size is very high in late fetal period.

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