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Cranial Fronto - Temporal Depression in a Fetus (A Case Report)

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ABSTRACT

Ultrasound shape of the crania was seen by measuring a frozen sonogram of the Biparietal Diameter (BPD) and Cranial Index (CI). The objective aims to report the value of prenatal ultrasound in identifying acute fronto-temporal depression. Also, to review specific developmental skull anatomy as it relates to the formation of cranial and fontanelle anomaly. Little data exists on the prevalence of this rare heterogeneous condition; 1 in 3,600 live births with genetic or hereditary factors responsible for most cases. The report in question was observed under routine ultrasound at 26 weeks gestation. Better understanding of fetal skull development (through sonar), and calvaric sutures will further help sonologists in evaluation of fetal brain. Ongoing research developments can be used to further evaluate cranial 'osteo' development as a consequence of synchondrosis and multiple suture unity.

Keywords: Fontanelle, Calvaria, Synchondrosis, Ultrasound, Suture.

INTRODUCTION

In – utero diagnosis of craniosynostosis depends on confirmation of molecular analysis, fetal DNA for anomaly screening which has ethical and logistic limitations. Nearly 90 different cranio-synostotic conditions have been described and majority have an autosomal – dominant genetic link. In Maiduguri, Nigeria Garba and Human (2008) studied cranial index (C.I) in both gender. [11] They documented female cephalus were mesocephalic (40.0%) or dolichocephalic (43.3%).

Males were with 33.3% mesocephalic crania; while 66.7% accounted for dolichocephaly. The male crania was not seen to be brachycephalic. Sonographically, transverse view of fetal crania can be visualized by projecting the acoustic beam parallel to the long surface of the curved skull, resulting in the "egg – shaped" echogenicity. Thus, a variant of brachycephalic skull will have frontal contour.

Little sonographic literature is available on calvaric size and shape; with sparse association correlating human skull to racial differences. [2] The relevance of this case report will be useful in forensic anatomy and skull reconstructions from remains after death. We have identified that ultrasonography is useful to establish closure of sutures and demonstrate fronto – temporal angular depression in rare affected cases. The

objective of the case report (expose) is to emphasize the value of prenatal ultrasound scan in observing (echogenic) cranial sutures and temporal bone depression in fetuses at risk for craniosynostosis and dolicocephaly, with the suspicion of the former, no prenatal X – ray was ordered.

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MATERIALS AND METHODS

Routine antenatal ultrasound scan was performed on a gravid patient at the onset of early 3rd trimester. USS performed at Crystal Specialist Hospital (CSH), Akowonjo – Dopemu – Lagos using a Logic 3 General Electric (GE) scan – machine. After following a standardized protocol that involved fetal biometric anatomical examination. (3.5 MHZ convex).

The probe / transducer focused on the transverse cranium and sutures tangentially to the lateral part of the calvarium. Radiological investigation was not performed postnatally in this case. Observation of

bilateral cranial and cerebral hemisphere in a "frozen" sonogram slice is important for satisfactory view of the brain and "normal" outer skeletal casing.

Ethical approval was sought and granted by CSH; Ethical Committee – Informed consent of patient was obtained; all in line with the 1975 Helsinki Declaration on patients' right. Ultrasound scanning parallel to the posterior and anterior fontanelles was used to examine more cephalad aspects of frontal and temporal lobes in the coronal plane.



Figure 1: Transverse sonogram of the fetal calvarium at 30 weeks gestational age. Note acoustic sonar transmission permeating through the postero-lateral fontanelle with emerging moderate dolicocephaly.

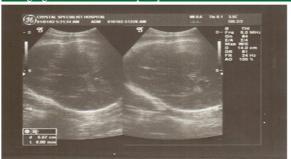


Figure 2: This frozen sonographic section can be used in observation of the anterior fossa in advanced fetuses. Acoustic beam travels through a portion of the suture. Note the acute depression in the calvaric echo – line.



Figure 3: Observation of normal (bilateral) cranial and cerebral hemisphere in a "frozen" sonogram is important for satisfactory view of the brain and normal outer skeletal casing.

DISCUSSION & CONCLUSION

Some researchers declared high risk of cranial deformities and possibilities of recurrence to be high. [3,4] However, others observed less specifics not sufficient to confirm diagnosis. With the advent of 4D and 3D ultrasonic imaging allowing for visualization of finer anatomic skull details when gross malformations of the fetal calvaria occurs in-utero. Ultrasound may further characterize and 'map' the level of the abnormality. A recent citation in literature is similar to our findings. As early 2nd trimesteric dimorphism and suspected cranial deformities becomes obvious above 26 weeks. [5]

The skull is not fully ossified at the onset of the 2nd trimester with classification of skull deformity based on sutures involved. Rare craniosynostosis occur as a result of certain embryonic anomalies, including vascular disruption, chorio-amniotic rupture and compressed skull development. Teratogenic effects, [6,7] causative substances like sodium - valproates; Williams. Ruval-Caba, and Mecker-Grubers Syndromes are known to affect skull development. Through biopsy, invasive-guided ultrasound with molecular analysis of fetal DNA can be obtained in Jackson - Weiss, Crouzon and Apert Syndromes respectively.[8,9]

Knowledge of fetal skull variation and calvaric anatomy correlates to evaluating unborn intercranial anatomy and pathology. One of the fundamental tasks required in obstetric ultrasound in 2nd and 3rd trimester, is the critical observation of fetal ventricle (to exclude dilation) in the posterior fossa. [10] Real time ultrasound of the fetal skull is justified because cranio-metric methods (in forensic anatomy) have been extensively used. This case report may have good prognosis when surgery is performed early in life. [11] Garba (2008) concluded in an anthropometric study done in Northern Nigeria that most of the crania were dolicocephalic 66.5%; stating 24.5% accounted for mesocephaly.^[1] This case study is in line with the theory of Hadlock (1984) and similar to a post-natal allegory by Howells (1989) and Keating (1997). [12,14] Uncertain gene determination of active froto-temporaldepression [Figures 1 and 2] appears to simultaneously establish a deformation sequence preceding cranial suture closure. Current evidence suggests there is a negative correlation between intelligence and Cephalic Index (CI). Ultrasound cranial measurements e.g. Biparietal Diameter (BPD), Occipito-Frontal diameter (OFD); can be used as an indicator for microsomia; and possibly correlate racial and ethnic groups. The chondro-cranium and part of the temporal bone through endo-chondrial ossification of cartilage (ectomeninx). Others are osteo-temporal, occipital and

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sphenoid bones. The temporal formed through unification of several 'micro' bones. Still on the embryology/developmental anatomy of the temporal bone formed from mastoid, tympatic, petrous and squamous bones.

The anterio-lateral fontanelle at the depressed angle (arrowed, [Figure 2]) shows visualization of the Temporal marginal surface. Even so, 2 dimensional Image obtained in this transverse section shows remarkable clarity in anatomic details when compared to a normal skull, demonstrated sonographically. The skull / calvaria showed acute depression [Figure 2] with a broadening convex posterior region.

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