

## ULTRASONOGRAPHIC ESTIMATION OF FETAL AGE BY HEAD CIRCUMFERENCE MEASUREMENTS IN INDIAN POPULATION

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### ARTICLE INFO

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### ABSTRACT

The present cross sectional study was designed to determine the gestational age by fetal Head Circumference measurement with its 2 standard deviations in North Indian population. 200 consecutive, healthy gravid patients with optimal menstrual histories were included in a prospective study from Delhi & nearby regions. The Head Circumference of fetus along with other parameters were measured from 12 to 40 weeks gestation and presented in tabulated form. The use of this table is recommended in clinical practice, to accurately determine mean fetal head circumference at each gestational age in India. This is expected to give more accurate gestational age estimation than the western tables prepared on Caucasian population, which are still followed in our country.

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### INTRODUCTION

Fetal head circumference (HC) is an important parameter, which can be used not only to determine fetal age but also fetal growth and the type of growth restriction- symmetrical or asymmetrical. Prenatal compression of the fetal skull is common. It occurs more often in fetal malpresentation, such as breech, or in conditions of intrauterine crowding, such as multiple pregnancies. The fetal skull can also be compressed in vertex presentations without any obvious reason or as a result of an associated uterine abnormality such as leiomyoma<sup>(1)</sup>. Because the biparietal diameter of the head can be misleading in cases associated with head shape changes (e.g. dolicocephaly)<sup>(2)</sup>, the HC is the measurement of choice for evaluation of head growth in utero<sup>(3)</sup> and also for determining gestational age of fetus. In symmetric intrauterine growth retardation (IUGR), fetal head size will frequently be compromised early in pregnancy and when dates are known unequivocally, a HC below the third percentile for age is cause for concern. In asymmetric IUGR, the growth of fetal head is typically normal until very late in pregnancy.

For this reason measurement of the head in such cases will typically fail to diagnose IUGR early enough to impact clinical management.<sup>(4)</sup> The measurement of HC is valuable because the head to trunk ratio will allow the diagnosis of asymmetric IUGR<sup>(5)</sup>. Various studies have determined that our fetal measurements are smaller than the Caucasian fetal measurement.<sup>(6,7,8,9,10,11)</sup> Therefore we need reference tables of our own population. This prospective study was designed to determine the

relationship between menstrual age and fetal head circumference with 2 Standard deviations (2SD) in a normal population. A normative table for fetal Head Circumference of our population will be produced.

### MATERIALS AND METHODS

This was a random cross sectional study performed in Meerut medical college. The study was approved by the ethical committee of that institute. 200, healthy gravid women were studied from Feb 2011 to July 2011. Their ages ranged between 20 to 36 years and they all belonged to the middle income group. All study subjects were Indians. Patients, who met the following criteria, were included in the study: Regular periods, well-defined last normal menstrual period, an early onset of antenatal care, no oral contraceptive for 3 months prior to conception, no history of maternal medical, surgical or obstetric complications or malnutrition, no uterine anomaly or fibroid and no congenital anomaly of the fetus. All women had antenatal care started prior to 20 weeks gestation. On entry, all patients underwent a complete ultrasonographic examination including measurements of the fetal biparietal diameter (BPD), Head circumference (HC), abdominal circumference (AC) and femur length (FL) using standard methodology.

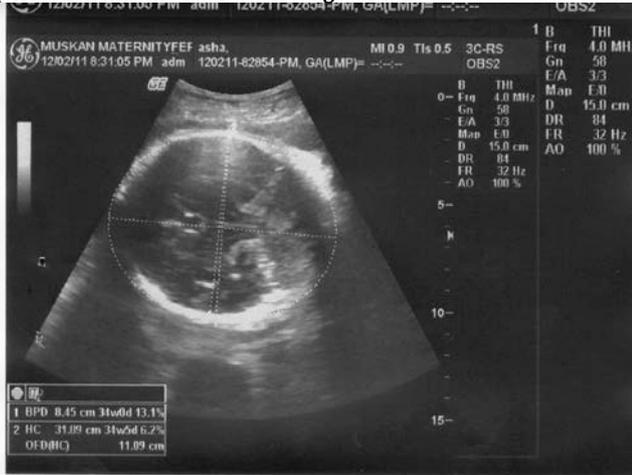
The ultrasonic scans were performed by a single Sonologist on one ultrasound machine, Wipro GE Logic 400 curvilinear probe with transducer frequency 3-5 MHz. This excluded inter-observer variations. All circumference measurements were obtained by tracing the appropriate circumference using an electronic digitizer. A 3.5 MHz

electronic curvilinear transducer was used for all examinations. Values were expressed as mean and 2 Standard deviations (2SD, sample) for the estimate in the tables, both in mm.

The HC was obtained at a level that shows a smooth symmetric head, a well-defined midline echo, Thalami, the cavum septi pellucidi, and the third ventricle, as for measuring a biparietal diameter (BPD). To obtain an accurate HC measurement, 60% to 70% of the skull outline should be displayed on the screen. Calipers that open to the outline of fetal head were used.

**RESULTS**

**FIGURE 1: U ltrasonographic image showing Head Circumference & Biparietal diameter at 34 weeks of gestation**



**Table I : Head circumference measurement (in cm) and standard deviations from 12 to 40 weeks of gestation**

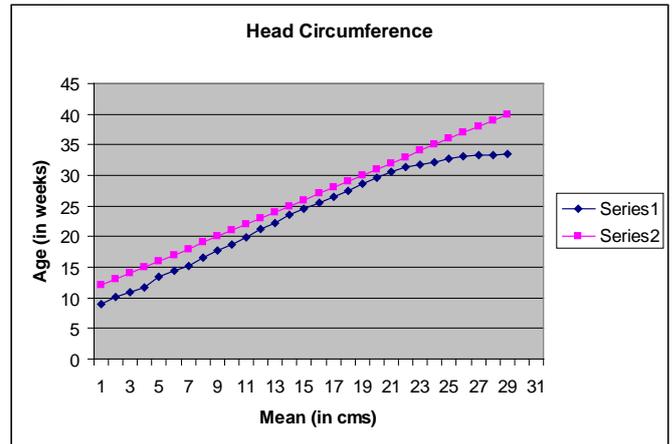
GESTATION AGE IN WEEKS	HEAD CIRCUMFERENCE (HC) IN CM	SD± IN CM
12	9	0
13	10.07	0.14
14	10.97	0.3
15	11.68	0.86
16	13.37	0.43
17	14.51	0.41
18	15.2	0.37
19	16.58	0.36
20	17.63	0.17
21	18.65	0.19
22	19.94	0.36
23	21.15	0.16
24	22.13	0.21
25	23.6	0.5
26	24.6	0.23
27	25.6	0.3
28	26.5	0.42
29	27.48	0.25
30	28.7	0.1
31	29.6	0.11
32	30.5	0.06
33	31.28	0.08
34	31.67	0.17
35	32.15	0.25
36	32.74	0.12
37	33.12	0.07
38	33.25	0.04
39	33.36	0.07
40	33.51	0.05

**DISCUSSION**

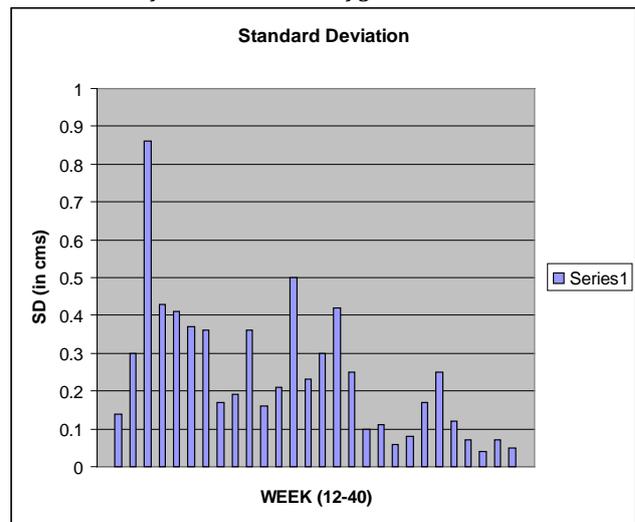
Estimation of gestational age accurately is one of the most important functions of diagnostic ultrasound. Of all the parameters used to determine gestational age of the fetus, head circumference has been proved to be one of the reliable one as established by different studies.

Determination of gestational age by ultrasound has now become an integral part of maternal antenatal care. Since up to 50 % of mothers who claim to know with certainty are in fact more than two weeks in error when gestational age is calculated with ultrasound. A discrepancy of 2 weeks can be critical for the survival of an infant who has to be delivered early because of some antenatal complication.<sup>(12)</sup> The two most often used charts of HC against gestational age are very similar <sup>(13,3)</sup>. They both show that changes in HC, like BPD, tend to tail off towards term but the standard deviations are much less so the likelihood of identifying the growth retarded fetus may be higher<sup>(14)</sup>.

**FIGURE 2: X-axis showing the measurements of HC & Y-axis showing the age in weeks.**



**FIGURE 3: Bar diagram showing standard deviations of HC measurements for 12 to 40 weeks of gestation**



In this study too the changes in HC tailed off towards term from 1.07 cm per week at 13 weeks to 0.15cm per week at term.

In a study by Hadlock et al at 40 weeks HC was 35 cm,<sup>(15)</sup> in Hansmann’s study it was 34.9 cm,<sup>(16)</sup> in another of Hadlock’s study it was 34.6 cm,<sup>(17)</sup> and in a study by Deter et al it was 35.9 cm.<sup>(13)</sup> Whereas in this study it was 33.51 cm at 40 weeks of gestation age. This means there is a difference of 1.09 to 2.39 cm between fetal HC in Caucasian population and in north Indian population at term.

In one study by Hadlock et al 2SD throughout was ±1.9 cm<sup>(3)</sup> and in another study it increased to ± 3 cm at term<sup>(17)</sup>. Whereas in this study it was ± .86 cm at 15 weeks of gestation being the maximum and at 37 weeks it was ± .04cm being the minimum. At term i.e 40 weeks it was ± .05cm.

In Hadlock et al's study 33.3cm was at 37 Weeks 3 days and in Hansmann's it was 35 weeks at 33.2 cm whereas it was 33.3cm at 39 weeks in this study. This shows that there is a discrepancy of 2 to 4 weeks from our population near term. Therefore for accurate determination of fetal head growth and gestational age we need tables prepared on our own population.

#### **CONCLUSION**

HC is an important and accurate parameter for gestational age estimation. But its accuracy decreases when we use the tables derived from studies on Caucasian population. In this study 200 healthy gravid women were scanned from 12 to 40 weeks menstrual age. The head circumference increased gradually with menstrual age from 9 cm per week to 33.51 cm per week at term. There is a discrepancy of 1.09 to 2.39 cm between HC at term in Caucasian population and Indian population. The normalcy of fetal head growth should therefore be judged against local population standards. The table, graph & image presented in this study were prepared from data collected from north Indian population and will therefore give accurate assessment of fetal age, not only in India but also in some other South Asian countries. More such studies on a larger study population should be undertaken.

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