Original Articles

Gestational age Estimated by Abdominal Circumference in Bangladesh

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Abstract:

Objective: Abdominal circumference measurement is an important parameter for determining fetal growth. Fetal growth will be more accurately assessed if we use tables constructed on our own population. A table of fetal gestational age estimation by abdominal circumference in Bangladeshi population is prepared, so that a quick assessment of its growth can be made.

Methods: This study was a prospective, cross-sectional study, conducted on well dated, singleton pregnancies. A table and a graph were prepared after fitting Polynomial regression models.

Results: Nomogram for gestational age estimation by abdominal circumference was prepared. 1223 patients were included in the study. Percentiles, mean and standard deviations were derived from the raw data. Polynomial regression model was a good fit to the data. Standard deviations increased with gestational age. In the early second trimester Bangladeshi and western studies were similar but as pregnancy advanced there was variation between the two races.

Conclusion: This chart can be useful for Bangladeshi population, by helping in assessment of fetal growth and gestational age by abdominal circumference, especially in the 3rd trimester. This is so, because abdominal circumference is very sensitive to fetal nutritional status.

Key words: Gestational age, abdominal circumference, fetal growth, Bangladesh.

Introduction:

Fetal growth assessment is very important in the antenatal period and ultrasonography plays an important role by accurately measuring the fetal body parts, of which abdominal circumference (AC) is the single most important parameter in growth assessment. This variable is not used routinely to estimate gestational age but is often used in combination with other parameters to determine the average gestational age by ultrasonography.

Fetal nomograms and growth charts that are used in Bangladesh have all been produced on Caucasian population. The stature of our population is different; those charts are therefore not suitable for Bangladeshi fetuses. Studies conducted in Bangladesh found that our own tables should be used for reference.[1-7]

The current study was designed to produce gestational age estimation table from fetal abdominal circumference, for improved growth assessment of the fetuses. For example, if at 40 weeks menstrual age, gestational age by fetal abdominal circumference measurement comes to 36 weeks, then the sonologist and obstetrician can become alert that fetal growth is compromised. In this way a quick assessment of fetal growth can be made.

Subjects And Methods:

A prospective, cross sectional study was carried out, in the city of Dhaka, from December 2004 to November 2007. Informed consent of the patients were taken. The inclusion criteria for the gravid ladies were:

Regular periods, certain last menstrual period, that was consistent with a less than 20 week ultrasound within 10 days, singleton pregnancy, no oral contraceptive used for 3 months before conception, no history of maternal medical, surgical or obstetric complication or malnutrition, no uterine anomaly or

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large fibroid and no congenital anomaly of the fetus. Well informed consent of the patients were obtained.

Ultrasonography was performed by a single sonologist on one ultrasound machine. Therefore there was no chance of inter-observer variation. Measurements were made by electronic calipers in mm. A 3.5 MHz curvilinear probe was employed. Measurements were taken of fetal biparietal diameter, head circumference, abdominal circumference and femur length by standard methodologies. Fetal abdominal circumference was measured at the level where the right and left portal veins were continuous with one another, appearing like a J-shape. The appearance of the lower ribs was symmetric and the shortest length of the umbilical segment of the left portal vein was depicted. The fetal stomach represented a secondary landmark.[8] This plane of section was frozen on the screen, then the electronic ellipse was fitted to the outer skin edge.

Statistical package for social science (SPSS), present in the computer software was used for data entry and statistical analysis. Polynomial regression model was fitted to the raw data.

Result:

A total of 1223 healthy pregnant subjects met the criteria and were included in the study. The demographic characteristics of the study population were as follows. 96.9% patients were from the middle income group and were aged between 17 to 40 years (Mean 26 ± 4.5 years). 54.7% were primipara. Range of parity was 0-5.

Estimated gestational age with 2 standard deviations (2SD) are given in Table I, in weeks. 65mm predicted 13.5 weeks (±1week) (±2SD) gestational age, 295mm predicted 36.2 weeks (±3 weeks) weeks and 335mm predicted 40.1 weeks (±3.4 weeks) gestational age.

Polynomial regression cubic model fitted well to the data. The coefficient of multiple correlation, $R^2 = 0.967$, ($p < .001$).

A gradual increase of abdominal circumference was noted up to 37th week of gestation. After that, the growth rate was slower. Graph 1, shows the fetal growth profile for abdominal circumference. Raw data with fitted 3rd, 10th, 50th, 90th and 97th percentile curves superimposed on it, are shown. 95% of the population is covered by it.

Table-I

Gestational age from fetal abdominal circumference.

| Abdominal circumference (mm)	Mean (wks)	2SD (wks)
65	13.5	0.9
70	13.8	1.0
75	14.0	1.0
80	14.4	1.1
85	14.7	1.1
90	15.0	1.2
95	15.4	1.2
100	15.8	1.2
105	16.1	1.3
110	16.5	1.3
115	17.0	1.4
120	17.5	1.4
125	17.9	1.5
130	18.3	1.5
135	18.8	1.6
140	19.3	1.6
145	19.8	1.7
150	20.2	1.7
155	20.7	1.7
160	21.3	1.8
165	21.8	1.8
170	22.3	1.9
175	22.7	1.9
180	23.4	2.0
185	23.9	2.0
190	24.5	2.1
195	25.0	2.1
200	25.6	2.1
205	26.1	2.2
210	26.7	2.2
215	27.3	2.3
220	27.8	2.3
225	28.4	2.4
230	29.0	2.4
235	29.6	2.5
240	30.0	2.5
245	30.7	2.6
250	31.2	2.6
255	31.8	2.6
260	32.4	2.7
265	32.9	2.7
270	33.5	2.8
275	34.0	2.8
280	34.6	2.9
285	35.1	2.9
290	35.7	3.0
295	36.2	3.0
300	36.7	3.0
305	37.2	3.1
310	37.7	3.1
315	38.2	3.2
320	38.7	3.2
325	39.2	3.3
330	39.7	3.3
335	40.1	3.4
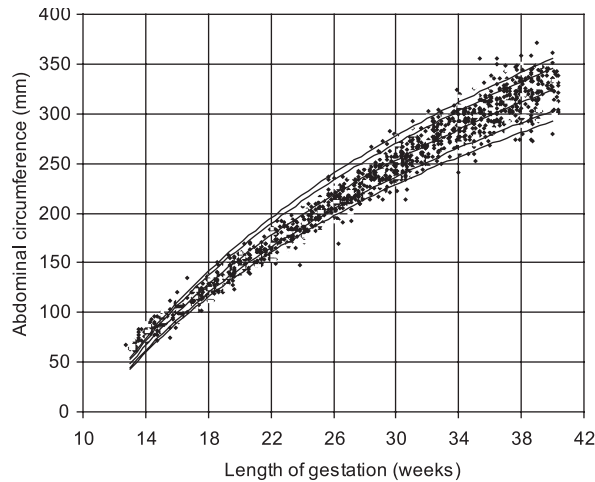
Fig.-1: *Raw data of fetal abdominal circumference with fitted 3rd, 10th, 50th 90th and 97th percentiles.*

Discussion:

In the present study 65mm predicted 13.5 weeks (±1week) (±2SD) gestational age, 295 mm predicted 36.2 weeks (±3 weeks) weeks and 335mm predicted 40.1 weeks (±3.4 weeks) gestational age. Polynomial regression (cubic) model fitted well to the data. The coefficient of multiple correlation, R^2 = 0.967, ($p<$ .001). This indicated good correlation between the two variables.

In a Bangladeshi study, at 16 weeks gestational age abdominal circumference was found to be 110mm (±11mm) and at 40 weeks it was found to be 328mm (±22mm) [6]. In another study here, gestational age obtained by ultrasonography, from the measurement of abdominal circumference using Hadlock et al's table, was found to be constantly smaller after 24 weeks age. At 40 weeks the abdominal circumference age was 37 weeks (±3 weeks) by using that table. At 40 weeks abdominal circumference was 359mm by Hadlock's table but 330mm by Bangladeshi table. Therefore a table was prepared to give the mean abdominal circumference measurements of our fetuses, so that in one glance the obstetricians can get an accurate idea of the fetal nourishment at a particular gestational age.[4]

In western studies with gestational age as dependent variable, 100mm predicted 15 weeks and 4 days (±13 days) gestational age, and 360mm predicated 40 weeks (±18 days) [9], in another study 63mm predicted 13 weeks gestational age and 320mm predicted 40 weeks.[10] In one of the earliest studies 90mm indicated 14 weeks (±14 days) (2SD) and 350mm predicated 40 weeks (±30 days).[11]

In all studies gestational age predicted by AC, showed that in the early second trimester the Bangladeshi and western predictions were similar but as pregnancy advanced there was variation. The findings of this study were similar to other local studies. The observed values of abdominal circumference measurements of the western studies were much bigger at term than this study, by 21 to 28mm.

The abdominal circumference is undoubtedly the best index with which to assess both fetal size and growth because the measurement is taken at the level of the fetal liver, which constitutes about 4% of the total fetal weight and which steadily increases in size with gestational age. The standard deviations widen towards term. In contrast to the brain, liver growth seems very sensitive to reduction in the supply of nutrients and so provides a potentially useful marker of intrauterine starvation.[12]

Limitation:

The limitation of this study was that low income group could not be included as they rarely go to doctors for antenatal checkup and even if they do they are unable to give their LMP. This nomogram can be used as a Bangladeshi standard and can therefore be installed in the ultrasound machines.

Conclusion:

The findings of this study suggest that this chart is unique for Bangladeshi population and can be useful for reliable assessment of fetal growth, especially in the 3rd trimester by determining the fetal age by abdominal circumference and then comparing it with the menstrual age of the fetus.

References:

1.   Moslem F, Latifa S, Iffatara B, Shamsuddin AK, Nasreen M, Momen A, et al. Relation of BPD with gestational age in Bangladeshi fetus. Bangladesh J Ultrasonogr 1996; 3: 3- 8.

2.   Bala KG. Ultrasound assessment of fetal BPD during normal pregnancy in Bangladeshi women and review of literatures. Bangladesh J Ultrasonogr 1991; 1: 3.

3.   Rashid SQ. Predicted gestational age for BPD in Bangladesh. The 8th Congress of the Asian Federation of Societies for Ultrasound in Medicine & Biology (AFSUMB), Bangkok. Paper

presented. Obstetrics and Gynecology 2007; FP 401- 2: 159.

4. Rashid SQ. Ultrasonic measurement of fetal abdominal circumference in context to Bangladeshi population. Bangladesh Med J 2000; 29: 36- 8.

5. Rashid SQ. Gestational age estimation from fetal Head circumference in Bangladesh. 11th Congress of the World Federation for Ultrasound in Medicine and Biology (WFUMB), Seoul. Paper presented. J Ultrasound in Med and Biology. Clinical Obstetrics 2006; 32 (5S) 2361: 163.

6. Rashid SQ. Fetal Biometry and Fetal weight in Bangladeshi population. Dissertation DMUD (USTC) 2002; 53- 69.

7. Rashid SQ. Gestational age prediction by Femur length in Bangladeshi population. 12th Congress of the World Federation for Ultrasound in Medicine and Biology (WFUMB) 2009, Sydney. Paper presented.

8. Hadlock FP. Ultrasound Evaluation of Fetal Growth. In: Callen PW(ed.), Ultrasonography in Obstetrics And Gynecology. 3rd Ed. Philadelphia, WB Saunders. 1994; p.129- 43.

9. Hadlock FP, Deter RL, Harrist RB, Park SK. Fetal abdominal circumference as a predictor of menstrual age. Am J Roentgenol 1982; 139: 367- 70.

10. Hansmann M, Hackeloer BJ, Staudach A. Ultrasound diagnosis in Obstetrics and Gynecology. New York. 1985.

11. Campbell S, Thomas A. Ultrasound measurement of the fetal head to abdominal circumference ratio in the assessment of fetal growth retardation. Br J Obstet Gynaecol 1977; 84: 165- 74.

12. Whittle MF. Fetal Growth. In: Dewbury K, Merie H, Cosgrove D, Ferrant P (eds.), Clinical Ultrasound: Ultrasound in Obstetrics and Gynecology (Vol. 3), 2nd Ed. London, Churchill Livingston. 2001; 231- 39.