

Estimation of Gestational Age by Foetal Biparietal Diameter in Bangladesh

S QUDDUS^a, S CHOWDHURY^b

Summary:

This cross sectional study was done with the objective to prepare a chart to estimate gestational age by biparietal diameter (BPD) measurements from 13 to 41 weeks menstrual age of the fetuses in Bangladeshi population. So far the western charts of gestational age determination from biparietal diameter that were prepared on Caucasian population are being used here. But measurements among eastern population were found to be smaller than the western by various studies.

This study was therefore designed to create local population standard for foetal BPD measurements. It was found here that BPD measurement of 23 mm predicted gestational age of 13 weeks, 61 mm predicted 25 weeks, 81 mm predicted 32 weeks, 87 mm predicted 36 weeks and 92 mm predicted 40 weeks.

(J Bangladesh Coll Phys Surg 2004; 22 : 53-56)

Introduction:

Estimation of gestational age by ultrasonography (USG) has now-a-days become an essential part of maternal antenatal care, especially in patients with uncertain dates or verification of dates for patients who are scheduled for elective cesarean section and induction of labour, to avoid preterm newborn. Ultrasound provides accurate dating for gestational age.

Therefore, it is now used widely by the obstetricians and has become one of the major tools to evaluate the growth of developing foetus. Multiple studies have found that accurate assessment of gestational age in the second trimester is possible with the measurement of foetal biparietal diameter^{1,2,3}. But the size and growth of Bangladeshi fetuses is less than the reference population whose charts are being used so far in this country^{4,5,6,7,8,9}.

In a developing country like Bangladesh, maternal malnutrition and consequent low birth weight of the neonate is quite common. In many such cases a timely and early delivery becomes mandatory. A discrepancy of two weeks can be critical for the survival of an infant who has to be delivered early because of some antenatal complication¹⁰.

Therefore, studies are required to create foetal biometry charts of the proposed population as standard. With this objective this study was done to develop a chart to estimate gestational age by biparietal measurement using ultrasonography.

Materials and method:

This cross sectional study was done over a period, starting from March, 1999 to September, 2001. The work was done in a private diagnostic center located in the city of Dhaka

A total number of 797 consecutive healthy gravid women were studied. Their age ranged between 18 and 30 years.

Inclusion criteria for the study population included regular menstrual history, accurate recalling of last menstrual period (LMP), antenatal care starting before 20 weeks, singleton pregnancy and no oral contraceptive taken three months prior to LMP. Exclusion criteria were maternal malnutrition and any major maternal systemic disease like hypertension, diabetes, severe anaemia, heart or chronic lung disease, foetal anomalies, oligo and polyhydramnios, direct occipito-anterior or posterior position of foetal head, when the proper plane of biparietal diameter (BPD) measurement was not possible to obtain, and when the head shape was not optimum, uterine anomalies like bicornuate uterus or large fibroids, bad obstetric history and substance abuse.

The study group consisted of a cross section of serially scanned healthy gravid women. All patients underwent a complete sonographic examination including measurements of the foetal BPD, femur length (FL) and abdominal circumference (AC) using standard methodology. All measurements were obtained in millimeters (mm). Each patient was studied only once.

All study subjects were Bangladeshis, staying in Dhaka but belonging to different districts of Bangladesh. They were of the same race. Patients of Caucasian and Mongol race were excluded. Majority of the patients belonged to the middle class.

The sonographic examinations were performed with a real-time ultrasound system Aloka SSD 900 of Japan. The probe used was a 3.5 MHz curvilinear transducer. Electronic calipers or digitizer capable of measuring up to 1 mm were used for the measurements. The biparietal diameter (BPD) is the maximum diameter of the foetal skull at the level of the parietal eminences¹¹. The correct transverse axial section of the head

a. Dr. Sabrina Quddus, MBBS, DMUD, Consultant, 'SONOLAB', Centre for Diagnostic Ultrasound, 150, Green Road, Panthapath Crossing, Dhaka

b. Prof. Sameena Chowdhury, Professor of Obst. & Gynae, ICMH, Matuail, Dhaka.

Address of Correspondence : Dr. Sabrina Quddus, 'SONOLAB', Centre for Diagnostic Ultrasound, 150, Green Road, Panthapath Crossing, Dhaka

demonstrated the following features on ultrasonography : oval shaped head, falx cerebri anteriorly and posteriorly only, cavum septum pellucidum anteriorly in the midline and choroid plexus in the atrium of each lateral ventricle.

Result

<i>Gestational age by foetal biparietal diameter measurement:</i>			
Number of Patients	BPD (mm)	Gestational age (weeks)	2 Standard deviation (weeks)
15	23	13.0	1
	25	13.5	1
13	26	14.0	1
	28	14.4	1
19	30	15.0	1
	32	15.3	1
17	34	16.0	1
	36	16.5	1
18	37	17.0	1
	38	17.3	1
26	40	18.0	1
	41	18.2	1
26	43	19.0	2
	44	19.4	2
	45	19.7	2
23	47	20.0	2
	48	20.4	2
24	49	21.0	1.5
	51	21.3	2
15	53	22.0	2
	55	22.5	2
30	56	23.0	2
	57	23.4	2
24	58	24.0	2
	59	24.3	2
30	61	25.0	2
	63	25.3	2
31	65	26.0	2
	67	26.3	2
27	69	27.0	2
	70	27.3	2
28	72	28.0	2
	73	28.4	2
30	74	29.0	2
	75	29.4	2
32	76	30.0	2
	77	30.4	3
33	78	31.0	3
	79	31.3	3
33	81	32.0	3
	82	32.4	3
33	83	33.0	3
33	84	34.0	2
	85	34.4	3
34	86	35.0	3
34	87	36.0	3
34	88	37.0	3
35	89	38.0	3
	90	38.4	3
33	91	39.0	3
34	92	40.0	2
26	92	41.0	3

Total Patient = 797

This chart was prepared by regression analysis of the raw data obtained from 797 subjects. In this study the BPD measurements increased gradually from 13 to 28 weeks at 3 mm per week, then from 28 to 33 weeks it increased by about 2 mm per week, there after up to 40 weeks the increase was about 1 mm per week.

In this study, when dating a pregnancy between 13 to 26 weeks the predictive value decreases from ± 6 days to ± 12 days in 95% of the population. The correlation of BPD with gestational age decreases in the third trimester and the predictive value decreases to ± 3 weeks or ± 14 to 23 days.

Discussion:

In the second trimester the BPD is the most widely accepted means of measuring the foetal head and estimating the gestational age¹². Biparietal diameter is simple to measure than the other two measurements or parameters that involve the foetal head: corrected BPD and head circumference (HC)¹³. Areas and circumference are much less sensitive than diameter to change in shape but are more difficult to measure. The simplicity of the measurement process makes diameter measurement inherently more reliable¹⁴.

All reports on the BPD have demonstrated it to be an accurate predictor of menstrual age before 20 weeks. A variability of ± 1 week (2 Standard deviation) was demonstrated in a population of 1,771 patients with optimal menstrual histories seen between 14 and 20 weeks¹⁵. After 26 weeks the correlation of BPD with gestational age decreases because of the increased biological variability. The predictive value decreases to ± 3 weeks in the third trimester. The growth of the foetal skull slows from 3 mm per week in the second trimester to 1.8 mm per week in the third trimester¹².

In this study the BPD measurements increased gradually from 13 to 28 weeks at 3 mm per week, then from 28 to 33 weeks it increased by about 2 mm per week, there after up to 40 weeks the increase was about 1 mm per weeks.

In this study, when dating a pregnancy between 13 and 26 weeks the predictive value decreases from ± 6

days to ± 12 days in 95% of the population. Here also, like the above mentioned study, and also other studies the correlation of BPD with gestational age decreases in the third trimester and the predictive value decreases to ± 3 weeks or ± 14 to 23 days. Here it was found that BPD of 92 mm predicts 40 weeks gestational age, but in Kurtz study 92 mm predicts gestational age of 37 weeks 6 days, 96 mm predicts 40 weeks 2 days and 97 mm predicts 41 weeks¹⁶.

This study provides a chart to determine gestational age from BPD measurements of the foetuses in Bangladeshi population. So far the measurements were dependent on western charts for gestational age determination. This study and the chart support the previous studies done on the similar population, and can be helpful for accurate dating of foetuses. However, more such studies are needed on bigger sample size.

References :

1. Campbell S. An improved method of foetal cephalometry by ultrasound. *J Obstet Gynecol Br Commonwealth* 1968; 75 : 568.
2. Campbell S. The prediction of foetal maturity by ultrasonic measurements of the biparietal diameter. *J Obstet Gynecol Br Commonwealth* 1969; 76 : 603.
3. Campbell S. Ultrasonic foetal cephalometry during the second trimester of pregnancy. *J Obstet Gynecol Br Commonwealth* 1970; 77 : 1057.
4. Moslem F, Latifa S, Iffatara B, et al. Relation of BPD with gestational age in Bangladeshi foetus. *Bangladesh Journal of Ultrasonography* 1996; 3 : 3-8.
5. Bala KG. Ultrasound assessment of foetal BPD during normal pregnancy in Bangladeshi women and review of literature. *Bangladesh Journal of Ultrasonography* 1991; 1 : 3-6.
6. Quddus SR. A study correlating the menstrual age and foetal age by ultrasonography in Bangladeshi population. *Bangladesh Journal of Ultrasonography* 1999; 6 : 3 - 8.
7. Quddus SR. Ultrasonic measurement of foetal abdominal circumference in context to Bangladeshi population. *Bangladesh Medical Journal* 2000; 29 : 36-38.
8. Quddus SR, Khatun S. A study of estimated foetal weights by ultrasound in Bangladesh and its correlation with birth weights. *Journal of Bangladesh College of Physicians and Surgeons* 2001; 19 : 47-51.

9. Quddus S. Foetal biometry and foetal weight in Bangladeshi population. Dissertation for DMUD (USTC) 2002 : 62-69.
10. Palmer PES. Estimation of fetal size and age (fetal biometry). Manual of Diagnostic Ultrasound. Geneva: WHO, 1995 : 236-44.
11. Pearce JM, Chazal RD. Establishing gestational age. In: Dewbury K, Merie H, Cosgrove D (editors). Ultrasound in Obstetrics and Gynaecology. Edinburgh: Churchill Livingstone, 1993 : 211-21.
12. Rosenberg JC, Chervenak FA. Gestational age and growth assessment. In: Hagen-Ansert SL (editor). Diagnostic Ultrasonography, Fourth edition Missouri: Mosby, 1995 : 903-919.
13. Benson CB, Doubilet PM. Fetal measurements- normal and abnormal fetal growth. In: Rumack CM, Wilson SR, Charboneau JW (editors). Diagnostic Ultrasound. St. Louis, Missouri: Mosby, 1998 : 1013-31.
14. Deter RL, Hadlock FP, Harrist RB. Evaluation of normal foetal growth and the detection of intrauterine growth retardation. In: Callen PW (editor). Ultrasonography in Obstetrics and Gynecology. Philadelphia, PA: WB Saunders Co, 1983 : 1 13-40.
15. Hadlock FP, Harrist RB, Martinez PJ. How accurate is second trimester fetal dating? J Ultrasound Med 1992; 10: 557.
16. Kurtz AB, Wapner RJ, Kurtz RI. Analysis of biparietal diameter as an accurate indicator of gestational age. Beuglet CC. Journal of Clinical Ultrasound 1980; 8 : 319-326.