



Sonographic determination of gestational age using multiple fetal growth parameters in third trimester

KEYWORDS

Multiple fetal growth parameters, Gestational age, Third trimester, Ultrasound

K.Kavitha

M.D.,(OBG) Plot No:4,Doctors colony, Kurnool.(A.P)

K.Sreelatha

,M.D.(OBG) Plot No:8,Doctors Colony, Kurnool.(A.P)

P.Geeta Lakshmi

Pasupuleti Nursing Home,4/370 Nagarajapeta, Kadapa.(A.P)

ABSTRACT This study has been undertaken to precisely quantify the accuracy of prediction of gestational age by multiple fetal growth parameters obtained with single ultrasound examination in third trimester and to correlate it with actual gestational age derived from New Ballard neonatal scoring system.

Methodology: 106 uncomplicated pregnant women, attending the antenatal clinic were selected. They were subjected to single ultrasonographic study to determine the gestational age by multiple fetal growth parameters. They were followed up till delivery and gestational age of neonate was evaluated by using New Ballard scoring system and this was taken as actual gestational age, which was compared with that obtained by ultrasound.

Results: Using Multiple Fetal Growth Parameters, 90% cases had a difference within 2 weeks from the actual gestational age. In 37.73%, the mean gestational age coincided with actual gestational age. In 39.6%, there was a difference of 1 week and in 13.2%, there was a difference of 2 weeks.

Conclusion : In order to improve the accuracy of prediction of gestational age by a single ultrasound examination at third trimester, one should utilize multiple fetal growth parameters and have their own standard values obtained from the population they are dealing with.

Introduction:

Estimation of gestational age and fetal maturity is one of the corner stones of prenatal care. When only history and physical examination are considered, it has been clearly demonstrated that the estimation of gestational age suffers from lack of precision. Inability of the patients to recall the date of last menstrual period, as often happens in our country due to low level of literacy, conception during lactation, hinders the estimation of gestational age. Other conditions like obesity, presence of uterine leiomyomata, the common necessity of having different physicians examine the patient at different gestational age and the subjective nature of maternal reporting of quickening, all confuse the clinician's estimate of fetal age.

Because of these problems with clinical estimation of gestational age (GA), it is not surprising that early measurement of fetus using diagnostic USG has been looked as a way of objectively confirming fetal age. Some of the parameters used to assess gestational age are: Gestational sac diameter, Crown rump length, Biparietal diameter, Head circumference, Femur length, Bi-ocular distance, Humerus length, Placental ageing, Transcerebellar diameter, Distal femoral epiphysis, Proximal tibial epiphysis, Fetal foot length, Fetal heel ossification centres.

Gestational sac diameter is the only parameter available for dating of pregnancy, up to 7 weeks gestation. Crown rump length is used to assess gestational age from 6-12 wks gestation. After 12wks, BPD is an excellent means of estimating gestational age, both because measurement is subject to relatively little error and also there is a close correlation between BPD and gestational age (Rajan et al). According to Sabbagha et al, it is unlikely that head shape variation will

occur, and although there may be racial or socio-economic differences or maternal disease that influence growth of BPD, they do so usually to a limited extent unless severe clinical disease, such as chronic hypertension or advanced diabetes are present. This stereotyped BPD growth makes it advantageous to take this measurement to assess gestational age. They suggested that the precision of a single measurement of BPD as a function of GA has a variation ranging from ± 7 days at 16wks, ± 14 days by 23wks while increasing still further to ± 21 days in the 29-40 wks of gestation. In later part of gestation, accuracy is affected by a slower rate of growth as in IUGR, pathological head growth as in hydrocephalus, microcephalus and head molding (FA Chernenak P Jeanty, 1983). In conditions like brachycephaly and dolicocephaly, BPD is of limited value to date the pregnancy and femur length and head circumference may be used.

Head circumference is measured in the same plane as BPD and is more predictable than BPD for dating the pregnancy after 26 wks (Rajan et al). Use of abdominal circumference in estimation of gestational age is proper only when no clinically apparent maternal or fetal conditions are present that would modify fetal growth. It has been found to be a reliable method of estimating gestation age even in the third trimester (Charles Hohler, 1984). According to Hadlock et al, AC is a poor predictor of gestational age than BPD, except during the interval between 36-42wks, at which time it is found to be slightly more accurate than BPD.

Femur is the easiest long bone to visualize and measure. Accuracy of FL in estimating GA is within ± 2.8 wks, almost as reliable as BPD (Hohler). So, it is an useful alternative dating method, when BPD or

and/or HC is unobtainable as in the presence of fetal anomalies as intrauterine fetal demise.

The rationale of employing multiple fetal parameters for dating indicates that, when 2 or more parameters predict the same end point, the probability of the accuracy of that end point is increased (Rajan et al). Once the BPD, HC, AC, FL have been obtained, use of standard reference charts to obtain an estimate of gestational age from each parameter is made. Maternal conditions like chronic hypertension, advanced diabetes mellitus or poorly controlled diabetes mellitus as well as other diseases that influence on uteroplacental perfusion would affect estimate of age based on fetal size. This is an important concept because estimation of age from size only works well when there is normally growing fetus with adequate fetal reserve and placental perfusion capacity. Congenital anomalies of head, abdomen or skeleton as well as functional disturbances such as malnutrition -IUGR/macrosomia or congenital infections which might lead to hepatosplenomegaly with commensurate enlargement of fetal abdomen. All these must be taken in to account prior to using this multiple fetal growth parameter method for estimation of age.

Other advantages of MFGP method are- any or all the measurements may be technically incorrect, however it is unlikely that all four measurements will be measured incorrectly. Abnormalities of body symmetry or proportion become quite obvious and allow for precise and detailed consultation and antepartum management, should they arise.

Material and methods:

The present study was conducted in the department of Obstetrics and Gynaecology, Kurnool Medical College, Kurnool during the year 2008. A total number of 106 uncomplicated pregnant women attending antenatal clinic were selected at random and were subjected to a single ultrasonographic study at third trimester to determine gestational age by Multiple Fetal Growth Parameters.

These patients were followed up till delivery and gestational age of the neonate was evaluated by using New Ballard scoring system and this was taken as actual gestational age. A comparison was then made between the actual gestational age and ultrasonically derived gestational, which is calculated by adding the time elapsed between sonographic examination and date of delivery to gestational age obtained on the date of examination.

Patients were scanned using Wipro GE Logic α 100 model. The instrument uses 3.5 MHz frequency ultrasound waves for imaging. BPD was measured as the longest distance from the outer skull table on one side to the inner skull table on the other side. The internal structures noted are the falx, cavum septum pellucidum, thalamus and basal cisterns. Head circumference was measured on the section taken for BPD, taking the distance from outer to the outer skull table. Abdominal circumference was measured from a transverse axial image of fetal abdomen at the level of the liver. The landmarks observed in this plane were the umbilical portion of the left portal vein deep in the liver and the fetal stomach. AC was measured by ellipse method, from outer to outer margin of abdomen. Femur length was obtained from the greater trochanter to

the lateral epicondyle, along the diaphysis excluding the head of femur and distal femoral epiphysis. The average gestational age was calculated by adding gestational age obtained BPD+HC+AC+FL and divided by 4. The standards were taken from Hadlock's chart. The estimated gestational age reading was compared with actual gestational age obtained by New Ballard scoring system.

Results:

In the present study, 82.1% of the patients were in the age group between 20-30yrs, 10% were below 20yrs and 7.54% were more than 30yrs.

There were 33% of cases of gravid 2 and 3, primigravida comprised of 45.9% of the cases. There were only 6.6% of cases of gravida 4. They were placed under three groups, based on their gestational age. Group 1 comprised of cases with gestational age between 37-40wks, Group 2 between 33-36 wks, Group 3 between 28-32 wks. Majority of the cases belonged to late third trimester, while only a few belonged to early third trimester (7.3% Vs 6.6%).

Table 1. Groups of patients according to the gestational age.

Group	Gestational age(Wks)	No. of cases	Percentage
1	37-40	82	77.35%
2	33-36	17	16.03%
3	28-32	7	6.6%
		106	100%

Mean gestational age correlated with the actual gestational age in 46.29% of cases of Group 1, 42.85% of Group 2, 47% of cases of Group 3. There was a mean difference of ± 1 wk in 31.48%, 40% and 35.29% of the cases of Groups 1, 2 and 3 respectively. There was a mean difference of ± 2 wks in 18.5, 11.4% and 11.76% of cases in these groups in the same order. There was disparity of ± 3 wks in lower percentage of cases in all the groups.

Table 2. Mean difference in weeks between gestational age and actual gestational age according to groups.

Mean difference in weeks from actual gestational age	Group 1		Group 2		Group 3	
	No of cases	% cases	No of cases	% cases	No of cases	% cases
Zero	25	46.29	15	42.85	8	47.00
± 1	17	31.48	14	40.00	6	35.29
± 2	10	18.5	4	11.4	2	11.76
± 3	2	3.7	2	5.71	1	5.88
	54		35		17	

In 37.73% of all the cases, the mean gestational age corresponded with the actual gestational age. In 39.6% of all the cases, there was a difference of 1wk and in 13.2% of cases, the difference was 2wks. Hence, with MFGP method 90% of cases had a mean difference within 2wks from actual gestational age.

Mean difference in wks from actual gestational age	No of cases	Percentage
Zero	40	37.73
±1	43	39.6
±2	14	13.20
±3	9	8.49

Discussion :

The study was undertaken in Government Maternity hospital, Kurnool. A total of 106 patients of different parity in third trimester with uncomplicated singleton pregnancy were selected and ultrasonography was performed using fetal parameters. They were followed up till delivery. Gestational age of neonate was assessed using New Ballard or Modified Dubowitz score, which is the most accurate method scoring gestational age in newborn.

In New Ballard Scoring system, there are six neurological criteria to assess the neuromuscular maturity and six external criteria to assess physical maturity. The external criteria is best assessed after birth when the baby is not crying, because crying alters the skin colour. The score is not influenced by the state of the baby or the presence of neurological abnormality and is reliable during the first four hours. The accuracy of gestational age using New Ballard Score is ± 1.02 weeks and 95% of confidence limits ± 2 weeks (Dubowitz and Goldberg).

In late pregnancy multiple variables do reduce the uncertainty of prediction, especially when the measurements are made for the first time in the third trimester (Clinical Ultrasound in OBG). According to studies done by Frank P Hadlock et al, 1987, on a racially mixed population, accuracy of prediction of gestational age with MFP was ± 2.18 weeks at 95% confidence limits. Since the study was carried out on a mixed population, it included cases with different socioeconomic and racial characteristics.

The mean of multiple fetal growth parameters like BPD, HC, AC and FL were used in the present study. In 37.73% the mean gestational age coincided with the actual gestational age. In 39.6% cases there was difference of 1 week and in 13.2% cases there was difference of 2 weeks.

The apparent difference in accuracy of prediction of gestational age in the present study as compared to other workers could be due to smaller number of cases taken for the study and further the exact gestational age was rounded off to the nearest week and not to days.

A degree of patient protection from over reading of ultrasound examination is afforded because technical errors or

minor degrees of individual variation in the head shape or body symmetry of an individual fetus will not change the estimate of gestational age in clinically significant way. Thus it appears that the estimate using multiple fetal growth parameters is both more accurate and precise than a single measurement.

Conclusion:

Using multiple fetal growth parameters, a total of 90% cases had difference within 2 weeks from actual gestational age. So, the estimated mean gestational age was much more nearer to actual gestational age. It is particularly useful in a patient who has reported for the first time during the 3rd trimester and when values of only scan are available. Our values have been found to be significantly lower than Western values and more in congruence with South Indian population. This lead us to conclude that in order to improve the accuracy of prediction of gestational age one should have their own standard values obtained from a population they are dealing with. Hence this study has proved the accuracy and precision of fetal dating by multiple fetal growth parameters.

REFERENCE

1. Charles Hohler 1984. Clinical Obstetrics and Gynaecology Vol.27 No.2 June 1984. | 2. Clinical Ultrasound, a comprehensive text of Obstetrics and Gynaecology 1993, Vol.3 P.220. | 3. Dubowitz and Goldberg, 1970. Gestational age in Newborn, Journal of Paediatrics 1970, Vol.77 | 4. Frank P Hadlock et al – American Journal of Obstetrics and Gynaecology 1987; 157; 955-7, Estimation of fetal age using multiple parameters. | 5. Hadlock F A, Kent W R et al., An evaluation of two methods for measuring fetal head and body circumference. Journal of ultrasound in Medicine: 1982; 1, 359 | 6. Hohler E W, Comparison of Ultrasound femur length and BPD in late pregnancy. American Journal of Obstetrics and Gynaecology 1981. | 7. Rajan R et al; Journal of Obstetrics and Gynaecology, India 35, 1985 | 8. Sabbagha Re Hughey M et al; Growth adjusted sonographic age, a simplified method; Obstetrics and Gynaecology, 1978, 51; 383.