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Comparative Study of Estimated BPD among Pregnant Women in Mosul District

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ABSTRACT

Biparietal diameter is one of the ultrasonic parameters, it is the best used after 12 weeks of gestation, reliable estimated gestational age is imported to predict time of delivery, organ development, maturity& monitor fetal growth. The study sample consist of 405 women attending the outpatient clinic of Al-Butool Teaching Hospital in Mosul city from January 2004 to March 2005, BPD was measured and gestational age was obtained, the mean maternal age was 25.4 years with SD 5.04.There were 135 women primigravidae (33.33%) and 270 women multiparas (66.66%) the average parity was 2.6.The BPD off et uses were measured starting from 15weeks up to 39 weeks depends on the date of last menstrual period. The BPD of each gestation was used to construct growth curve among Iraqi populations in Mosul city & compared with other growth curves, our curve was closely similar to previous study in Mosul city at 1998 & to the study which was done in north of Iraq.

Keywords: Biparietal Diameter, Estimated Gestational Age, Monitor Fetal Growth, Ultrasonic Parameters, Ultrasonography.

1. INTRODUCTION

Accurate assessment of gestational age is very important in every practice. Reliable gestational age and growth assessment has long posed a challenge to obstetrical profession. Estimated gestational age is important to predict the time of delivery, to estimate organ development, maturity in addition to monitor fetal growth [(1)], as well as to detect intrauterine growth retardation at early stage [(2)]. There is an inverse association between the size of an infant at birth and neonatal morbidity and mortality. As a group, infants who are small at birth have higher neonatal morbidity and mortality and worse prognoses than infants who are the appropriate size for their gestational age [(3)(4)]. To identify fetuses who are at greatest risk for poor outcomes at birth, clinicians and researchers have worked to detect small size in utero at varying stages of gestation. Because it is often difficult to identify any cause for a fetus's small size, all small fetuses are usually classified together and considered to have intrauterine growth restriction (IUGR) [(5)(6)].

The average pregnancy is conventionally described as lasting 280 days from the last normal menstrual period with a normal biological range of 266 to 294 days or 38-42 weeks. Accurate assessment of gestational age is an essential component of good obstetric care .Documentation of gestational age not only enables the expectant mother her family and the physician to know when to expect the onset of labor, but also aids in obstetric assessment and management should complications occur [(7)]. Unfortunately women don't always remember the date of the LMP[(8)], or they attend for antenatal care late in pregnancy making their retrospective dating more difficult .Moreover the menstrual history is considered adequate for the purpose of establishing gestational age only if last menstrual history was normal in duration and amount of flow and if prior menstrual periods came at regular intervals& if the patient don't use oral contraceptives within 3 months of their last period [(9)] About 25-45 %of women are unable to provide an accurate menstrual history[(10)(11)(12)]. Ultra sonography allows the direct visualization of the fetus as well as measurement of the embryonic /fetal structures in noninvasive manner [(13)], and compare these measurements with reference standards observed in normal pregnancy [(14)].

A number of ultrasonic parameters have been used to calculate gestational age: crown- rump length [(15)], biparietal diameter [(16)], femur length [(17)], other long bones [(18)],head circumference [(19)], abdominal circumference [(20)],and binocular diameter [(21)].The accuracy of these parameters have been evaluated by a number of investigators .In first trimester crown- rump length CRL which is the distance between two fetal poles (excluding the extremities) is the most accurate

sonographic technique can be used to establish gestational age [15]. Growth of CRL shows a rapid increase doubling approximately every 10 days from 6-10 weeks and it can be seen that the velocity increases by about 1.4 mm per week in this period of pregnancy [22].After that CRL is no longer considered accurate because of flexion and extension of the active fetus [13], so other parameters can be used like biparietal diameter, femur length, head circumference, abdominal circumference etc., but biparietal diameter and femur length are the most widely accepted and simplest mean of fetal parts and measuring gestational age[15]. Biparietal diameter which is the distance between biparietal eminence, was among first obstetric application of ultrasound and it was the first parameter used to assess gestational age early 1960s [23][24]. Also it is the only measurement of the head which can be made independently of the presentation or the degree of flexion or deflection attitude [25].

How To Measure An Early BPD

When the usual cranial landmark was not yet visible or developed the section in which the BPD is obtained is selected by these criteria[26].

- A perfectly symmetrical head.
- A smooth oval shape.
- Largest possible section. Visible choroid plexuses.
- A well-defined midline echo equidistant from both parietal bones.

So when we can see cavum septum pellucidum, the frontal horns, and the occipital horns .the thalamus surrounds the third ventricle this regarded as the normal level for BPD measuring [27].

Kopta reported that a second trimester BPD is as accurate as first trimester CRL in establishing gestational age and estimated date of delivery[16]and a second trimester scanning is among meaning period to determine placental localization, evaluate amniotic fluid volume, exclude congenital abnormality [28][29] and detect multiple gestation, so it is important from both medical and economic stand point [16][30]. BPD varies as a result of racial and socioeconomic difference, maternal disease and fetal growth gradually slows during the third trimester, the dating of fetus by ultrasound may be less accurate as pregnancy precedes through the second and third trimester and found that gestational age accuracy is within +/-1 week from 10-19 weeks +/-2weeks from 20-29 weeks, and +/3weeks from 31-40 weeks [31]. It has been reported that there is no significant difference in BPD between white and black although the mean birth weight of newborns in different population varies with different head sizes and shapes, this may explain partially the variation that have been shown to exist between published biparietal diameter menstrual age graphs in different centers However other study showed that the mean BPD value of Chinese fetuses are lower than the Caucasian [32]. Meire was unable to demonstrate a difference in mean BPD measurement between European and Indian women throughout the pregnancy [14] [22]. Moreover no difference was obtained between Sudanese BPD growth curves and some American and Japanese chart [33]. Other most widely used parameter during the second and third trimester is the measurement of femur [34], it reflects the longitudinal growth of the fetus and it increases from about 1.5 cm at 14weeks to about 7.8 cm at term [35].

Yeh et al. [36]claimed that the fetal femur can predict gestational age between 25-35 weeks with less than 5 days accuracy and within 6 days at the 4th week. While Hadlok et al[17],found that the variability associated with predicting menstrual age from femur length (FL) is +/- 9.5 days between 12-23 weeks and +/-22days between 23-40 weeks. Among the other long bones, the humerus is surely the easiest to measure and the most reproducible .The tibia comes next, and the radius and ulna should be used only when we have confusing results from other methods [14].

2. PATIENTS AND METHODS

The study sample comprised 405 pregnant women attending the outpatient clinic of Al-Butool Teaching hospital in Mosul city who full the following criteria:

1. History of regular menses “28-32 days”.
2. Known L.M.P.
3. No oral contraceptives use in the last 2 months.
4. Singleton pregnancy.
5. No maternal disease known to affect fetal growth.

No detectable fetal abnormality by ultrasound examination.

Only one BPD measurement was made for each pregnant woman making the study truly cross sectional to avoid bias in variability estimates. AllBPD measurements were made by an experienced physician ultrasonographer using Schimdzu sector array time scanner with 3.5 MHz transducer. The method of obtaining the BPD was mentioned previously in the

introduction. BPD was measured at right angle to the echogenic midline. The measurement was made from the outer surface of one wall to the inner aspect of the other (outer to inner).

Gestational age of pregnancy was expressed as menstrual age in weeks plus days after the first day of the last menstrual period. For each week of pregnancy, the number of fetuses were recorded so that the mean and standard deviation of BPD of the observed rates were calculated with their growth rates. The mean BPD in our study was compared with previous study done at 1998 and with another study was done in North of Iraq mean BPD by using t- test for each week of the pregnancy, the difference was considered significant if P-value was below 0.05.

3. RESULTS

The mean maternal age was 25.4 years with SD 5.04 there were 135 women primigravidae (33.33%) and 270 women multiparae (66.66%),the average parity was 2.6. The BPDs of fetuses were measured starting from 15 weeks up to 39 weeks of gestational age depending on the date of the last menstrual period. (Table 1) shows the number of fetuses, their mean BPD, standard deviation and the growth rate for each week of pregnancy. There was a progressive increased in mean BPD through all weeks of gestation, it raised faster in the beginning of the second trimester between 15-18 weeks and there was catch up of growth between 21-25 in which growth was more than 3mm (i.e. the average was 3.35 mm between 21-25 weeks). After 37 weeks of gestation the growth appeared marginally less rapid in a rate of less than 1 mm per week (i.e. the average was 0.8 mm).The growth rate of the rest weeks of pregnancy appeared to be more constant (the average was 2.3 mm). (Figure 1) showed mean growth curves of BPD in Iraqi fetuses in Mosul city. There is a linear increase in mean of BPD throughout all weeks of gestation - Standard deviation of them was changing throughout the pregnancy. The maximum Standard deviation was at 35 week. Table (2) shows comparison between the mean value of BPD of the present study with those of previous study in Mosul at 1998 [37] The mean of BPD of fetuses of present study was higher than mean BPD of fetuses of previous study in 15, 32, 33 and 36 week of gestation only with significant difference between the two groups ($p < 0.05$). Table (3) show comparison between the mean values of BPD of the present study with those of a study was done in North of Iraq [38]. The mean of BPD of fetuses of present study was higher than mean BPD of fetuses of a study of North of Iraq in 16, 18, 24 weeks of gestation only and in 31 week of gestation it was less than that in study of North with significant difference between the two groups ($p<0.05$).

Table 1: Mean BPD fro each gestational week of Iraq in Mosul city

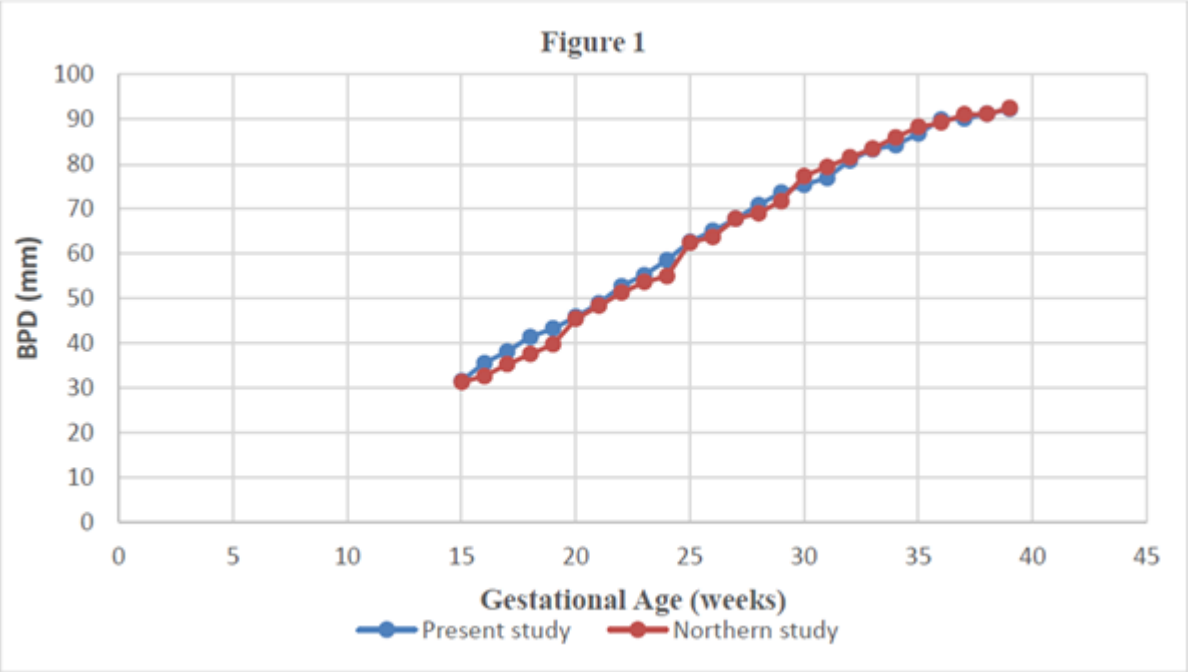
Week	No.	Mean (mm)	SD	Groth rate
15.00	10.00	31.50	1.18	
16.00	11.00	35.54	1.35	4.04
17.00	10.00	38.12	1.57	2.58
18.00	10.00	41.40	1.65	3.28
19.00	11.00	43.26	1.82	1.86
20.00	12.00	45.84	2.18	2.58
21.00	14.00	48.86	1.29	3.02
22.00	7.00	52.70	1.61	3.84
23.00	15.00	55.20	2.48	2.50
24.00	11.00	58.56	1.03	3.36
25.00	19.00	62.65	2.05	4.08
26.00	12.00	65.07	2.11	2.42
27.00	13.00	67.76	1.00	2.69
28.00	18.00	70.83	2.46	3.07
29.00	10.00	73.60	2.72	2.77
30.00	16.00	75.39	1.80	1.79
31.00	15.00	769.00	2.94	1.51
32.00	13.00	80.77	1.88	3.87
33.00	12.00	83.29	2.85	2.52
34.00	30.00	84.27	2.31	0.98
35.00	20.00	86.76	2.97	2.48
36.00	25.00	89.94	1.49	3.19
37.00	27.00	90.21	1.99	0.27
38.00	23.00	91.22	2.07	1.01
39.00	24.00	92.33	2.10	1.12

Table 2: Comparison of BPD in present study and previous study in Mosul for each gestational week

Week	Mean ± SD		Significant (t-test)
	Present study	Previos study	
15.00	31.50 ± 1.18	30.40 ± 0.55	S
16.00	35.54 ± 1.35	34.42 ± 1.78	NS
17.00	38.12 ± 1.57	37.85 ± 1.06	NS
18.00	41.40 ± 1.65	40.38 ± 1.24	NS
19.00	43.26 ± 1.82	42.71 ± 1.25	NS
20.00	45.84 ± 2.18	45.22 ± 1.39	NS
21.00	48.86 ± 1.29	49.00 ± 0.89	NS
22.00	52.70 ± 1.61	52.11 ± 1.36	NS
23.00	55.20 ± 2.48	55.40 ± 1.52	NS
24.00	58.56 ± 1.03	58.22 ± 0.97	NS
25.00	62.65 ± 2.05	61.30 ± 1.19	NS
26.00	65.07 ± 2.11	64.29 ± 1.74	NS
27.00	67.76 ± 1.00	67.66 ± 1.80	NS
28.00	70.83 ± 2.46	70.35 ± 2.45	NS
29.00	73.60 ± 2.72	72.43 ± 1.55	NS
30.00	75.39 ± 1.80	74.57 ± 1.28	NS
31.00	76.90 ± 2.94	77.29 ± 1.46	NS
32.00	80.77 ± 1.88	79.32 ± 1.96	S
33.00	83.29 ± 2.85	81.06 ± 1.84	S
34.00	84.27 ± 2.31	83.00 ± 1.93	NS
35.00	86.76 ± 2.97	86.04 ± 2.45	NS
36.00	89.94 ± 1.49	87.13 ± 2.25	S
37.00	90.21 ± 1.99	89.86 ± 1.93	NS
38.00	91.22 ± 2.07	91.24 ± 2.36	NS
39.00	92.33 ± 2.10	92.61 ± 1.88	NS

Table 3: Comparison of BPD in present study and previous study in Northern Iraq for each gestational week

Week	Mean ± SD		Significant (t-test)
	Present study	Northern study	
15.00	31.50 ± 1.18	31.28 ± 6.61	NS
16.00	35.54 ± 1.35	32.65 ± 3.12	S
17.00	38.12 ± 1.57	35.28 ± 5.65	NS
18.00	41.40 ± 1.65	37.53 ± 5.32	S
19.00	43.26 ± 1.82	39.72 ± 8.30	NS
20.00	45.84 ± 2.18	45.42 ± 4.74	NS
21.00	48.86 ± 1.29	48.34 ± 3.73	NS
22.00	52.70 ± 1.61	51.27 ± 4.98	NS
23.00	55.20 ± 2.48	53.62 ± 4.38	NS
24.00	58.56 ± 1.03	55.00 ± 4.12	S
25.00	62.65 ± 2.05	62.44 ± 3.43	NS
26.00	65.07 ± 2.11	63.74 ± 5.18	NS
27.00	67.76 ± 1.00	67.77 ± 7.51	NS
28.00	70.83 ± 2.46	69.00 ± 5.11	NS
29.00	73.60 ± 2.72	71.74 ± 4.06	NS
30.00	75.39 ± 1.80	77.36 ± 4.30	S
31.00	76.90 ± 2.94	79.39 ± 4.45	NS
32.00	80.77 ± 1.88	81.49 ± 4.44	NS
33.00	83.29 ± 2.85	83.48 ± 5.33	NS
34.00	84.27 ± 2.31	85.97 ± 4.37	NS
35.00	86.76 ± 2.97	88.28 ± 4.17	NS
36.00	89.94 ± 1.49	89.27 ± 4.44	NS
37.00	90.21 ± 1.99	91.11 ± 3.66	NS
38.00	91.22 ± 2.07	91.19 ± 3.54	NS
39.00	92.33 ± 2.10	92.48 ± 4.40	NS



4. DISCUSSION

Sonographic analysis of fetal biometry has been useful in determination of gestational age using different parameters. CRL is the most accurate technique that can be used to establish gestational age in first trimester and determination of BPD during this period has proved less accurate than CRL in estimation of gestational age due to slow growth and greater variability [39]. As it has been reported that gestational age assessment with the use of fetal biometry from 14 -22 weeks is accurate for singleton and even twin and triplet gestations [40]. So in our study we started to measure the BPD from 15 weeks of gestation onward. Although the comparison of data obtained in different centers has its limitation, the technique to determine BPD is now a routine procedure and reliable results are excepted from all major institutions [33] Accuracy of BPD prediction is greatest in the early second trimester where growth rate is most rapid, later in gestation, intrauterine growth retardation, pathological head growth e.g. hydrocephaly, microcephaly and head moulding, This deformation of the head most often occur in non-vertex presentation [41]so these conditions were excluded from our study It has been reported that in a symptomatic low risk pregnant women, single scan in second trimester may be used to estimate gestational age in women with unreliable date [40], and BPD continued to be superior to suspected menstrual history until 36 weeks gestations [11] .More over the BPD measurements were significantly more accurate in gestational age prediction at 89% than were prediction based on menstrual history [11]

As our patients attended during the pregnancy at different gestational age , the various gestations at which the U/S scan done was entirely random and reflected the pattern of the attendance as noticed in this study that most women attended during the last trimester In this study, the growth of BPD was nearly linear throughout the pregnancy with a maximum growth at the beginning of the second trimester between 15-18 weeks and there was catch up of growth between 21-25 in which growth was more than 3 mm (i.e. the average was 3.35 mm between 21-25 weeks) After 37 weeks of gestation the growth appeared marginally less rapid in a rate of less than 1 mm per week (i.e. the average was 0.8 mm). The growth rate of the rest weeks of pregnancy appeared to be more constant (the average was 2.3 mm).

This dramatic reduction in the head growth velocity during the final weeks of pregnancy is very surprising as the brain growth continued unabated even in the presence of sever growth retardation[22]. The growth rate of the rest of the weeks of pregnancy appeared to be more constant. However Campbell found that there was a steady decline in the mean growth rate from 3.43 mm per week at 17 weeks to 1.23 mm per week at 39 weeks [42]. The growth of BPD in Saudi Arabian from 16-27 weeks was 3.1 mm per week and before the 16 weeks the growth was slightly less, after 27 weeks the growth rate decreased continuously until it reached less than 1mm per week after 39 weeks [33].

In a study 1996 it was reported that the rate of fetal head as presented by BPD was maximal in a late trimester with a gradual reduction in velocity toward term [43]in our study the mean standard deviation was 1.95 mm less than those reported by Hern whose mean SD was 5.7 mm [44]. However Campbell reported SD which were smaller, their value ranged from 2.3-3.5 mm[42] These differences among SD may be due to the fact that some author used more than one examination per patient when constructing the growth curves and also the homogeneity of studied population may have been different The SD of a BPD at a certain point of pregnancy may give some information about the variability of this parameter in the population In the present study SD did not show a systematic increase and the greatest SD was found

to be at 35 week gestation. Campbell found that SD at the mean BPD was increased gradually from 30 weeks till term [42] Growth pattern of fetal BPD in our study was compared to previous study done in Mosul at 1998 [37] No significant difference was observed between 16-31 weeks except in 15, 32, 33 and 36 weeks and also compared to the study done in North of Iraq and no significant difference except in 16, 18 ,24 ,and 31 weeks .However the mean BPD in our study was significantly of lower value compared to those mean BPD reported by Campbell in British population. Other studies could not demonstrate a difference in BPD between European and Asian Groups [22] [11]. The BPD growth curve obtained in Saudi Arabian was almost identical to the Japanese and some Americans curves [33]

The rate of growth of PBD was comparable between West Indies population and French population [45]however other study reported that the BPD growth in the third trimester in Bengali fetus was found to be slightly slower than in Caucasian women in the same trimester [46], and the mean BPD value of the Chinese fetuses were lower than Caucasian[32]. A study compared the BPD growth of Negro to white gravies of similar socioeconomic status and did not found significant difference between these two groups [47]however it has been found that the BPD growth curve for the black population was significantly different from the white population at the 28 weeks onward[47].Furthermore, fetal race difference could account for some degree of error in ultrasound estimation of gestational age [44].

The variability in ultrasonographic estimation of gestational age may be related to technical error or individual growth curve [33], or may be related to ovulation even in regular cycle with 28- 30 days as the length of follicular phase contribute approximately one week to the confidence interval of fetal age [33]. It has been reported that there is ahigh correlation between individual growth rate and the start of growth of both CRL and BPD. This might imply that afetus with an impeded start of growth generally has a higher growth rate, which could be called an “early pregnancy catch up growth". This individual variation of starting time of gestational age in early pregnancy [45]

CONCLUSION

The absent of difference between our mean BPD and previous study in Mosul encourages us to depend on our normal range of BPD of Iraqi fetuses. This study is a limited one and it could be followed by other studies including large number of populations.

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