Biparietal Diameter: Significant Gender Difference is present in later weeks of Gestation

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Objective: Objective of this study was to find the presence and significance of difference in biparietal diameter values of male and female fetuses of local population at 35 weeks of gestation. **Material & methods:** Study was conducted at Lahore General Hospital, and partly in Sir Ganga Ram Hospital/Fatima Jinnah Medical College, Lahore, Pakistan in the year 2005. Outer to inner biparietal diameter in 60 normal singleton fetuses was measured at 35 weeks of gestation. Among them 30 fetuses were male and 30 females. All had comparable values of femur length and fetal abdominal circumference. Mean BPD and standard deviation were calculated for the total, male and female groups separately. **Results:** Mean BPD in total 60 patients was 87.1mm, SD2.6. Mean BPD of male group was 88.4mm, SD2, while that of female group was 85.9mm, SD2.4. Lower limit of 2SD range was accordingly different. When lower 2SD limit of male group was used, significant ($P<0.05$) number (23%) of female fetuses showed BPD<2SD. Using common mean and SD, 13% females showed BPD<2SD, while use of female specific mean and SD showed normal distribution. **Conclusion:** Biparietal diameter values at 35 weeks of gestation are significantly different in fetuses of each sex. Mean BPD of female fetuses at 35 weeks is 2mm shorter than mean BPD of male fetuses of same age. Male fetuses have a relatively narrow range of normal BPD; and this parameter can be used in males for reliable estimation of gestational age. Females have relatively wider range of normal BPD. Female BPD seems to be responsible for wider range of common nomograms. This parameter alone should not be used for age estimation or diagnosis of small for dates, or microcephaly, in later weeks of gestation in females. Gender specific BPD nomograms may improve the prenatal assessment of fetal growth and structural anomalies.
Key Words: Biparietal diameter (BPD), Microcephaly, small for dates, intrauterine growth retardation (IUGR).

It was observed by the authors during antenatal ultrasound examinations that biparietal diameter (BPD) values of female fetuses are commonly found to be less than expected for that gestational age. While at the same gestation BPD values of male fetuses corresponded well to the used nomogram[1]. This difference increases along with increasing gestational age and becomes more obvious in late third trimester. Objective of following study was to find significance of this observation.

Smaller BPD may signify presence of intrauterine growth retardation, small for dates baby, or microcephaly.

However, our study suggests that slightly smaller BPD may be normal finding in the female fetuses of local population during later weeks of gestation.

Material and method

Study was conducted at Radiology Department of Postgraduate Medical Institute/ Lahore General Hospital, Lahore and partly in Fatima Jinnah Medical College/Sir Ganga Ram Hospital, Lahore, Pakistan. Study was started in January 2005 and completed towards the end of the same year. Total 60 pregnant ladies with normal singleton pregnancy were included. Among them, 30 were having male and similar number having female fetuses. All ladies were having pregnancy of 35 weeks ± 5 days of gestational age. Femur length of all fetuses was in range of 66-70mm. Fetal abdominal circumference was in range of 29-32cm.

Patients having diabetes, hypertension and any sign of intrauterine growth retardation were not included in study. Fetuses lying transverse or in breech position were also excluded from study. 3.5MHz convex ultrasound probe was used. BPD was measured in transverse section at the level of thalami. Reading was taken keeping near curser outside of bone, and second curser at inner margin (outer to inner). All the pregnancies were followed up to 1st week after delivery.

Results

Mean BPD of total 60 fetuses was 87.1mm, SD2.6. Mean BPD of male fetuses was 88.4mm, SD2, while that of female fetuses was 85.9, SD2.4. Since there was difference in mean and SD of each group, 2SD range was also affected.

Normal 2SD Range of BPD

- Total 60 fetuses 82-92 mm. (10mm)
- Male group 84.4-92.4 mm. (8mm)
- Female group 81.1-90.7mm. (9.6mm)
- Using female group range, only two female fetuses had BPD less than 2SD.
- Using the range of combined population, four (13%) female fetuses had BPD<2SD. While according to male BPD range, seven female fetuses (23%) had a BPD <2SD. Using chi-square test, this was found to be statistically significant ($P<0.05$).

Table 1: Chi square test: Application of male BPD on female fetuses (n=60)

Fetal gender	BPD within 2SD of male group	BPD<2SD of male group
Male	29	1
Female	23	7

$X^2 = 5.2$ $P < 0.05$

This table shows that if BPD chart designed for male fetuses is applied on female population, significant ($P<0.05$) number of normal female fetuses will be labeled as having abnormal BPD. This indicates that separate charts should be used for each sex.

Table 2: Distribution of biparietal diameter in each sex, at 35 weeks of gestation.

BPD MM	No. of Male Fetuses	No. of Female Fetuses	Total
81	0	2	2
82	0	2	2
83	1	0	1
84	0	3	3
85	1	5	6
86	2	5	7
87	6	5	11
88	7	3	10
89	5	5	10
90	2	0	2
91	4	0	2
92	2	0	2
Total	30	30	60

Discussion

BPD is routinely measured at 12 weeks and more of gestational age. It is one of parameters used extensively for estimation of fetal age and growth. Various nomograms are available for BPD values[1].

Nomograms vary between populations[2,3]. New charts for assessing gestational age based on fetal biometry are notably different from charts presently in use[4]. In many other studies fetal sex was found to have significant influence on values of biparietal diameter, head circumference and femur length[5]. Small but consistent sex related differences in prenatal BPD and Head circumference are established by as early as 15 weeks of gestation[6]. Studies comparing BPD and femur length show that femur is more reliable index of third trimester gestational age prediction than biparietal diameter. BPD showed poor correlation after 32 weeks of gestation[7].

Since BPD values are affected by multiple factors, complex charts are required for interpretation. Only two phase models computed independently for males and females are appropriate to describe fetal head growth[8]. Even sex-specific charts may not allow the recognition of a substantial number of fetuses affected by late onset microcephaly[9].

Our study was aimed to some what simplify BPD interpretation for practical use during antenatal scan of local population. Significant number of ladies in our community do not remember last menstrual period exactly. Also a significant number suffers malnutrition and poor antenatal medical care. Most obstetricians are dependant on antenatal ultrasound for determination of gestational age.

Therefore it is required that fetal age determined by ultrasound should be as accurate as possible. Fetal age estimation using any single parameter like BPD, HC, FL, & FAC is not reliable, especially during third trimester of pregnancy. However an average calculated using multiple parameters becomes more reliable. Our study suggests that normal BPD range is wide if common chart is used for male and female. Therefore BPD will not add significantly to age determination during third trimester. However if gender specific chart is used, age estimation by BPD may become more reliable. This will be especially useful for males, where normal range was found to be narrow.

In the female fetuses, normal range of BPD was relatively wide, and it correlated poorly with gestational age.

When common chart was applied, gender difference was not obvious. However, when separate mean and SD was calculated, and male chart was applied to female population, gender difference became obvious and statistically significant ($P<0.05$).

Our study was confined to gestation of 35 weeks ± 5 days and number of patients was relatively small (60). However, study suggests that separate BPD nomograms are required for fetuses of each gender. Use of sex specific nomograms may improve prenatal assessment of fetal growth as well as diagnosis of structural abnormalities. (6). Normal range of female BPD was wider, and that of male BPD was relatively narrow. Most likely it is the variation in the BPD of female fetuses along with their slight difference from male, which is responsible for a wider range of normal, when combined mean and SD are calculated.

All the babies were born with normal birth weight. No case of microcephaly was seen in study population. We can suggest that relatively smaller BPD in later weeks of gestation in a female fetus of local population may be normal finding. It does not signify presence of IUGR, or microcephaly unless gross and associated with other findings. In such fetus BPD value is not reflective of actual gestational age, and should not be used in average calculation. Femur length and other biometric values should be used for interpretation of such pregnancies.

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