

MEAN DIFFERENCE OF TRANSCEREBELLAR DIAMETER ON ULTRASOUND IN THIRD TRIMESTER OF PREGNANCY: USEFUL INDICATOR OF GROWTH RETARDATION

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ABSTRACT

OBJECTIVES: To determine the mean difference of Transcerebellar diameter between normal and growth restricted fetuses as a useful indicator of growth retardation. **STUDY DESIGN:** Cross sectional study. **STUDY PLACE AND DURATION:** Department of Obstetrics & Gynaecology in collaboration of Department of Radiology, Sir Syed Hospital Karachi, a private tertiary care center. Over six months from 15th June 2016 to 15th December 2016. **PATIENTS AND METHODS:** Total 120 pregnant women were recruited in the study referred for ultrasound scan between 28-40 weeks of gestation during the antenatal period (60 normal fetuses and 60 growth restricted fetuses) were included. All the observations included maternal age, parity, history of any medical disorder, gestational age, last menstrual period, ultrasonographic findings (i.e. Normal growth or IUGR) and transcerebellar diameter were recorded on proforma. SPSS version 20.0 was used for data analysis. All continuous response variables like maternal age, gestational age, parity and transcerebellar diameter were presented as Mean \pm SD. Unpaired T-test was applied to see mean difference of maternal age, parity, gestational age, transcerebellar diameter between normal and growth restricted fetuses. **RESULTS:** Overall mean maternal age was 28.61 ± 4.72 years and mean gestational age was 33.8 ± 2.93 weeks. Mean transcerebellar diameter of fetus by scan of Normal group was 34.40 ± 3.70 cm and 32.93 ± 2.47 cm of IUGR group ($p=0.012$). In the gestational age 37-40 weeks, mean TCD 36.11 ± 1.537 of IUGR group was less than 38.93 ± 2.086 of normal growing fetus group ($p=0.001$). Pearson's correlation ($r=0.892$) between TCD and actual gestational age. The correlation between gestational age and TCD in normal growth fetus was $r = 0.876$ and in IUGR group was $r = 0.901$. **CONCLUSION:** Measurement of TCD with expert hands is a useful indicator of growth retardation with regards to strong correlation between TCD & GA and mean difference of TCD of normal growth versus intrauterine growth restricted fetuses, particularly in gestational age group 37-40 weeks.

Keywords: Transcerebellar diameter, growth retardation, gestational age, biometric measurement, ultrasound.

Introduction

Forecasting fetus appropriateness for gestation on sonographic parameters following the anomaly scan in 2nd trimester typically between 20 to 25 weeks is considered an important concern in latest obstetrics.^{1,2} An approach of the numbers 7, 3 and 10 refers this scan where, the number "7" indicates steps of the procedure, number "3" to sight three anatomical structures in each plane and "10" is the maximum

limit of normal for measurements of lateral ventricles, cistern magna and renal pelvis.³

Doppler ultrasound in high-risk conditions abridged the risk of worsen prenatal outcome.⁴ On time detection of the IUGR is essential, as it instigates with assessment of risk factor(s), sonographic accurate measurements of biometry confirms an estimated fetal weight (EFW) of <10th percentile of the growth chart.⁵⁻⁷

In most of the cases, recall of the last menstrual

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dates is also a barrier in the measurement of accurate gestational age. Traditionally, bi-parietal diameter (BPD), head circumferences (HC), abdominal circumferences (AC) and femur length (FL) were considered common ultrasonically measured biometrics for establishing gestational age.⁸⁻¹⁰

Fetal transcerebellar diameter (TCD) is considered superior in predicting gestational age in both singleton and twin pregnancies, since cerebellar size is likely unaffected by fetal number.¹¹ Transcerebellar diameter is the distance between lateral aspects of the cerebellum and incorporates the width of cerebellar vermis cerebellum grows progressively along with gestational age at any trimester.⁴

In a local study based on ultrasound biometric measurement training demonstrated that sonography apprentices in a limited resource set up may provide satisfactory TCD measurements in late pregnancy after a brief demo with hands-on practice.¹² The measurements of TCD had a comparable correlations with gestational age in the agreement of formerly reported nomograms before 28 weeks, however significant differences occurred in predicting gestational age after 33 weeks,¹³ that reveals to monitor the appropriateness for gestation into various cohorts based on actual gestational age.

The objective of this study was to determine the mean difference of Transcerebellar diameter between normal and growth restricted fetuses in order to establish a new and effective measurement criterion for prediction of IUGR and useful estimation of gestational age in a set up of limited resources which will be helpful in cases of forgotten dates, small for gestational age fetuses and IUGR and timely delivery can be planned.

Patients and Methods

Total 120 pregnant women were recruited in the study from Obstetrics & Gynaecology Department of Sir Syed Hospital, Karachi who were referred to its Department of Radiology for ultrasound scan between 28-40 weeks of gestation during the antenatal period (60 normal fetuses and 60 growth restricted fetuses) were included. Those women whose dates were not confirmed by the presence of early scan, twin pregnancy, gestational diabetes mellitus or fetal CNS

anomalies like hydrocephalus, anencephaly and any other abnormality of brain developing were excluded from the study.

After taking informed consent, the consultant radiologist was unaware of early dating scan notes and gestational age or L.M.P of that woman before taking the transcerebellar diameter. The radiologist was unaware about the gestational age by dates and by early ultrasound and fetal diameters were taken including biparietal diameter (BPD femour length (FL), abdominal circumference (AC) and transcerebellar diameter (TC). Gestational age based on first three parameters was calculated by the machine by using US scanner GE logiq alpha 100 with 3.5 MHz transducer and recorded.

Transcerebellar diameter was the distance between lateral aspects of the cerebellum and incorporates the width of cerebellar vermis, were measured thorough ultrasound.

The consultant radiologist then correlated the transcerebellar diameter with gestational age according to early ultrasound this was documented in the patient's file. Either normal growth or intrauterine growth retardation was confirmed by the consultant obstetrician having > 10 years of obstetrical practice. Intrauterine growth retardation (IUGR), which was defined as less than 10 percent of predicted fetal weight based on the measurements of head circumference, abdominal circumference and femur length. These measurements were plotted on a preexisting standardized chart for gestational age (The date of the last menstrual period).

All the observations included maternal age, parity, history of any medical disorder like diabetes mellitus, hypertension and ischemic heart disease, gestational age, last menstrual period, ultrasonographic findings (i.e. Normal growth or IUGR) and transcerebellar diameter were recorded on research proforma. SPSS version 20.0 was used for data analysis. All continuous response variables like maternal age, gestational age, parity and transcerebellar diameter were presented as Mean \pm SD. Unpaired T-test was applied to see mean difference of maternal age, parity, gestational age, transcerebellar diameter between normal and growth restricted fetuses. Pearson's correlation coefficient was calculated to measure the correlation between TCD & GA and presented in a scatter plot. Regression equation was derived as

$Y=a+bx$ following 'a' as intercept and 'b' as slop of the equation where Y represented gestational age (GA) and X represented transcerebellar diameter (TCD). A p-value ≤ 0.05 was considered statistically significant result.

Results

Overall mean maternal age was 28.61 ± 4.72 years and mean gestational age was 33.8 ± 2.93 weeks. Mean age of mothers in normally growing fetus was 28.04 ± 4.02 years and of IUGR group was 29.1 ± 5.23 , that reveals insignificant difference of mean maternal age between two groups ($p=0.111$).

Overall average parity was 1.09 ± 1.22 . The average parity in normal growth group was 1.2 ± 1.3 that was not statistically similar as compared with the average parity 1 ± 1.1 of IUGR group ($p=0.331$). Almost half of number of women in both groups were primiparous i.e. 50% in IUGR and 41.7% in normal growth group. About 22% of normal growth and 15% of IUGR group mothers had para 1. Maximum parity was para 4 which was seen in 6.7% women of normal and 1.7% women of IUGR group. Almost statistically consistent difference of proportions was seen in normal versus IUGR groups with regards to the parity ($p=0.490$). Mean gestational age in normal growing group was 33.98 ± 3.08 weeks that was not statistically significant as compared with the gestational age of IUGR group 33.68 ± 2.80 weeks ($p=0.577$). The commonest gestational age group in both the study group was 33-36 weeks.

Mean transcerebellar diameter fetus by scan of Normal group was 34.40 ± 3.70 cm which was significantly higher with the mean transcerebellar diameter 32.93 ± 2.47 cm of IUGR group ($p=0.012$). The TCD was compared with regards to the stratification of gestational age into three groups. Mean TCD was significantly higher in the gestational age group 37-40 weeks (Tab. 2).

There was found significantly strong correlation $r=0.892$ between TCD and actual gestational age. The correlation between gestational age and TCD in normal growth fetus was $r = 0.876$ and in IUGR group was $r = 0.901$ reveals significant positive correlation between gestational age and TCD ($p=0.001$). The scatter plot has shown a clear demarcation of TCD

in relation with gestational age of IUGR versus normally growing fetuses (Fig. 1). The regression equations of TCD and gestational age were thus derived as $GA = 13+0.6 (TCD)$ in normal growing fetuses and $GA = - 5.6+ 1.2 (TCD)$ in growth restricted fetus group.

Growth parameters	IUGR	Normal growth	p value
Transcerebellar diameter on scan	32.93 ± 2.47	34.40 ± 3.70	0.012
Gestational age (weeks)	33.68 ± 2.80	33.98 ± 3.08	0.577

Table 1: Comparison of gestational age & TCD between IUGR and normal growth group.

Gestational age (weeks)	Transcerebellar diameter on scan				p value
	n	IUGR	n	Normal growth	
28-32	22	30.55 ± 1.371	22	31.00 ± 2.024	0.388
33-36	29	33.76 ± 1.527	23	34.70 ± 2.077	0.067
37-40	9	36.11 ± 1.537	15	38.93 ± 2.086	0.001

Table 2: Comparison of TCD between IUGR & normal growing fetuses in relation to the gestational age stratifications

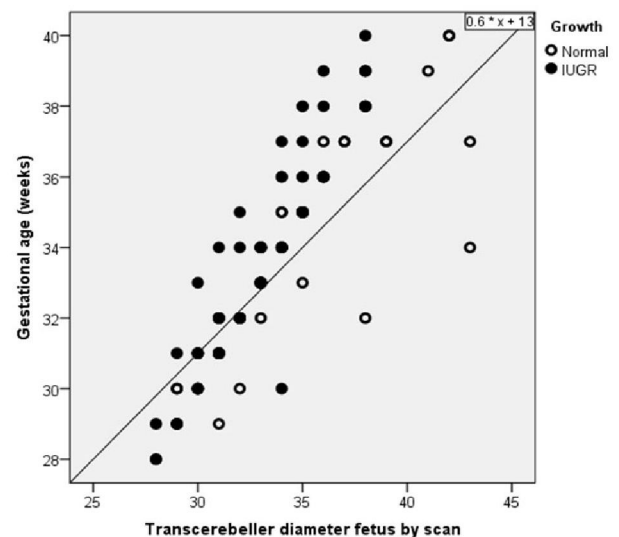


Figure 1: Correlation between gestational age and TCD in IUGR and normal growth fetuses.

Correlation between gestational age and TCD in normal growth fetus was $r = 0.876$ and in IUGR group was $r = 0.901$ reveals significant positive correlation between gestational age and TCD ($p=0.001$).

Discussion

In the present study, the preexisting standard procedures were accumulated to encounter an accurate and easily reproducible ultrasound fetal biometry

parameter for gestational dating required for the management of pregnancies, especially in determining time of variety of gestational test assessing adequacy of growth and timing of delivery.¹¹ Our study have shown significant difference of mean TCD between normal & IUGR fetuses ($p=0.012$), particularly for the gestational age group 37-40 weeks and strong positive correlation between gestational age and TCD ($r=0.892$). Substantially stronger correlations between TCD and GA were also reported by Sharma et al¹⁴ ($r=0.962$), Bhimarao et al⁸ ($r=0.9946$) and Holanda-Filho et al¹⁵ ($r=0.97$, $p<0.001$), however less stronger than ours reported by Takano et al¹⁶ ($r_s=0.766$, $P<0.0001$).

In agreement of the present study, Bansal et al¹⁷ reported strong positive correlation between TCD & GA ($r = 0.9686$). One-way ANOVA reveals significant mean difference of TCD in IUGR group were 28 ± 1.87 for 25-28 weeks, 34.47 ± 1.68 for 29-32 weeks, 40.54 ± 3.01 for 33-36 weeks and 45 ± 0.82 for 37-40 weeks ($p<0.01$). Our study has greater worth over this study due to its cross sectional design for comparison between IUGR and normal growth fetuses groups. TCD measurements had a similar relationship with gestational age across previously published nomograms before 28 weeks. Significant differences occurred in predicting gestational age after 33 weeks, which reveals in agreement of our study results that mean TCD was significantly higher in the gestational age group 37-40 weeks.¹³

Contrarily to our study, Hagmann et al¹⁸ reported no correlation between GA or gender and TCD but there was a strong correlation with HC, author identified the justification by the narrow range of gestational age i.e. ≥ 36 weeks or some inaccuracy in the estimate of GA. The additional feature they have shown was the difference of TCD between the genders however, this difference was also not significant.

There was a lacking in our study that we could not document the fetal genders and compare the mean TCD in relation to the gender of fetus however, a study¹⁵ suggests TCD fetal ultrasound as a predictive biometric parameter of gestational age independent of fetal gender in the last two trimesters of a pregnancy based on regression equations. But a significant linear correlation was also observed for both males ($r = 97.0\%$; $p < 0.001$) and females ($r = 96.9\%$; $p < 0.001$). Joshi et al¹³ reported a considerable difference in

predicted gestational age in 3rd trimester by using nomogram while difference of mean TCD at 95% confidence interval was 4-6 mm between 29-32 weeks and of 7-11 mm after 33 weeks. Prasad BS et al¹⁹ reported the results of 100 pregnant women (80 normal and 20 IUGR pregnancies) between 15 to 40 weeks of gestation and showed that in 17/20 patients the TCD measurements were within the normal range and only in 3 patients it was less than 5th percentile. In a local study done by Khan et al, the ratio of TCD/AC was used as predictor marker for growth retardation, they found a raised TCD/AC ratio in 15/30 patients (50%) as following 10th percentile of nomogram value.²⁰ The experience and skills of sonographer also matters in the accuracy measurement of biometric measurements as marker for estimation of gestational age.²¹⁻²² Therefore, in the study of Naqvi et al¹² about the training session to evaluate concordance, 3 trainees and 1 trainer independently obtained two measurements of the fetal biometrics measurements including TCD. They reported self-reported confidence in obtaining TCD measurements increased following the training ($p=0.002$).


In a recent local study²³ on the same model, mean TCD was reported statistically insignificant such that 35 ± 3 mm in normal growing fetuses and 33.9 ± 2.1 in IUGR ($p=0.221$) however they showed a positive correlation between TCD and GA. An important feature of this study is either missing or unseen that the range of actual gestational age not described and TCD average difference in various stratum based on gestational age were not compared neither correlation coefficient exhibited along with correlational chart.

Thus, it is concluded that measurement of TCD with expert hands is a useful indicator of growth retardation with regards to strong correlation between TCD & GA and mean difference of TCD of normal growth versus intrauterine growth restricted fetuses, particularly in gestational age group 37-40 weeks.

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