



**ORIGINAL RESEARCH PAPER**

**Radio-Diagnosis**

**ACCURACY OF FETAL KIDNEY LENGTH AND  
TRANSCEREBELLAR DIAMETER IN  
DETERMINATION OF FETAL GESTATIONAL  
AGE IN MID TRIMESTER IN HEALTHY WOMEN**

**KEY WORDS:** Biometry, Ultrasonography, Last Menstrual Period, Gestational Age

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**ABSTRACT**

Accurate assessment of gestational age (GA) is pivotal to provide good quality maternity care. Reliability of routinely used ultrasonographic biometric parameters like Biparietal diameter (BPD), Head circumference (HC) and Femur length (FL) decrease with increasing GA. Fetal kidney length (FKL) and transverse cerebellar diameter (TCD) have been shown to strongly correlate with GA in 2nd and 3rd trimester. The present study was conducted on 150 pregnant women at 20 weeks of gestation to evaluate the role of FKL and TCD in estimation of GA and compare their accuracy with other established biometric indices. The GA of the included women was confirmed by early dating scan and exact Last Menstrual Period (LMP). BPD, HC, FL, FKL and TCD were calculated in millimetres (mm) and GA was calculated by using these parameters individually. Standard deviation and standard error of the GA calculated at 20 weeks was lesser for TCD and FKL than BPD, HC and FL with p values of 0.01636 and 0.0129 respectively. It was also observed that values of TCD and FKL in mm correspond to GA in weeks. So it was concluded that FKL and TCD can be used as an individual parameter in estimating GA in mid trimester in patients presenting for the first time with uncertain dates, lack of early dating scan or with IUGR.

**INTRODUCTION**

Accurate assessment of gestational age (GA) is extremely important in obstetrical management. Last menstrual period (LMP) has been a reliable parameter for estimation of gestational age but Garg A et al [1] suggested that 30% of women cannot recall the exact date of LMP. The mean gestational sac diameter and crown-rump length (CRL) are reliable parameter for estimation of gestational age in first trimester [2]. Uncertainty of dates and no ultrasonography (USG) done in first trimester creates a problem in accurate estimation of GA which can affect management decisions leading to iatrogenic pre or post maturity.

USG fetal biometry is the most widespread method to establish GA. Biparietal diameter (BPD), Head circumference (HC), Abdominal circumference (AC) and Femur length (FL) are the sonographic parameters which are generally used in 2nd and 3rd trimesters for estimation of GA. The reliability of these parameters decreases with increase in GA [3]. These routine biometric parameters are also affected in conditions like IUGR. Many other sonographic parameters which are routinely used for estimation of GA are fetal Transverse Cerebellar Diameter (TCD), Fetal Foot Length, Fetal Kidney Length (FKL), epiphyseal ossification centres and amniotic fluid volume. FKL and TCD are strongly correlated to GA [4,5]. Both these parameters are more accurate method of estimation of gestational age as seen in previous studies [4,5]. In the current study, we evaluated the role of TCD and FKL in estimation of GA and compared their accuracy with other established biometric indices at 20 weeks of gestational age.

**MATERIAL AND METHODS**

This prospective study was conducted in the radiology and obstetric department in a tertiary care institute for period of one year from January 2019 to January 2020. 150 women with singleton normal pregnancies who were certain of their LMP's and whose pregnancies were accurately dated by an early dating scan were included in the study after counselling and informed consent. The women included in the study were

registered, had routine antenatal checkups and investigations and underwent fetal biometry (FKL and TCD at 20 weeks of pregnancy). Cases of oligohydrominos or polyhydrominos, dilated renal pelvis (>4mm), chromosomal and congenital anomalies, abnormal renal morphology, obscure renal borders, multiple pregnancies, gross maternal obesity, gestational diabetes mellitus or early onset preeclampsia were excluded from the study.

TCD was calculated as the maximum diameter between the cerebellar hemispheres on axial scan. The value of TCD is measured in millimetres. FKL was taken as a bipolar measurement cautiously excluding the adrenals. Kidneys were identified first in transverse section just below the level for measurement of AC and then the probe was rotated longitudinally till full length of kidney was identified. An average of 3 measurements of the right kidney was recorded as final measurement in millimetres. The measurements were performed using grey scale real time USG scanners with 3.5-5 MHz curvilinear transducer. Appropriate statistical analysis was done. ANOVA test was applied and p-value was calculated.

**RESULTS**

Women included in the study were seen in the age range of 21-38 years. Maximum number of women were in the age range of 27-32 years (58%) followed by 26% in the age range of 21-26 years and 16% in 33-38 years age group. Majority of the patients were primigravide (64%) followed by multigravide (36%).

Table 1 shows mean, standard deviation (SD) and standard error (SE) of the GA age estimated by using various parameters i.e BPD, HC, FL and FKL. SD and SE for GA estimated by FKL was lesser as compared to other parameters. On applying ANOVA test for FKL, BPD, HC and FL, p-value observed was 0.0129 which was significant.

Table 2 shows mean, standard deviation (SD), standard error

(SE) of the GA estimated by using various parameters i.e BPD, HC, FL and TCD. SD and SE for GA estimated by TCD was lesser as compared to other parameters. On applying ANOVA, test for TCD, BPD, HC and FL, p-value observed was 0.01636 which was significant.

Table 3 shows the mean, SD and 95% confidence interval (CI) of various parameters used for estimation of GA. 95% CI and SD for TCD and FKL was lesser than the others parameters estimated. Also it was observed that TCD and FKL in mm correspond to the GA of the fetus.

**DISCUSSION**

Accurate estimation of GA is required in prenatal medicine, while planning for termination of pregnancy due to complications in high risk cases like Preeclampsia, IUGR, and Gestational DM. Accurate estimation of GA is also required for planning fetal investigation and fetal therapy [6]. Availability of exact LMP and measurement of gestational sac and crown lump length done in early trimester can give exact gestational age. Measurement of GA using ultrasonographic parameter like BPD, HC, AC and FL is routinely done in 2nd and 3rd trimester. But these parameters are not as reliable as parameters used in 1st trimester and their reliability decreases as pregnancy advances [5]. Moreover these parameters are affected by conditions like IUGR. So search remains for a method of dating pregnancy that is simple, easy to define and reproducible. FKL and TCD are two such parameters Growth variations in the fetus affects all organs including the kidney but only in the Antero-Posterior & transverse diameter and not length [6,7]. Seilanian Toosi F et al [8] has also observed in their study that FKL is an accurate parameter for estimation of GA in late pregnancy. Fetal kidney length constantly increases at the rate of 1.7 mm fortnightly throughout pregnancy and remains unchanged by growth disorders in length [9] which makes it more reliable than other parameters in complicated pregnancies. Measurement of FKL provides an obvious advantage where there is difficulty in measuring BPD, HC, FL, AC and TCD due to conditions like achondroplasia, phocomelia, fetal hepato-splenomegaly, cranial agenesis, cerebellar hypoplasia and anencephaly. In such conditions FKL can be used on its own to estimate GA accurately.

The FKL measurements in our study are comparable with study by Bardan J et al [10]. In our study we found that FKL can be a better predictor of GA as compared to BPD, HC and FL as evidenced by least standard deviation and standard error of FKL and p-value of 0.0129 at 20 weeks of pregnancy. Kaul I et al [6] also advocated that the single most accurate parameter for estimating GA is the FKL. Kiran L et al [11] in their study determined that FKL correlated well with GA estimated from standard fetal biometry and can be used as an independent parameter in estimation of fetal GA. Das SK et al [12] concluded that FKL showed a strong correlation with GA compared to other conventional parameters and can easily be included in routine obstetric scan to enhance the accuracy of GA measurement and in cases where conventional parameters are difficult to obtain.

Growth variations in the fetus affect all organs except TCD as evidenced by Dashottar S et al [13]. Measurement of TCD provides an obvious advantage in cases where these parameters (BPD, HC, FL and FKL) cannot be measured like in cases of IUGR, fetal hepatosplenomegaly, polycystic disease of kidney, atrophic kidney, hydronephrotic kidney, multicystic dysplastic kidney etc. The TCD measurement in our study is comparable with Dashottar S et al [13]. In this study, we found that TCD is a better predictor of GA at 20 weeks of pregnancy than BPD, HC and FL as evidenced by least SD and SE and p-value of 0.01636. Pavithra SN et al [5] in their study suggested that fetal TCD on ultrasound is a reliable predictive biometric parameter of gestational age. Luiz N et al [14] in their study found that TCD to be more consistent with GA as compared to

other biometric parameters. Rajendra TM [15] in their study concluded that TCD is an accurate parameter in estimation of gestational age in second and third trimesters and its values are in close relation with that of GA by LMP. Eze CU et al [16] also concluded that the sonographically measured TCD was more accurate as a single estimator of GA than BPD, HC, AC, and FL in the late stages of pregnancy in their study.

From this study we found that FKL and TCD are two USG parameters which can be used for estimation of GA in cases where LMP is uncertain, no availability of early dating scan, in conditions where routine parameters are affected like IUGR, and in condition where these cannot be measured. Moreover FKL is beneficial in condition where TCD is affected like cerebellar hypoplasia and anencephaly and TCD is beneficial in conditions affecting fetal kidney.

The limitation of the present study was the limited size of population. Studies with larger population size are required to improve the accuracy of the values which are obtained.

**CONCLUSIONS**

Ultrasonographic parameters like FKL and TCD are the parameters which can be used individually or in combination with other routine USG parameters for estimation of GA in patients with uncertain dates and lack of early dating scan presenting in mid trimester for the first time.

**TABLES**

**Table 1: Mean GA (weeks), standard deviation and standard error calculated by using various parameters (BPD, HC, FL and FKL) individually**

PARAMETER	MEAN GA (WEEKS)	SD (Standard Deviation)	SE (Standard Error)	P value=0.0129
BPD	19.22	1.05	0.19	
HC	18.49	3.264	0.59	
FL	19.09	1.051	0.19	
FKL	20.04	0.328	0.05	

**Table 2: Mean (weeks), standard deviation and standard error of gestational age calculated by using various parameters (BPD, HC, FL and TCD) individually**

PARAMETER	MEAN GA (WEEKS)	SD (Standard Deviation)	SE (Standard Error)	P value=0.01636
BPD	19.22	1.05	0.19	
HC	18.49	3.264	0.59	
FL	19.09	1.051	0.19	
TCD	20.004	0.3618	0.06	

**Table 3: The mean (mm) and 95% confidence interval of various ultrasonographic biometric parameters at 20 weeks of gestation**

PARAMETER	Mean ( mm ) ± SD	95% CI
BPD	47.07±7.07	47.07±2.53
HC	176.13±16.96	176.13±6.07
FL	31.89± 3.39	31.89±1.019
FKL	20.16±0.531	20.16±0.19
TCD	20.15±0.52	20.15±0.187

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