



Original Article

Fetal Kidney length as a parameter for determination of Gestational Age from 20th Weeks to term in healthy women with uncomplicated pregnancy

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Abstract

Background: Accurate assessment of gestational age is pivotal to give quality maternity care. Ultrasonographic fetal biometry is the most widespread method to establish gestational age (GA). Ultrasound parameters like Biparietal Diameter (BPD), Head Circumference (HC), & Femur Length (FL) in second and third trimester are not very reliable for dating the pregnancy. Fetal Kidney length (KL) has been shown to strongly correlate with gestational age in late trimesters and even in cases like IUGR, where others parameters like BPD, HC, AC are affected.

Methods: The study was conducted in Government Medical College, Jammu on a population of 50 pregnant women between 20-36 weeks of gestation. The accurate gestational age of all the subjects of study population was already calculated from early dating scan. Length of the right kidney was measured in all subjects in centimeters at 20 weeks, 28 weeks & 36 weeks of gestation along with other parameters like BPD, HC & FL.

Results: In the present study, it was found that standard error from the gestational age at all weeks is least for KL. It indicated that the KL in the present study correlates well with assigned gestational age.

Conclusion: Kidney length can be used as individual parameters in estimating gestational age especially in late trimesters and in cases where other biometric indices are not reliable.

Keywords: Pregnancy, Kidney Length, Ultrasound.

Introduction

Since long time, there has been search for a single ultrasonographic parameter to determine the gestational age which is not affected by IUGR. As accurate age of the fetus plays an important role in obstetrical management, uncertain dates and no assigned ultrasound dates in early trimester poses a dilemma in management decisions leading to

iatrogenic pre or post maturities. There is need for accurate gestational age while planning for termination of pregnancy due to complications in high risk cases like Preeclampsia, IUGR, GDM and accurate gestational age is also required for planning fetal investigation and fetal therapy. Various sonographic parameters commonly used are BPD, HC, AC & FL. As the pregnancy

advances these parameters became increasingly unreliable in prediction of GA^[1]. Therefore accurate estimation of GA in late 2nd and 3rd trimesters and in conditions like IUGR where these parameters are affected still remains a problem. Various non-traditional sonographic parameters for estimating GA are being studied like transverse cerebellar diameter, fetal foot length, epiphyseal ossification centers, amniotic fluid volume, placental grading and fetal kidney length. Fetal kidney length is strongly correlated to gestational age and is more accurate method of GA estimation than BPD, FL & HC after 24th weeks of gestation^[2-4]. In this study, we sonographically measured Fetal KL, evaluated its role in estimation of GA and compared its accuracy with other established biometric indices.

Methods

50 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 after counseling and informed consent. Study group women were registered and had their regular antenatal checkups and routine investigations and underwent fetal biometric and kidney length measurement at 20, 28 & 36 weeks of pregnancy. Cases of oligohydramnios or polyhydramnios, dilated renal pelvis (> 4mm), chromosomal and congenital anomalies, abnormal renal morphology, obscure renal borders, multiple pregnancies, gross maternal obesity, GDM or early onset preeclampsia were excluded from the study. The Kidney length has been taken as a bipolar measurement cautiously excluding the adrenals. Kidneys were identified first in transverse section just below the level for AC measurement, and then the probe was rotated longitudinally till full length of kidney was identified. Average of 3 measurements in centimeters of the right kidney was recorded as final measurement. The measurements were performed using grey scale real time

ultrasonography scanners with 3.5-5 MHz curvilinear transducer.

Appropriate statistical analysis was done. Pearson's correlation was calculated for estimated gestational age and the measured gestational age by BPD, HC & FL.

Results

50 women were selected to complete the study with the ages ranging from 18-35 years. There was no difficulty in identification of right Kidney and taking appropriate measurements.

Figure 1 shows maximum number of women between 24-28 years of age (54%) and which was the highest number of the study, where as 29-34 age group was lowest (16%) in number among the subjects selected for the study.

Figure 2 shows that both primigravide and multigravide were included in the study and primigravide (64%) was the highest frequency compared to multigravide (36%). The gestational age was calculated by Hadlock Formula using BPD, HC & FL. Renal length was measured in centimeters at 20, 28 & 36 weeks.

Table 1 indicates the mean of gestational age determined by all parameters including KL. According to the observations, the mean deviation from the gestational age at all weeks is least for KL. It can be concluded that KL estimates the gestational age at any given gestation with the least deviation from the mean.

It is clear from the Table 2 that the standard deviation and 95% confidence interval of the measurements for KL are the least at all gestations indicating the reliability of KL for estimation of gestational age at all gestational ages. Also, the renal length of the fetus at any given gestation in millimeters almost responds to the gestational age of the fetus. This also helps in easy estimation of gestational age without any software or formula.

Pearson's co-relation was calculated for estimated gestational age and the measured gestational age by BPD, HC, FL & KL. It is observed that all parameters are highly correlated ($r^2 = 0.90-0.98$, $P < 0.05$).

Figure 1: Age Distribution of the subjects in the study.

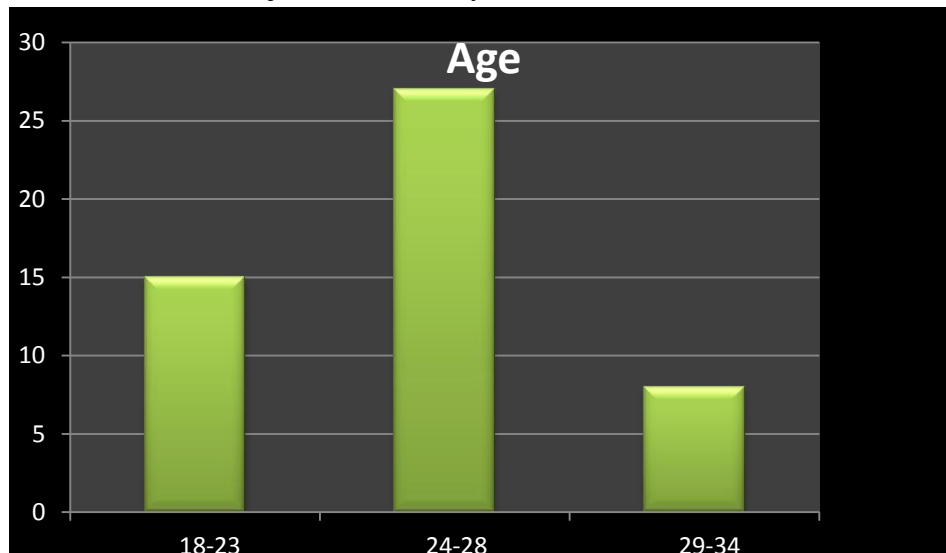


Figure 2: Distribution of parity

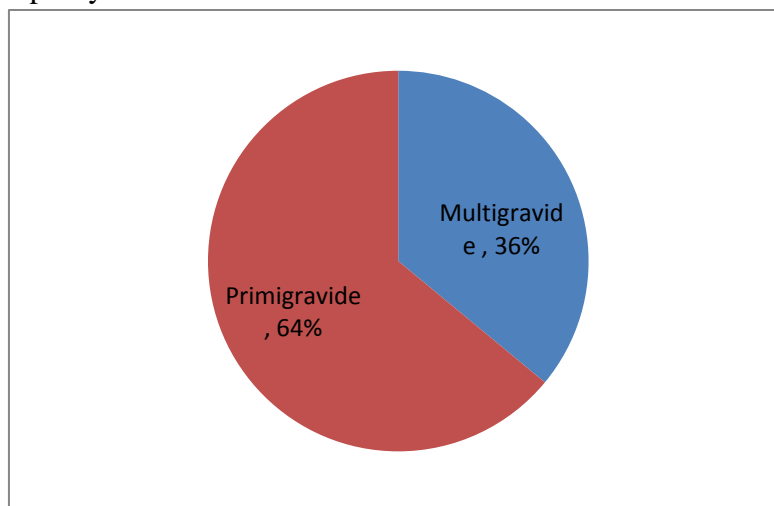


Table 1: The relationship of gestational age and the various indices used for gestation age between 20-36 weeks including kidney length

WEEKS	MODE	SD (Standard Deviation)	SE (Standard Error)
At 20 Weeks			
BPD	19 weeks	0.624	0.088
HC	19 weeks	1.620	0.229
FL	19 weeks	0.614	0.086
KL	20 weeks	0.535	0.075
At 28 Weeks			
BPD	28 weeks	0.893	0.126
HC	28 weeks	1.127	0.159
FL	28 weeks	0.862	0.121
KL	28 weeks	0.611	0.086
At 36 Weeks			
BPD	34 weeks	0.397	0.055
HC	35 weeks	1.924	0.272
FL	37 weeks	1.451	0.205
KL	36 weeks	0.315	0.044

Table 2: The mean and 95% confident interval of measurement of various parameters at different gestational age

WEEKS	Mean (cm) ± SD	95% CI
At 24 weeks		
BPD	4.51 ± 0.239	4.51 ± .1049
HC	16.98 ± 0.94	16.98 ± 0.41
FL	3.17 ± 0.18	3.17 ± 0.079
KL	1.96 ± 0.010	1.96 ± 0.044
At 28 weeks		
BPD	7.03 ± 0.21	7.03 ± 0.121
HC	25.7 ± 0.77	25.7 ± 0.33
FL	5.30 ± 0.158	5.30 ± 0.069
KL	2.77 ± 0.086	2.77 ± 0.037
At 36 weeks		
BPD	8.74 ± 0.19	8.74 ± 0.083
HC	31.5 ± 0.606	31.5 ± 0.265
FL	6.82 ± 0.147	6.82 ± 0.084
KL	3.644 ± 0.76	3.644 ± 0.034

Discussion

The present day challenge in dating pregnancy is to find a method which is simple, easy to define and reproducible. With the advent of high resolution real time ultrasound, the ability to image various organs in utero dramatically improved. Ultrasonography fails in accurate determination of fetal age in the third trimester due to a large variability in the biometric parameters readings. Women booked late in pregnancy and in particularly those who are uncertain of their last menstrual period, it is often difficult to date pregnancies. There is therefore need to investigate a method of dating pregnancy that is simple, easy to define and reproducible. Fetal Kidney length is one such parameter.

Growth variations in the fetus affects all organs including the kidney but only in the AP & transverse diameter not length^[5,6]. Earlier works have found that fetal kidney is easy to identify but Duval JH et al^[7] encountered difficulty in imaging kidney in breech presentation and in vertex presentation with back facing laterally or posteriorly. In the present study, there was no problem in identifying and measuring the kidney length. In the present study, measurement of only right kidney was taken. The kidney length in present study is correlated well with assigned gestational age and found almost same as all

parameters put together. This provides an obvious advantage where there is difficulty in measuring BPD, HC due to engaged head or small AC due to IUGR. In such circumstances, KL can be used on its own to estimate gestational age accurately.

The KL length measurements in our study are comparable with Shivalingaiah N et al^[8], but more than Kansaria JJ et al^[5] and less than Kaul I et al^[6]. It can be explained by the differences in ultrasound machines, number of operators, type of study and the region of study.

The present study found a strong Pearson's correlation (0.90-0.98, P<0.05) for all the biometric parameters including KL, which is comparable with other studies like Cohen et al, 1991^[4] (r = 0.82), Shivalingaiah N et al 2014^[8] (r = 0.85-0.98).

The present study reveals that KL can be used in the estimation of gestational age in combinations with other parameters for better prediction and in cases where dates are uncertain and the women present late for ultrasound biometry dating. The present study concludes that KL is a good indicator of gestational age.

The limitation of the present study was the size of the population. Larger study population is required to improve the accuracy of the values which are obtained.

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Conflict of Interest: None Declared.

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