



## ULTRASONOGRAPHIC EVALUATION OF FETAL KIDNEY LENGTH FOR ASSESSMENT OF GESTATIONAL AGE AND ITS COMPARISON WITH OTHER CONVENTIONAL PARAMETERS.

### Gynaecology

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### ABSTRACT

**BACKGROUND;** Accurate assessment of gestational age is first and foremost for the obstetrician to date the pregnancy as early as possible during antenatal examination for the better management of pregnancy. The traditional fetal biometric parameters, such as biparietal diameter (BPD), head circumference (HC), abdominal circumference (AC) and femur length (FL), become increasingly unreliable for accurate gestational age estimation, with advancing pregnancy, especially in 3rd trimester. This study was conducted to assess the role of fetal kidney length (KL) as an alternate parameter to assess gestational age in 2nd and 3rd trimesters and to compare its accuracy with other biometric parameters.

**AIM;** To assess the relationship between sonographic gestational age and fetal KL between 16 and 40 weeks of gestation and to compare its accuracy with other biometric parameters.

**MATERIALS AND METHODS;** Prospective, cross-sectional, single operator study of 500 antenatal cases between 16 to 40 weeks of gestation where in bipolar measurement of both kidneys, mean were taken along with other biometric parameters. The 500 cases were grouped in to five groups ie 16 to 20 weeks n= 93, 21 to 26 weeks n=91, 26 to 30 weeks n=96, 31 to 35 weeks n=135 > 36 weeks n=85.

Statistical analysis is done using, Stat14, The r and p value of each group, for each biophysical parameter were highly significant and are less the r value of 0.4726 and p value of 0.001 respectively.

**RESULTS;** A strong statistical correlation was found between sonographic gestational age and fetal KL. Monograms and growth curves were constructed to correlate gestational age with fetal KL.

### KEYWORDS

Gestational age=GA. Kidney length=KL, Ultrasonographic=USG, BPD=biparietal diameter. HC=head circumference. AC=abdominal circumference. FL=femur length.

### INTRODUCTION;

Gestational age estimation is one of the foremost important information conveyed by a Radiologist when performing an obstetric ultrasound examination for better management of pregnancy and to manage iatrogenic prematurity or post maturity of fetus leading to perinatal morbidity, mortality, to optimize the timing of amniotic fluid assay and maternal serum assays, helps in timing of fetal interventional therapy when indicated, for diagnosis of fetal growth disorders, and in high-risk pregnancies, such as those complicated by gestational hypertension, preeclampsia, central placenta previa, and sensitized Rh negative mothers where delivery is timed as soon as the fetus becomes mature.

Traditional biometric parameters commonly used are gestational sac volume, gestational sac diameter, and crown-rump length (CRL) measurements, Biparietal diameter (BPD), Head circumference (HC), abdominal circumference (AC) and Femur length (FL).

Unexpected conditions like oligohydramnios, multiple gestation, breech presentation, polyhydramnios and intrauterine growth restriction (IUGR) can affect the BPD, HC, AC, FL measurements. As the pregnancy advances these parameters become increasingly unreliable in the prediction of GA<sup>11</sup>.

Nontraditional sonographic parameters for estimating GA are being studied like transverse cerebellar diameter<sup>4,6</sup>, fetal foot length<sup>7</sup>, clavicular length, epiphyseal ossification centers, amniotic fluid volume. Placental grading, (DOI: <http://dx.doi.org/10.18203/2349-3933.ijam20175181>) colonic echogenicity, (DOI: <http://dx.doi.org/10.18203/2320-1770.ijrcog20161328>). Some authors have found a strong correlation of fetal sacral length, hard palate width, length and area, with gestational age in 2nd and 3rd trimesters<sup>13</sup>. Fetal Kidney Length is strongly correlated to GA and is more accurate method of GA estimation than BPD, HC, AC and FL, after 24th week of gestation<sup>9, 8, and 9</sup>. In this study we sonographically

measured FKL, evaluated its role in estimation of GA and compared its accuracy with other established biometric indices.

### MATERIALS AND METHODS;

Five hundred pregnant women between 16 and 40 weeks of gestation were recruited into this prospective, cross-sectional study after obtaining their written informed consent, pcpndt procedure, between Jan 2019 to sept 2019. The study was done in the Department of Radio-Diagnosis PESIMSR Kuppam, AP, India after obtaining clearance by the Institutional Ethical Committee with voluson PRO 730.

**Inclusion criteria -** Healthy women who were certain of their LMP and had prior regular menstrual cycles with uncomplicated pregnancy between 16 to 40 weeks of gestation were selected for the study.

**Exclusion criteria- Unknown or inaccurate date of last menstrual period. Before 16 weeks of gestational age. Oligohydramnios. Polyhydramnios. Diabetic mother. Pregnancy induced hypertension. Pre-eclampsia. multiple gestations.**

Fetal kidneys length, percentage and mean length was obtained in the axial plane as described by Bertagnoli al<sup>1</sup>, with other parameters with a little manipulation of the transducer position and angle of insonation allowed easy identification of both fetal kidneys Duval et al (Anat Clin 1985; 7(2):107-123). At each gestational age in weeks, the fetal KL was calculated, mean. Linear regression analysis was used to establish a relationship between sonographic gestational age in weeks and fetal KL. Significance was expressed as p value and r values, a p-value of < 0.001 were taken as strongly significant. Nomo grams and growth curves were constructed to correlate gestational age in weeks with fetal KL measurements.

The statistical software used for analysis was skat 14 and Microsoft Excel was used to generate the graphs and tables.

**RESULTS.**

**Table.1. Age-wise details.**

Age of pregnant patients	No of patients n=500
<20 yrs	92(18.4%)
21-25 years	91(18.2%)
26 -30 years	97(19.4%)
31 to35 years	136(27.2%)
• 36 years	84(16.8%)

Table 1 shows 27 % of our pts were between 31-35 weeks followed by 19.4% between26-30 weeks of gestation.

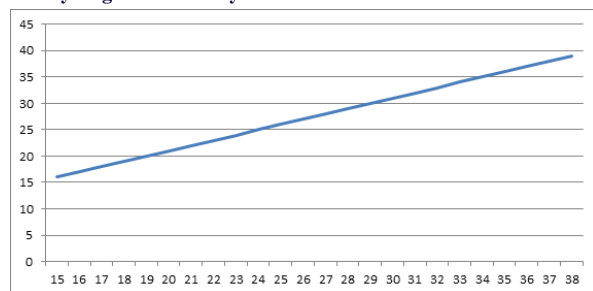
**Table.2. Gravid wise details**

gravid	No of cases	percentages
1	205	41%
2	176	35.2%
3	86	17.2%
4	33	6.6%

**Table.3.Fetal kidneys length percentage and mean length.**

CGA WEEKS	N0	PERCENTAGE %	MEAN length
16 WEEKS	3	0.6%	15MM
17 WEEKS	8	1.6%	16MM
18 WEEKS	10	2%	17MM
19 WEEKS	32	6.4%	19MM
20 WEEKS	36	7.2%	21MM
21 WEEKS	24	4.8%	23MM
22 WEEKS	23	4.6%	24MM
23 WEEKS	15	3%	25MM
24 WEEKS	17	3.4%	27MM
25 WEEKS	12	2.4%	28MM
26 WEEKS	12	2.4%	29MM
27 WEEKS	15	3%	30MM
28 WEEKS	25	5%	32MM
29 WEEKS	15	3%	34MM
30 WEEKS	30	6%	35MM
31 WEEKS	22	4.4%	36MM
32 WEEKS	23	4.6%	37MM
33 WEEKS	35	7%	38MM
34 WEEKS	17	3.4%	38MM
35 WEEKS	39	7.8%	39MM
36 WEEKS	46	9.2%	40MM
37 WEEKS	25	5%	42MM
38 WEEKS	09	1.8%	42MM
39 WEEKS	07	1.4%	43MM
	500	100.00 %	

**Figure.1. scatter plot of sonographic gestational age vs Fetal mean kidney length in our study.**



**Table.4.Correlation of biophysical parameters with FL**

Parameter	Cga	R value	P valve
BPD vs. MKL	16-20 weeks	0.4038	0.001
HC vs. MKL	21-25 weeks	0.4395	0.001
AC vs. MKL	26-30 weeks	0.4726	0.001
FL vs. MKL	31-35 weeks	0.4321	0.001

**Table. 4.** A significant linear statistical correlation was found between sonographic gestational age and fetal KL with p-value of < 0.001 and R2 value of 95%. The p value of 0.001 indicates that the relationship between fetal KL and gestational age has a strong statistical significance.

**Table.5. comparison of the mean fetal kidney lengths in three previous studies with our study.**

Gestational age in weeks	Mean fetal kidney length in mm (Kansaria and Parulekar)	Mean fetal kidney length in mm (Konje et al)	Mean fetal kidney length in mm (Cohen et al)	Mean fetal kidney length in mm (sandhya et al)	Mean fetal kidney length in mm (our study)
24	23.8	24.2	31	32.1	27mm
26	25.2	26.3	34	34.2	29mm
28	26.9	29	34	35	32mm
30	29	30.9	38	37.4	35mm
32	30.8	33.2	41	40.0	37mm
34	32.5	35	42	40.5	38mm
36	34.2	38.2	42	41.2	40mm
38	36.2	40.1	44	43.8	42mm

**Table.5.** shows that the mean fetal KLs in our study correlate closely with those of Cohen et al but are significantly longer than those of Kansaria<sup>12</sup> and Parulekar<sup>14</sup> and correlate closely with those of cohen<sup>8</sup> and sandhya.

**DISCUSSION;**

The fetal kidneys develop in a complex but distinctive sequential pattern, beginning around the 7th to 8th week of gestation and continuing up to 35 to 36 weeks. The fetal kidneys are difficult to identify, characterize and measure sonographically before 17 weeks of gestation. However, they are imaged satisfactorily in about 90% of fetuses between 17 and 22 weeks of gestation. The fetal kidneys appear sonographically as oval-shaped hypo echoic structures in the retro peritoneum surrounding the slightly more echogenic pyelocalyceal sinus. By about 30 weeks of gestation, there is sufficient perinephric fat accentuating the renal outline to make its identification easy and accurate. Gestational age has traditionally been estimated from the 1st day of the last menstrual period (LMP) using Naegel's rule. Doubilet who noted that the accuracy of these traditional predictors ie GS, CRL, BPD, HC, AC and FL, decreases as the pregnancy advances to third trimester. Benson CB, Doubilet PM. (Sonographic prediction of gestational age: accuracy of second- and third- trimester fetal measurement. Am J Roentgenol. 1991;157(6):1275-7). Therefore suggested that in addition to these traditional parameters, ancillary biometric and non biometric measurements can help to narrow the biological variability between fetuses.( Gottlieb AG, Galan HL. Nontraditional sonographic pearls in estimating gestational age. Semin Perinatal. 2008; 32(2):154-6).

Cohen study<sup>8</sup> showed strong statistical correlation between renal length and sonographic gestational age.

The present study is an attempt to find whether fetal kidney length can be used as an independent parameter to calculate the gestational age like the other established biometric indices (BPD, HC, FL, AC) and accuracy to which gestational age can be calculated if kidney length is added to the four routine biometric parameters. An often quoted rule of thumb is that “renal length in mm approximates gestational age in weeks”.

The values of fetal kidney length at different gestational ages was similar to that of **Kansaria, Parulekar Konje et al, Cohen et al and sandhya et al.**

The present study, we have correlated gestational age from fetal kidney length with gestational age derived from standard measured parameters like BPD, FL, HC, AC and it demonstrated that strong correlation(p<0,001). Similar correlation was found by Nahid Yusuf<sup>10</sup> et al in their study. The study shows correlation of gestational age from LMP with gestational age derived from biometric indices BPD, HC, AC, FL, and FKL.

In our study, we found no statistically significant difference between the left and right fetal KL measurements at each gestational age. The findings in several studies were consistent with those of our study. Left fetal KL was slightly but significantly longer than the right KL in the study by Fitzsimons<sup>18</sup> and Kaul et al.

**CONCLUSION;**

In India, where routine antenatal registration is now mandatory, and where illiteracy makes it difficult to elicit proper menstrual history, it is

very imperative that accurate dating is very much essential for the management as described above. FKL increases linearly with gestational age. There is a good correlation between gestational age derived from FKL and gestational age from established biometric indices like BPD, HC, AC, and FL. The FKL in mm collaborates nicely with GA in weeks.

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**Ethical approval:** The study was approved by the Institutional Ethics Committee.

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