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Research Article

## Foetal kidney length as a parameter for determination of gestational age in pregnancy by ultrasonography

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### ABSTRACT

**Background:** Establishing the gestational age of the fetus, especially in late trimester is a challenge to aptly treat the pregnant woman. Ultrasound parameters like BPD, HC, AC and FL in second and third trimesters are not very reliable for dating the pregnancy. Fetal kidney length has been studied and shown to strongly correlate with the gestational age in late trimesters even in IUGR fetuses.

**Methods:** This cross section hospital based study was conducted in the Department of Obstetrics and Gynecology, P.B.M. and Associated Group of Hospitals, attached to Sardar Patel Medical College, Bikaner during study period of one year from 2015 to 2016. 100 pregnant women with known dates of different parity and ages were included in this study.

**Results:** According to the observations, the mean deviation from the gestational age at all the weeks is least for KL. The result indicates that the kidney length in the present study correlated well with the assigned gestational age and found almost same as all the ultrasound biometric parameters put together.

**Conclusions:** Kidney length can be used as an individual parameter in estimating gestational age, especially in later trimesters, where biometric indices may not be much reliable.

**Keywords:** Pregnancy, Kidney length, Ultrasound, Gestational age

### INTRODUCTION

From time immemorial there has been search for a single ultrasonographic parameter to determine the appropriate gestation of the fetus which is not affected by IUGR. As accurate age of fetus plays a pivotal role in obstetric care, uncertain dates and no assigned ultrasound dates in early trimesters poses a dilemma in management decisions leading to iatrogenic pre or post maturities. In high risk pregnancies like preeclampsia, IUGR, GDM, planning termination of pregnancy due to complications or to plan for fetal investigations or therapy requires an accurate gestational age. There are number of parameters used to calculate gestational age, but most commonly used by all sonologists is a composite GA obtained by BPD, HC, AC and FL in second and third trimesters. Even these may

not provide GA with great accuracy owing to the discrepancies in late trimester scans and IUGR.<sup>1</sup>

Fetal kidney has been shown a steady growth of 1.7 mm fortnightly throughout pregnancy and is unaffected by growth abnormalities.<sup>2</sup> Various studies have reported that fetal kidney length strongly correlates with the gestational age in late trimesters. Hence, this descriptive study was undertaken in the department of Obstetrics & Gynaecology, SP Medical College, Bikaner, Rajasthan India to evaluate the application and accuracy of fetal kidney length measurement in determining the gestational age of the fetus as compared to that of other fetal biometric indices.

**METHODS**

This cross section hospital based study was conducted in the Department of Obstetrics and Gynecology, P.B.M. and Associated Group of Hospitals, attached to Sardar Patel Medical College, Bikaner during study period of one year from 2015 to 2016. 100 pregnant women with known dates of different parity and ages were included in this study.

The women were evaluated as per history, general physical examination and routine antenatal investigations and using third trimester ultrasonography, mean fetal kidney length along with fetal head circumference, femur length, abdominal circumference and biparietal diameter were measured. Gestational age was calculated from mean fetal kidney length using normogram by Cohen et al.<sup>3</sup> These values were then compared with actual gestational age derived from actual dates taken as a standard.

The subjects were informed about the study and informed consent was taken before they enrolled in the study.

**Inclusion criteria**

1. All cases with singleton pregnancies in the third trimester (28 to 40 weeks).
2. Cases who were sure of the dates of their last menstrual period.
3. Normal antenatal pregnant women with no associated risk factors.

**Exclusion criteria**

1. Anomalous fetus
2. IUGR
3. Pregnant women with unknown dates
4. Off-springs of diabetic mothers
5. Renal pelvic dilatation of 5 mm or greater.
6. Twin pregnancies.
7. Renal anomalies or known case of renal anomalies

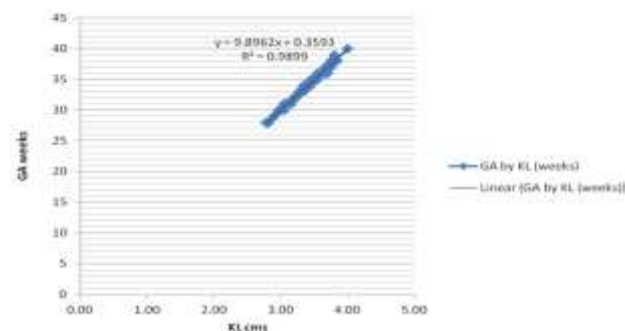
**RESULTS**

**Table 1: Distribution of cases showing Kidney Length (KL) for various gestational ages.**

Gestational age in weeks (n=100)	Mean KL in mm	SD	Median
28 (n <sub>1</sub> =5)	28.00	0.00	28.00
29 (n <sub>2</sub> =2)	29.00	0.00	29.00
30 (n <sub>3</sub> =6)	29.67	0.51	29.00
31 (n <sub>4</sub> =7)	30.28	0.48	30.00
32 (n <sub>5</sub> =5)	32.00	0.00	32.00
33 (n <sub>6</sub> =9)	32.88	0.33	32.00
34 (n <sub>7</sub> =9)	33.44	0.52	33.00
35 (n <sub>8</sub> =16)	34.68	0.47	34.00
36 (n <sub>9</sub> =17)	35.76	0.56	35.00
37 (n <sub>10</sub> =17)	36.76	0.43	36.00
38 (n <sub>11</sub> =5)	37.40	0.54	37.00
39 (n <sub>12</sub> =1)	38.00	0.00	38.00
40 (n <sub>13</sub> =1)	40.00	0.00	40.00

**Table 2: Regression equation application between KL versus GA.**

	Intercept estimate	Intercept SE	Slope estimate	Slope SE	R <sup>2</sup>	SE <sub>P</sub>	P value	Conclusion
KL v/s GA N=100	0.3016	0.3434	9.907	0.0998	0.9899	0.2814	<0.001	Highly significant correlation between KL and GA (highest strength of association among these 3 measurements*)



**Figure 1: Correlation between KL and GA (weeks).**

100 women were selected to complete the study with the ages ranging from 18-34 years. There was no difficulty in identification of kidney and taking appropriate measurements.

Table 1 showing distribution of cases showing KL for various gestational ages. In present study, gestational age was ranging from 28 to 40 weeks and their mean kidney length was ranging from 28.00 to 40 mm. Maximum number of cases was found in gestational age 36 and 37 weeks (n=17 each) while least common gestational age was 39 and 40 weeks, where only 1 patient was found in each.

## DISCUSSION

This study was mainly done to measure the normal length of fetal kidneys sonographically during 3<sup>rd</sup> trimester of pregnancies in all the cases of study. The greatest fetal kidney length of each of 100 consecutive fetuses between 27 to 40 weeks gestation was measured on sonogram. Abnormal fetuses, twins, offspring of diabetic mothers and fetuses with renal pelvic dilatation of 4mm or greater were excluded to avoid any questionable measurements.

The range of mean fetal kidney length was from 22 mm at 22 weeks to maximum of 39mm at 39 weeks at gestation, along with standard deviation and their 95% confidence interval. According to our study the fetal kidney lengths in mm are almost equal to the weeks at a particular gestational age i.e. at 22 weeks of gestation (according to PA); the fetal kidney length was 22mm. It is also evident from this study that as the gestational age increases, the length of fetal kidney also increases and there is significant difference in the mean fetal kidney length that is found when lengths are compared across the 22 to 39 weeks of gestational age ( $0 < 0.001$ ). Kurtz et al in their review of studies of obstetrical measurements in ultrasound, noted only two earliest studies of fetal kidney length, that used renal time equipment.<sup>4</sup> Two studies i.e. Bertagnoli et al and Lawson et al showed their measurement almost equal to our study, and suggested a rule of thumb that is renal length in millimetres approximates gestational ages in weeks.<sup>5,6</sup>

The study by Bertagnoli et al and their chart were recommended.<sup>5</sup> The reference articles showed, that mean length increases with gestational age. The study of Lawson et al using articulated arm scanning, showed measurement of 32 mm at 30 weeks and measurement of 42-43 mm at term, which are closer to our measurements.<sup>6</sup>

The study of Cohen et al, reported in their sonographic study of 397 obstetric patients, showed mean renal length of 27mm at 22 weeks and of 42 mm at 39 weeks of gestation.<sup>7</sup> These findings are greater and confidence intervals are wider than our study and previously reported.

Ansari et al also in their sonographic study of 793 fetus for measurement of normal fetal kidney length in Bangladesh reported that the average fetal kidney length of full term is 39.5mm. The findings are similar to our study.<sup>8</sup>

According to Konje et al the estimation of gestation age by foetal kidney length measurements was  $\pm 1$  week at 24-34 weeks of gestation and  $\pm 2$  weeks at 34-38 weeks of gestation. These findings are closely related to findings of our study.<sup>9</sup>

Although renal dilatation as great as 10 mm may be considered physiological and normal we arbitrarily

decided to exclude kidneys with anterioposterior pelvic measurements greater than 4mm. We did so in order to avoid the possibility of considering pelvic dilatation, even if physiological, a reason for the longer length that we measured.

To confirm our measurement, Han and Babcock et al noted measurements of 39 to 59 mm in neonates.<sup>10</sup> Fitzsimons showed measurement of neonatal kidneys among premature infants whose gestational age was determined by menstrual history, fetal sonographic measurements or maturity assessment were higher to those of our fetuses at equivalent gestational age, both our measurement and those of Fitzsomons showed little difference in the renal length measurement between weeks 22 to 40 we have no explanation for these findings.<sup>11</sup>

## CONCLUSION

Kidney length can be used as an individual parameter in estimating gestational age, especially in later trimesters, where biometric indices may not be much reliable.

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

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