

Fetal Kidney Length in Estimation of Gestation Age by Sonography

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A B S T R A C T

Introduction: Various biometric parameters like BPD, HC, AC and FL are used either independently or as an average of all the parameters in estimation of fetal gestation. This study evaluates estimation of gestational age by fetal renal length as correlated with other standard biometric parameters.

Material and Methods: This was a single institutional prospective cross-sectional study which included healthy pregnant females with known LMP and dating scan between 26 weeks to 40 weeks of gestation. 100 consecutive pregnant women were evaluated.

Results: Kidney length in present study correlated well with gestation age estimated from standard fetal biometry (BPD, HC, FL and AC).

Conclusion: Fetal renal length is an independent parameter in estimation of fetal gestational age.

Keywords: Sonography, Kidney Size, Gestational Age, Fetal Renal Length

INTRODUCTION

Kidney are one of the important abdominal organs not just after birth but also during fetal development.¹ Developing fetus is suspended with in the gestational sac in the amniotic fluid. Fetal kidneys are the important source of amniotic fluid.^{2,3} Hence evaluation of kidneys during fetal development is essential. One of the parameters to assess the development of fetal kidneys is estimation of size. As with development of any organs during fetal life there is progressive growth, similarly fetal kidneys develop progressively. It has been known fact that estimation of fetal gestational age by conventional parameters is widely accepted. However fetal kidney length has also been shown to correlate with the gestational age and hence can be used for estimation of fetal gestational age and vis-versa for a given gestational age the normal size of kidney can be tabulated and serves as guide for appropriateness of the kidney size for the expected gestational age.

MATERIAL AND METHODS

This was a single institutional prospective cross-sectional study. Study was performed from Jan 2017 till Feb 2018. Institutional review board cleared the study. 100 consecutive normal pregnancies with known LMP and correlating dating scan were included in this study. Oral informed consent was obtained from all the participants. Any pregnancies with

known complications like IUGR, poly or oligohydramnios, maternal diabetes mellitus, unreliable LMP or without first trimester dating scan including multiple pregnancies were excluded from study. In presence of prominent/dilated renal pelvis of more than 5 mm were arbitrarily excluded from the study. While measuring the renal length if the upper pole and adrenal gland were not clearly separately visualized then such cases were not included in the study. Fetal kidneys were visualized in para sagittal plane, both the lower and upper pole were identified and the longest pole to pole length was measured (Figure 1). Multiple studies have shown there is no significant difference in the right and left renal length.^{7,8} Also fetal sex doesn't affect the measured fetal kidney size.⁹ We measured both the right and left kidney length and an average of the values were recorded to reduce the operator error in measuring the kidney.

STATISTICAL ANALYSIS

The data obtained were tabulated and analyzed by calculating the mean, standard deviation, standard error and the results were converted into scatter plotter graph using the MS excel software.

RESULTS

Out of the 100 cases enrolled in the study, predominant cases are in 33 to 38 weeks of gestation, with average of 10-15 cases per week of gestation, followed by at 31, 28 and 26

Gestation age in weeks	No. of cases	Mean renal length (mm)	SD
26	7	26.03	0.26
27	4	27.00	0.08
28	9	28.02	0.17
29	5	29.00	0.16
30	4	30.13	0.30
31	7	31.13	0.26
32	4	32.55	0.41
33	11	33.57	0.47
34	7	34.57	0.34
35	10	35.89	0.57
36	8	36.63	0.50
37	8	37.66	0.68
38	11	38.82	0.68
39	3	39.50	0.50
40	2	42.50	0.71

Table-1: Distribution of cases based on gestation age with renal length

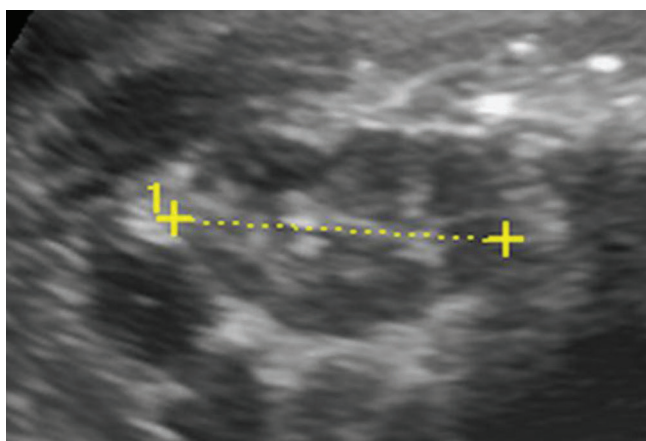
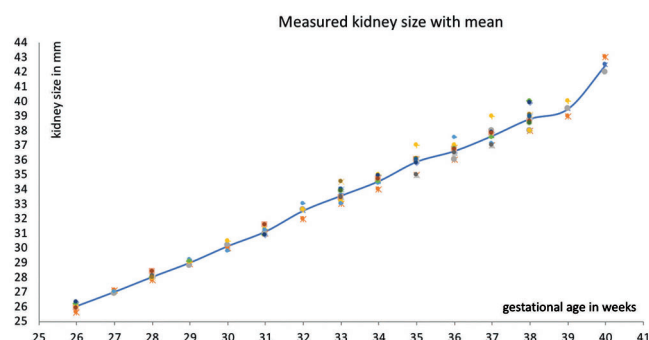


Figure-1: Kidney length



Graph-1: Gestational age with measured kidney size

weeks, with average of 5-10 cases per week of gestation. Very few cases are in the 39 and 40 weeks of gestation (Table-1). As noted in the previous published articles, we were able to identify and measure the length of the kidneys of all the fetuses.

In our study the mean fetal renal length measured from 26.02 ± 0.25 mm at 26 weeks to 42.5 ± 0.7 mm at 40 weeks of gestation (table 1). As the gestational age progressed there is linear correlation between the kidney length and calculated gestational age (Graph 1). With progress in gestation the

standard deviation of the measured fetal kidney length increases, however the measured renal length correlated well with the standard biometry.

DISCUSSION

Estimation of gestational age is one of the predominant indications for sonography in pregnant women. Gestational age is important to assign the estimated date of delivery in first trimester and for evaluation of growth in second and third trimester. Biparietal diameter (BPD), Head circumference (HC), Abdominal circumference (AC) and Femoral length (FL) have been widely accepted fetal biometric parameters worldwide for estimation of gestation age. However, as the gestation progresses especially in third trimester the margin of error in calculated gestational age is almost 2-3 weeks. Other parameters like fetal kidney length, fetal foot length and transverse cerebellar diameter have also been proposed for estimation of gestational age to increase the accuracy of the calculated gestational age. Studies have mentioned that fetal renal length correlates well with the gestation age.⁴⁻⁶ Fetal kidney can be visualized as early as 16 weeks of gestation with newer advanced in sonographic machine. In this study we have measured the fetal renal length and evaluated its accuracy in predicting fetal gestational age as compared to the standard biometric parameters from 26 weeks to 40 weeks of gestation.⁷⁻¹⁰

Fetal kidneys are usually imaged during routine antenatal scans. Kidneys are located on either side of the spine.¹⁰ The adrenal glands are closely related to the upper pole of kidney anatomically. Identifying the fetal renal poles except in cases with thick abdominal wall patients is easier. Hence accurate measurements of fetal renal length can be obtained. Although studies have shown that the fetal kidneys can be visualized as early as 16 weeks, we have restricted ourselves to 26 to 40 weeks of gestational age as the variability of calculated fetal gestation age by standard biometric parameters in first and second trimester is negligible.¹¹

Hence fetal renal length can be used to assign gestational age in third trimester and as problem solving tool when the standard biometric values are not correlating and also when standard biometric values cannot be measured due to maternal and fetal factors.

CONCLUSION

Fetal renal length is an independent parameter in estimation of fetal gestational age. As a general rule of thumb fetal length in millimeter correlates with fetal gestation age in weeks, however towards term the fetal renal length is generally higher than the gestation age.

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