



Original Article

Fetal Kidney Length: Can be a New Parameter for Determination of Gestational Age in 3rd Trimester

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Abstract

Ultrasound provides an accurate & objective method of determining fetal age in utero. A prospective study was done in 102 pregnant women after 30 weeks of pregnancy whose gestational ages were confirmed by early USG. (<24 weeks). The aim of this study was to establish a correlation between the fetal kidney length & gestational age in 3rd trimester. The mean length of fetal kidneys showed a linear correlation with gestational age. The mean fetal kidney length in mm approximates the gestational age in weeks in 3rd trimester as predicated by BPD, FL, AC & HC (P<0.001). Maternal height, weight & socioeconomic status did not show any effect on growth of fetal kidneys. The result obtained confirmed that measurement of fetal kidney length in mm can be used as an additional parameter for documentation of gestational age in 3rd trimester & also an early means of detection of abnormal renal development.

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Introduction

The first & foremost duty of an obstetrician is to date the pregnancy as early as possible during the antenatal period. An accurate estimation of gestational age is fundamental to the management of all pregnancies, especially high-risk pregnancies. In some cases early termination is necessary as soon as fetus becomes mature e.g. severe pre-eclampsia & eclampsia, chronic hypertension, chronic renal disease, severe IUGR, patient with diabetes, central placenta previa, sensitized Rh-Ve mother etc. Accurate estimation of gestational age is also necessary to obtain materials for different tests as well as to interpret the results of these tests¹.

Traditionally the duration of pregnancy is calculated in terms of 9 calendar months & 7 days

or 40 weeks or 280 days, calculated from the 1st day of last menstrual period².

Unfortunately some times calculation of EDD based on LMP becomes very difficult when (a) The menstrual cycle is irregular; (b) Patient fails to remember LMP or reports inaccurately (c) Pregnancy occurs during lactational amenorrhoea & (d) if patient had bled in early pregnancy³.

After 24 weeks the symphysio-fundal height in cm. approximates to the number of weeks up to 36 weeks of gestation. But a number of factors influence the measurement including multiple gestation, IUGR, diabetic pregnancy, maternal size, variation in fetal lie & engagement as well as inter & intra observer measurement variation⁴.

Ultrasonic measurement of fetal biometry (CRL, BPD, FL) are considered to be reliable when they

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are performed in first & early 2nd trimester (<24 weeks)⁵. Currently there is no single fetal measurement used for accurate estimation of gestational age in the 3rd trimester especially in women who booked late & unsure about their LMPs⁶.

Several longitudinal studies have been performed in the western countries concerning sonographic measurement of foetal kidney length. Initially these were done for diagnosis of renal malformation in utero & later on they were to find out the correlation between the fetal kidney length and the gestational age. So we also planned to measure the fetal kidney length sonographically & to consider it as a new parameter to determine the gestational age in third trimester in Bangladeshi Population.

Methodology

A prospective study was carried out in the Dept. of Obstetrics & Gynaecology, BSMMU during the period September 1999 to February 2001 with full cooperation of Institute of Nuclear Medicine, BSMMU, Dhaka.

A total number of 102 patients, aged between 15-40 years attending OPD of BSMMU for antenatal check up were studied after 30 weeks of pregnancy whose gestational age were confirmed by early USG (<24weeks). Only singleton foetus with complete visualization of at least one kidney was included in the study. Patients with known diabetes or hypertension, oligo/polyhydramnios IUGR, multiple pregnancies, suspected fetal anomalies & gross maternal obesity were excluded from the study. Unclear adrenal or renal borders, abnormal renal morphology & renal pelvic dilatation more than 4 mm were grouped for exclusion from the measurement. Standard foetometry included BPD, FL, HC, & AC & their measurements were also recorded in data collection sheet. Comparison between right & left renal lengths were demonstrated. The length of fetal kidney was measured from outer to outer margin using gray scale real time ultrasonographic scanner with 3.5 mHz transducer.

Statistical analysis: Statistical analysis was done with the statistical package for social science (SPSS). Standard deviation was taken as measure of variation & the frequencies of the data were expressed as mean (\pm SD). The relationship between fetal kidney length & maternal parameters have been explored by using regression analysis. Same test was used to explore relationship between the fetal kidney length & other fetal parameters. (BPD, FL, HC & AC). Level of significance was expressed as 'P' value <0.05 was taken as significant.

Result

This study included 201 fetal kidneys (100 left & 101 right kidneys) from 102 pregnant women. Two left & one right kidney were not visualized. As expected, the kidney length increased linearly as pregnancy advanced. (Fig. 1) We found a strong correlation between mean kidney length & gestational age as predicted by BPD, FL, AC & HC (P< 0.001). Mean kidney length were presented in millimeter (mm) with standard deviation (\pm SD) & 95% confident interval (CI). There was no relationship between gestational age & maternal height, weight or socioeconomic status.

Table-I: Mean foetal kidney (left plus right) length at various gestational age (n = 102)

Gestational age (weeks)	n	Left plus right (mean) kidney length (cm)	
		Mean \pm SD	Confidence interval (95%)
31	4	3.14 \pm 0.14	2.92-3.37
32	13	3.20 \pm 0.04	3.17-3.22
33	2	3.30 \pm 0.04	2.95-3.65
34	9	3.42 \pm 0.04	3.39-3.45
35	14	3.51 \pm 0.08	3.46-3.56
36	18	3.59 \pm 0.04	3.57-3.61
37	17	3.69 \pm 0.06	3.66-3.72
38	13	3.70 \pm 0.14	3.62-3.79
39	6	3.93 \pm 0.08	3.84-4.01
40	6	4.05 \pm 0.13	3.92-4.19

Table-I shows that mean kidney (left plus right) lengths increased linearly with increase in gestational age. The relationship between gestational age and mean foetal kidney length is highly significant (r = 0.990, P = 0.000).

Table II: Relationship for biparietal diameter, femur length, abdominal circumference and head circumference with mean foetal kidney length (left plus right).

Parameters	R	P value ^a
Mean foetal kidney length (Left plus right)		
Biparietal diameter (BPD)	0.632	0.001***
Femur length (FL)	0.692	0.001***
Abdominal circumference (AC)	0.871	0.001***
Head circumference (HC)	0.861	0.001***

^a Correlation-coefficient

***Significant P< 0.001

Table-II: Shows that the relationship of mean foetal kidney length either with BPD, FL, AC or HC were highly significant (P<0.001). Therefore, any one of the parameters can be used to determine gestational age.

Table-III: Comparison of findings in kidney length in foetus of Bangladesh women

Gestational age (weeks)	S. Afroz et al 1996	Ansari <i>et al</i> (1997)	Kidney length (cm) (Mean ± SD)
			Present study (2001)
31	30.00 ± 1.51	3.20 ± 0.50	3.14 ± 0.14
32	32.87 ± 4.83	3.20 ± 0.51	3.20 ± 0.04
33	32.80 ± 1.26	3.20 ± 0.70	3.30 ± 0.04
34	34.00 ± 2.91	3.30 ± 0.66	3.42 ± 0.04
35	35.00 ± 2.22	3.40 ± 0.62	3.51±0.08
36	35.64±2.89	3.50±0.79	3.59±0.04
37	37.00±3.53	3.60±0.79	3.69±0.06
38	37.33±2.31	3.70±0.74	3.70±0.14
39	38.67±2.00	3.80±0.56	3.93±0.08
40	40.20±2.97	3.95±0.58	4.05±0.13

Discussion

With the advent of high resolution real time ultrasound, the ability to image various organs in utero has dramatically improved. This is certainly true for genitourinary tract⁷. The appearance of fetal kidney changes with advancing gestational age. On sonography, in the second trimester, the kidneys appear as avoid retroperitoneal structure that lack of distinctive borders⁸. As pregnancy advances, increased echogenicity from increasing perinephric fat is said to make them more visible by allowing easier separation of the kidney from its surrounding soft tissue⁹. By 30 weeks, their size is adequate to accentuate the normal renal parenchyma & to make identification relatively simple¹⁰. Technical error or maternal obesity may result in poor scans & prevent identification of fetal kidneys¹¹. This is particularly true during early gestation where the fetal adrenal & renal parenchyma have very similar homogenous patterns. Later in gestation, closer to term this point is further obscured by echogenic nature of

lower ribs¹². This results in an apparent increase in the length of the kidney. This probably explains the slightly different results in different studies¹³. However, improved resolution with current machinery & transducer seems to make this less of an issue¹⁴. By overcoming all these obstacles, if renal length can be measured properly, it would be a good parameter to assess the gestational age of the fetus.

An often quoted rule-of thumb is that “renal length in mm approximates gestational age in weeks”¹⁵. In our study we also found that the mean length of fetal kidney linearly increased with gestational age (table. I) & strong correlation exists between fetal kidney length & gestational age determined by BPD, FL, AC, & HC & an average of these. (Table II)

Results of our study are also in agreement with the studies done by Bertagnoli et al. (1985) & Scott et.al. (1995). A previous study regarding the fetal kidney lengths carried out in Bangladesh by

Ansari et al (1997) and S. Afroz et al (1996) also showed agreement with us.(Table III). Fetal kidney diseases are among the most common malformation & some of them (agenesis, hypoplasia, cyst, polycystic kidney, hydronephrosis etc.) can be detected in utero by sonographic method¹⁶. So, taken in conjunction with BPD, FL, HC & AC, renal length could well be used as an alternative parameter for documentation of gestational age where necessary & also an early means of detection of abnormal renal development. The present study comprised a sample size of only 102. Such a study on larger population may establish a national reference value as a new parameter for documentation of gestational age.

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