Ultrasonic Evaluation of Fetal Kidney Length in Second and Third Trimester Correlated with Gestational Age in Salaldeen General Hospital

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Abstract

Background: Various organs are measured to estimate the gestational age of the fetus.. Assessment of the fetal kidney length alone or in combination with other biometric parameters can be used in gestational age calculation more precisely in the first and second trimesters.

Aim: The current study aimed to establish the correlation between fetal kidney length and gestational age in the second and third trimesters.

Materials and Methods: A cross-sectional study was conducted in Saladin General Hospital /Gynecology and Obstetrics department during the period from 1st of January to 30th of June 2022. A convenience sample of 100 pregnant women who attended the Gynecology and Obstetrics department. Inclusion criteria included pregnant women who were in the second or third trimester with a history of regular menstrual cycles

Results: According to the results of the current study, there were significant positive correlations between the right kidney length, left kidney length and gestational age according to the last menstrual period in weeks. There was a significant difference between different gestation ages according to the menstrual cycle regarding the mean of the right or left kidney length (mm). in addition, a significant correlation was obtained between the gestational age according to the last menstrual period length, biparietal diameter, head circumference, abdominal circumference, and femur length. In conclusion, fetal kidney length is a reliable parameter for the determination of gestational age in the second and third trimesters of pregnancy and can be used when other methods like the last menstrual period are unknown.

Keywords: Ultrasonic Evaluation, Fetal Kidney Length, Pregnancy, Gestational Age.

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INTRODUCTION

The first and principal duty of an obstetrician is to date the pregnancy failing[(1)]. Accurate gestation age assessment is pivotal to quality maternity care. Failure can result in iatrogenic prematurity or post-maturity, both being associated with increased perinatal morbidity and mortality[(2)] In addition, the estimation of gestational age is also very helpful in categorizing the fetus into normal fetus (normal for gestational age), small for gestational age, and large for gestational age. An accurate estimation of gestational age is fundamental to the management of all pregnancies, especially high-risk pregnancies (chronic hypertension, severe preeclampsia, central placenta previa, severe IUGR, sensitized Rh-negative mother etc.) where sometimes, early termination may become compulsory as soon as the fetus becomes mature[(3)]. Although obstetric sonography plays an important role in the accurate determination of intrauterine gestational age[(2)], accurate assessment of gestational age using ultrasound has posed a serious problem to obstetricians, especially as the pregnancy approaches term. This stems from the fact that there are increased fetal biological variations as pregnancy advances. These variations can be caused by maternal age, parity, pregnancy weight, geographic location and specific population characteristics. Also, technical factors like interobserver error and different measuring techniques contribute to fetal variability as pregnancy advances to term[(4)]. The last two decades have seen tremendous progress in the application of ultrasound as a diagnostic modality to establish gestational age with several sonographic biometric parameters[(1,2,3)]. Various organs are measured to estimate the gestational age of the fetus. Sonographically derived parameters used to date pregnancy include crown-rump length, biparietal diameter, head circumference, femoral length and abdominal circumference. Fetal kidney length, transcerebellar diameter and placental thickness are emerging as new parameters and are claiming to be more accurate in certain situations[(4-7)] The fetal kidney can be reliably measured using transvaginal sonography between 14 weeks and 17 weeks of gestation, while it can be measured using transabdominal ultrasonography from

18 weeks of gestation and above[8-11]. Assessment of the fetal kidney length alone or in combination with other biometric parameters can be used in gestational age calculation more precisely in the first and second trimesters[12-14]. The **aim of the study was** to establish the correlation between fetal kidney length and gestational age in the second and third trimesters.

Subjects and Method

A cross-sectional study was conducted in Saladin General Hospital /Gynecology and Obstetrics department during the period from 1st of January to 30th of June 2022.

A convenience sample of 100 pregnant women who attended the Gynecology and Obstetrics department

1. Pregnant women with any maternal complication, e.g. hypertension, preeclampsia, maternal diabetes, central placenta previa, oligohydramnios or polyhydramnios.
2. Fetal Complications such as severe intrauterine growth retardation (IUGR), congenital abnormalities, and dilated renal pelvis (>4mm).
3. Twin pregnancy.
4. Unknown or inaccurate date of the LMP

Data Collection

A structured questionnaire was adopted for data collection, this questionnaire was prepared by the researcher after a review of many similar articles with revision by the supervisor. The data collection was done through two steps, including:

Step one: Including history, examination, and investigation. It included the following information:

1. Sociodemographic history included age, residency, occupation
2. Medical and obstetrical history included the history of chronic disease, parity, gravidity, abortion, number of previous cesarean sections (CS), menstrual history, and date of the LMP
3. Examination included weight and height. Accordingly, the body mass index (BMI) was calculated according to the formula: BMI= weight (Kg) / (height (m))^2(36). In addition, the blood pressure was measured by a mercury sphygmomanometer in a sitting position.
4. Investigation included random plasma glucose and measurement of proteinuria by urine dipstick protein.

Step Two: Included ultrasonography.

The ultrasonography was performed in the ultrasound clinic in the Department of Obstetrics and Gynaecology by using a Philips HD xE ultrasound scanner. Ultrasonography was performed with pregnant women in supine positions with an excellent acoustic coupling using synthetic ultrasound gel. The FKL was obtained in the sagittal plane, and the adrenal gland had to be identified and excluded from the measurement. The maximum length of the right or left fetal kidney was measured from the upper pole to the lower pole at least three times, and the mean of the measurements was taken. In addition, BPD, HC, AC, and FL parameters were obtained.

Results

A total of 100 pregnant women were enrolled in the current study. The mean age was, more than half of the participants were at age of 20-29 years. More than half of the participants had overweight. More than half of the participants had gravidity and parity of ≤3, and most of them had had no abortion previously. As shown in table 1.

Table 4.1: Age, body mass index, and obstetrical history of the participants

Characteristics of participants		N	%
Age (years)	<20	2	2.0
	20-29	54	54.0
	30-39	39	39.0
	≥40	5	5.0
Body mass index	Underweight	0	0.0
	Normal weight	19	19.0
	Overweight	57	57.0
	Obese	24	24.0
Gravidity	≤3	66	66.0
	4-6	27	27.0
	≥7	7	7.0
Parity	≤3	81	81.0
	4-6	17	17.0
	≥7	2	2.0
Number of previous abortions	0	81	81.0
	1	12	12.0
	2	4	4.0
	3	3	3.0

The lowest gestational age of the participants according to the LMPwas 22 weeks and the highest was 41. The mean of right kidney length was 37.8 (6.7) mm, and the left kidney length was 38.1 (6.3) mm (Table 2).

Table 2: Gestational age, right kidney length, and left kidney length of the participants

Parameters	Minimum	Maximum	Mean (±SD
Gestational age (weeks)	22	41	34.3 (4.5)
Right kidney length (mm)	21	60	37.8 (6.7)
Left kidney length (mm)	21	50	38.1 (6.33)
Mean of kidney length	21	55	37.9 (6.5)

There were significant positive correlations between the right kidney length, left kidney length and gestational age

according to the LMP in weeks. As shown in table 3 and figure 1 and Figure 2.

Table 3: Correlations correlations between the right kidney length, left kidney length and gestational age

Parameters		Gestational age
Right kidney length	Pearson Correlation	0.310**
	P-value	0.002
	N	100
Left kidney length	Pearson Correlation	0.324**
	P-value	0.001
	N	100

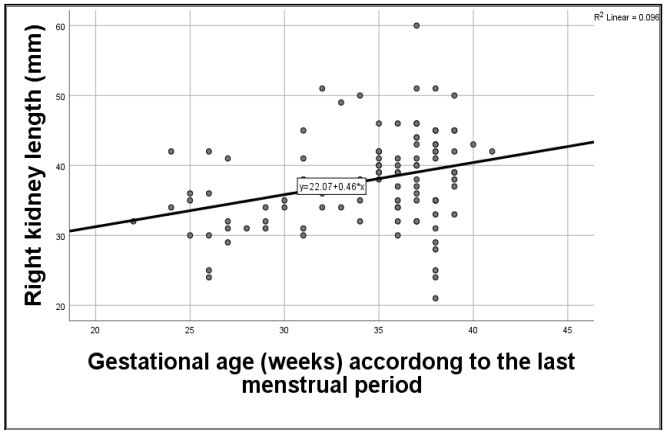

Figure 1: Correlation between gestational age and right fetal kidney length

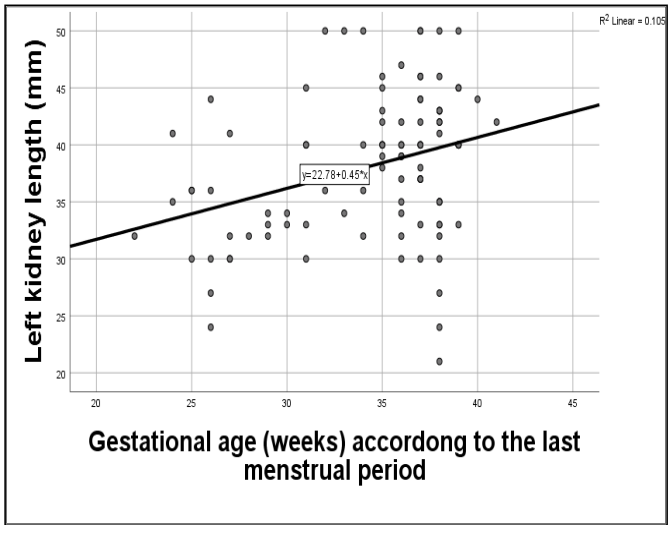

Figure 2: Correlation between gestational age and left fetal kidney length

There was a significant difference between gestation ages according to the menstrual cycle regarding the mean of the right or left kidney length (mm) (P-values were 0.001 for both. As shown in table 4.

Table 4.4: Distribution of the kidney length according to the gestational age

Gestational age (weeks)	N	Right kidney length (mm) Mean (±SD)	Left kidney length (mm) Mean (±SD)
22	1	32.0	32.0
24	2	33.0 (2.8)	34.5 (2.1)
25	3	29.6 (5.5)	30.0 (6.0)
26	5	28.6 4.3)	29.6 (4.2)
27	5	30.6 (4.0)	31.0 (3.3)
28	1	31.0	32.0
29	3	32.3 (6.1)	33.0 (1.0)
30	1	35.0	33.0
31	6	37.3 (6.1)	37.6 (5.7)
32	3	36.0 (15.0)	35.6 (14.5)
33	2	32.0 (2.8)	32.0 (2.8)
34	4	42.5 (9.0)	43.0 (8.7)
35	9	35.4 (4.9)	35.7 (5.2)
36	11	38.0 (3.9)	39.0 (3.8)
37	14	43.1 (6.8)	42.0 (5.0)
38	19	40.7 (4.9)	41.2 (5.0)
39	9	40.8 (2.5)	41.5 (2.0)
40	1	43.0	44.0
41	1	42.0	42.0
Total	100	37.8 (6.7)	38.1 (6.3)
P-value		0.001	0.001

There were a significant correlations between the gestational age according to the LMP and HC, AC, BPD, and FL. As shown in table 5.

Table 5: Correlations between HC, AC, BPD, and FL with gestational age

Parameters		Gestational age (weeks) according to the last menstrual period
HC	Pearson Correlation	.517
	Significance	.000
	N	100
AC	Pearson Correlation	.570
	Significance	.000
	N	100
BPD	Pearson Correlation	.167
	Significance	.490
	N	100
FL	Pearson Correlation	.476
	Significance	.000
	N	100

DISCUSSION

The accurate knowledge of gestational age is very important for the obstetrician as well as the mother. Estimation of gestational age is also very helpful to categorize the fetus as normal fetus (normal for gestational age), small for gestational age, and large for gestational age[3]. This study

was one among other studies that tried to assess other parameters for accurate calculation of the gestational age rather than LMP. The primary finding of the current study was a significant correlation between gestational age with the left and right fetal kidney length. In comparison, the same results were obtained in another study that was done in Iran by Farrokh et al.[7]. In agreement, another study was done in Ethiopia revealed a strongly positive significant correlation between FKL in mm and gestational age by the LMP in weeks[8]. In India, a study that was done by Nirmala et al. indicated that the kidney length correlated well with the assigned gestational age and found almost the same as all the ultrasound biometric parameters put together[12]. The same results were obtained in Turkey in the study that was done there and concluded significant correlation between gestational age and fetal kidney length and gestational age can be better predicted by adding fetal kidney length to other routine parameters[13]. In Egypt, Samira et al. concluded that Gestational age in weeks is nearly equal to the mean of fetal kidney length and can be concluded that kidney dimensions can be helpful in determining the gestational age when menstrual dates are uncertain[14]. There is a strong correlation between gestational age by date and estimated average kidney length in the third trimester, it could estimate the actual gestational age[15].

The mean of the right and left fetal kidney lengths were 37.8 (6.7) and 38.1 (6.33), respectively during gestational age ranged from 22-41 weeks. The same results were obtained in another study that was done in Pakistan and concluded that among 371 participants with gestational ages ranged from 24-39, the right and left fetal kidney length were 33.2 (3.) and 33.3 (3.4), respectively[3].

In addition, the current study showed that a gestation age of 38 weeks was correspond to the right fetal kidney length mean of 40.7 (4.9) and left kidney length mean of 41.2 (5.0). In agreement, Kuldeep revealed that the mean sonographic kidney length at the 38th week of gestation was 40.4 ± 1.71 mm, indicating that the mean fetal kidney length increases as pregnancy progresses from 18 weeks to 38 weeks of gestation[41]. In another study, the average fetal kidney length increased linearly from 30.7 mm at 27 weeks to 39.4 mm at 38 weeks gestation[16,17]. The average fetal kidney length increased from 25.7mm at 24 weeks of gestation to 41.7 at 38 weeks of gestation in another study that was done in India by Indu et al. Another finding of the current study was a significant correlation between gestational age and HC, AC, BPD, and FL. In comparison, the same results were obtained by another study that was done in Nepal by Birendra et al.[2]. This agreed with another study that was done in Pakistan by Wafa et al.[3]. Indu et al. obtained the same results in their study that was done in India[12].

CONCLUSION

Fetal kidney length is a reliable parameter for the determination of gestational age in the second and third trimesters of pregnancy and can be used when other methods like LMP are unknown.

RECOMMENDATIONS

1. The Fetal kidney length should be examined in the ultrasonic examination of the pregnant women to add significant accuracy to the gestational age calculation.
2. Other studies should be carried out during the upcoming period with a large sample and more detailed variables to explore if there are impacting factors on fetal kidney length.

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