ORIGINAL ARTICLE

Determining the gestational using Foetal Kidney Length during third Trimester pregnancy in Indian population

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ABSTRACT

Introduction: Although fetal biometry measurements aid in an accurate estimation of GA in the early second trimester, the biological variations of size lead to these parameters' accuracy to vary as the age of the fetus advanced, making it challenging to date a fetus accurately in the late second or third trimester. Therefore, this study conducted to assess correlation of foetal kidney length with gestational age in third trimester of pregnancy.

Methodology: This was a cross-sectional observational study conducted among 120 pregnant women in the 3rd trimester. For obtaining foetal kidney length, longitudinal section was taken in sagittal plane using ultrasound.

Results: Out of total 120 cases, the left kidney length (LKL) is slightly higher than the right kidney length (RKL). Mean kidney lengths (MKL) rose consistently with gestational age, from 27.18 ± 2.20 mm at 28 weeks to 38.0 ± l.80 mm at 39 weeks. RKL, LKL and MKL were positively correlated with gestational age. R squared (R^2) value was 0.769 which is a good fit and indicates that this regression model explains 76.9% changes in GA with MKL.

Conclusion: Foetal kidney length is a reliable measure of gestational age. Measuring the foetal mean kidney length using ultrasound is a simple technique to determine the gestational age. In third trimester pregnancy with uncertain LMP, the length of the foetal kidneys may be extremely helpful in determining gestational age.

INTRODUCTION

The foundation of the obstetrician's ability to properly manage prenatal care, prenatal testing, and successful treatment or intervention planning. Precise knowledge of gestational age. Prematurity, which is linked to higher perinatal morbidity and mortality, can result from failure.[1] Even if the menstrual cycles start date is accurate, the exact moments of ovulation, fertilization, and implantation are unknown. During the typical menstrual cycle, women may experience many "waves" of vesicle growth, which could lead to irregular ovulation during any one cycle. The "known" pregnancy date is not entirely trustworthy because sperm can stay in a woman's reproductive system for 5 to 7 days. According to recent studies, the interval between ovulation and implantation might vary by 11 days,

which may have an impact on the size and growth of the foetus. [2]

Fetal kidney length (FKL) has recently been found to have a strong correlation with gestational age. According to the investigations, the fetal kidney length may be utilized to estimate gestational age when dates are ambiguous or when women seek ultrasound fetal biometry dating during the third trimester itself. [3] The length of the fetal kidney has been measured using sonography in a number of long-term investigations conducted in western nations. These were initially carried out to diagnose prenatal renal malformations, and later tests were used to determine whether there was a relationship between fetal kidney length and gestational age. [4] For the purpose of reducing variability, all pregnancies longer than 20 weeks are suggested to employ all four biometric indices. BPD, HC, AC, and FL can reasonably predict GA in the second trimester (± 10–14 days). These criteria grow more and more inaccurate in estimating GA as pregnancy progresses. [5] Throughout pregnancy, the fetal kidney has been observed to expand at a constant rate of 1.7 mm every two weeks and is unaffected by growth anomalies. Fetal kidney length (FKL), according to a number of studies, closely corresponds with gestational age in the third trimester. Although ultrasound textbooks frequently include tables of various sizes, the fetal kidney has not received much research as a biometric criterion for estimating gestational age. [6]

Although fetal biometry measurements aid in an accurate estimation of GA in the early second trimester, the biological variations of size lead to these parameters' accuracy to vary as the age of the fetus advanced, making it challenging to date a fetus accurately in the late second or third trimester. Therefore, some investigations concentrated on the relationship between a normal fetus' kidney size and gestational age. [7]

The purpose of the study is to correlation of foetal kidney length with gestational age in third trimester of pregnancy.

METHODOLOGY

This was a cross-sectional observational study conducted among pregnant women in the 3rd trimester attending obstetrics and gynaecology OPD in Krishna Hospital, Karad

Sample Size

Estimated sample size is calculated by formula sample size (n) = **n=$([Z\alpha + Z\beta]/C)$2+3**

Where c was 0.5ln(1+r/1-r) and r was Correlation between foetal kidney length and gestational age which is taken as (r) =0.907. [7] Hence by this formula sample size calculated is 120.

All ANC cases in the 3rd trimester attending OPD in tertiary care centre after obtaining written informed consent with fairly reliable LMP and documented dating scan of different parity and ages, were included in this study.

Eligibility Criteria:

All women with singleton pregnancies in the third trimester (28 to 40 weeks), patient with documented dating scans, patient who are sure of their last menstrual period, and normal antenatal period with no associated risk factors were included in the study.

Any pregnant women with oligohydramnios or polyhydramnios, dilated renal pelvis (> 4 mm), chromosomal and congenital anomalies, abnormal renal morphology (nephromegaly, agenesis, hypoplasia, cyst, polycystic kidney, hydronephrosis etc.), obscured adrenal and renal borders or margins, multiple pregnancies, gross maternal obesity, gestational diabetes mellitus, or preeclampsia was excluded from the study.

Procedure

Sonography was carried out on each patient included in the study using Ultrasound equipment. Longitudinal section will be taken in sagittal plane for obtaining foetal kidney length. Length will be determined for both left and right kidney. The average of their length in millimetre will be recorded as final measurement. The fetal kidney will be measured from outer-to-outer margin.

Approval of "Institutional Ethics Committee" was sought before start of the study.

Statistical Methods

Data was analyzed and appropriate statistical methods like frequency, percentage, Mean, Standard Deviation (SD), chi-square test, and 't' test were employed to analyze data throughout study. Pearson's correlation and regression coefficient were calculated between gestational age and renal length as well as between gestational age. P value <0.05 will be taken as significant.

RESULTS

The present study was conducted among 120 pregnant women. Out of total 120 participants, most of the participants were in the age between 25 to 29 years followed by 25 to 24 years. More than half of the participants were multipara. Most of the cases were in 30 to 36 weeks of gestation. Among all cases, 14 (11.67%) were in 32 weeks of gestation, 13 (10.83%) cases in 36 weeks and 13 (83%) were in 30 weeks of gestation (table 1).

Out of total 120 cases, the left kidney length is slightly higher than the right kidney length. It was also found that the kidney length (mm) is increasing steadily with the gestational age in both RKL and MKL. Mean kidney lengths also rose consistently with gestational age, with the average renal length raising from 27.18 ± 2.2O mm at 28 weeks to 38.O ± l.8O mm at 39 weeks (table 2).

Figure1A, 1B and 1C show correlation of gestational age with right kidney length (RKL), left kidney length (LKL)and Mean kidney length (MKL). All three lengths were positively correlated with gestational age. Pearson Correlation Coefficient (r) for MKL and Gestational Age by LMP was 0.877 which indicate a strongly good strength of correlation. P value is <0.001 indicating that the both the values were significantly correlated. R squared (R^2) value is 0.769 which is a good fit and indicates that this regression model explains 76.9% changes in GA with MKL.

Table 1: Distribution of study participants according to their age, parity and gestational age

Variables	Women (n=120) (%)
Age of mother in years	
<=19	9 (7.5)
20-24	45 (37.5)
25-29	52 (43.3)
30-34	12 (10)
>=35	2 (1.7)
Total	120 (100)
Parity	
Primipara	58 (48.3)
Multipara	62 (51.7)
Total	120 (100)
Gestational Age in weeks	
28	8 (6.67)
29	6 (5)
30	13 (10.83)
31	11 (9.17)
32	14 (11.67)
33	9 (7.5)
34	10 (8.33)
35	11 (9.17)
36	13 (10.83)
37	10 (8.33)
38	8 (6.67)
39	7 (5.83)

Table 2: Right, Left and Mean kidney length according to Gestational age (n=120)

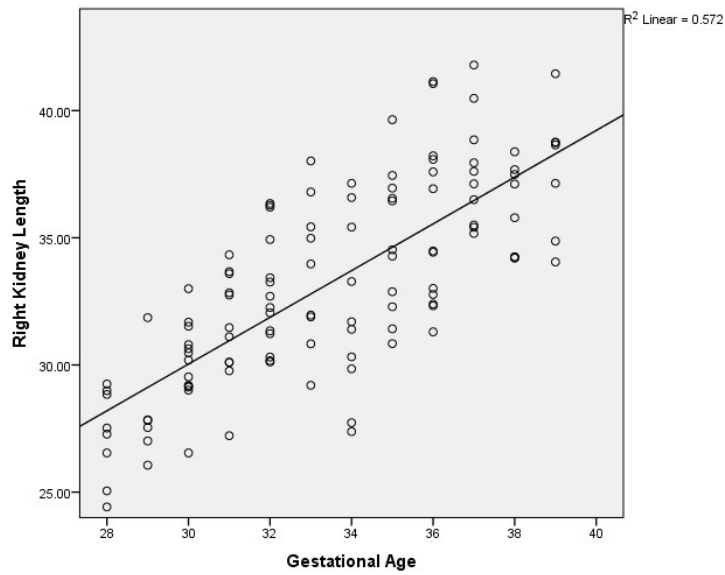| Gestational Age in weeks	Right Kidney Length (mm) (Mean ± SD)	Left Kidney Length (mm) (Mean ± SD)	Mean Kidney Length (mm)	
			Mean ± SD	95% CI
28	26.78 ± 2.10	27.48 ± 2.50	27.18 ± 2.2	26.41 - 27.96
29	28.39 ± 2.40	28.44 ± 1.85	28.44 ± 2.05	27.6 - 29.28
30	30.12 ± 2.70	29.52 ± 1.20	29.82 ± 1.9	29.29 - 30.35
31	31.13 ± 2.50	31.08 ± 1.60	31.13 ± 2	30.52 - 31.73
32	32.27 ± 2.30	32.77 ± 2.00	32.57 ± 2.1	32.01 - 33.13
33	33.10 ± 2.85	34.05 ± 2.00	33.6 ± 2.35	32.82 - 34.39
34	34.09 ± 3.40	35.49 ± 2.00	34.79 ± 2.6	33.96 - 35.61
35	34.97 ± 3.35	35.97 ± 2.40	35.47 ± 2.8	34.62 - 36.31
36	36.01 ± 3.30	36.61 ± 2.80	36.31 ± 3	35.48 - 37.14
37	36.46 ± 2.55	37.26 ± 2.10	36.86 ± 2.25	36.15 - 37.57
38	37.07 ± 1.80	38.07 ± 1.40	37.57 ± 1.5	37.04 - 38.1
39	37.50 ± 2.10	38.50 ± 1.90	38 ± 1.8	37.32 - 38.68

Figure 1A: Correlation between Gestational age and right kidney length (RKL)
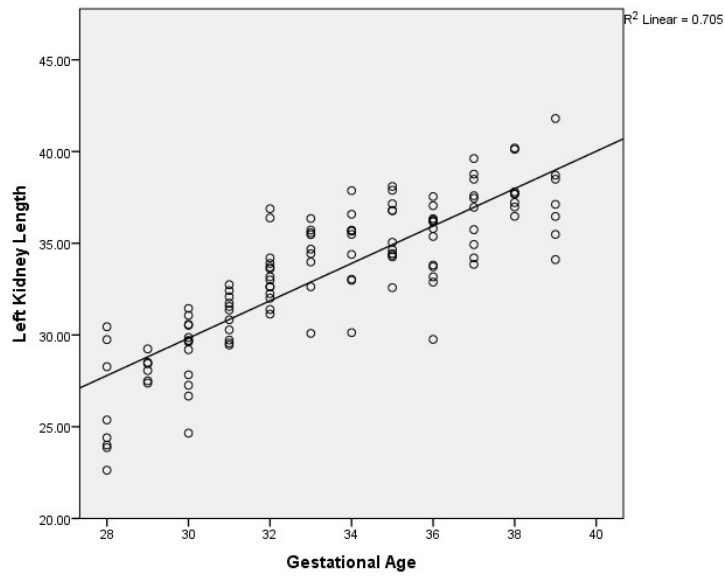

Figure 1B: Correlation between Gestational age (GA) and left kidney length (LKL)
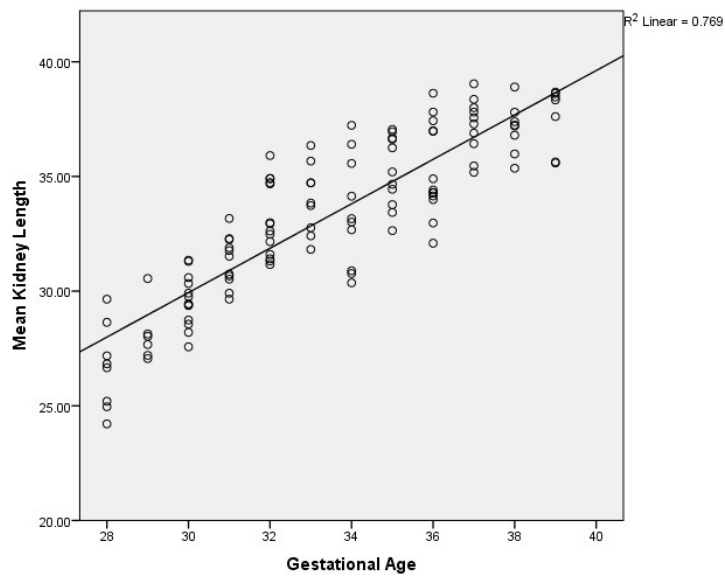

Figure 1C: Correlation between Gestational age (GA) and mean kidney length (MKL)

DISCUSSION

An obstetrician must accurately determine the gestational age and anticipated date of delivery (EDD) in order to evaluate and monitor a pregnant patient. [8] Numerous examinations and screening procedures for foetal congenital abnormalities are gestational age-specific. [9,10] Therefore, it is crucial to calculate gestational age accurately in order to monitor foetal progress and choose the best time and date for delivery or labour induction. Knowing the gestational age is crucial for planning deliveries in pregnancies with medical complications like preeclampsia and for procedures like amniocentesis. [11,12]

For many years, the conventional method for estimating gestational age by LMP has been used. It becomes problematic to evaluate the GA based on the LMP that the expectant mothers mention in impoverished nations since many of them are uneducated. In this situation, it is crucial for the treating obstetrician to determine the EDD using a variety of other resources that are readily available. [13]

In this investigation, we assessed the accuracy of additional foetal biometric indices and other assessments of the mean kidney length in estimating gestational age.

In present study out of total 120 cases, it was observed that the left kidney length is slightly higher than the right kidney length. It was also found that the kidney length (mm) is increasing steadily with the gestational age in both RKL and LKL. The similar results also found in the study performed by Ramachandran K et al (2021). [13]

In present study out of 120 cases, the kidney lengths in millimetres rose steadily with gestational age, with the mean kidney length increasing from 27.18 ± 2.20 mm at 28 weeks to 38.0 ± 1.80 mm at 39 weeks. In study by Ramachandran K et al (2021) [13], the mean kidney length increased gradually as the gestational age progressed, from 15.2± 2.4 millimetres at 18 weeks to 37.8± 3.3 weeks at 38 weeks. In the study by Bardhan J et al [14], the mean kidney length increases with GA. At 28 weeks of gestation mean kidney length was 28.15 mm and at 38 weeks of gestation MKL was 38.15 mm. According to the Samira-Al-Mlah et al (2019) [15], study foetal kidney length rose linearly in millimetres as gestational age increased in weeks. Similar results also found in the stud by Aremu OA et al (2005) [16]. According to Edevbie & Akhigbe [17], who found significant length differences between the two kidneys, the left kidney is

longer than the right kidney. Additionally, Seilanian and Delui [18] discovered that the left kidney's length is both marginally and significantly greater than the right kidneys. The lengths of the right and left kidneys were not significantly different, contrary to findings by Konje et al [1] and Kansaria [3]. In spite of the fact that Ahmadi et al (2015) [19] analysis of 557 foetuses revealed no difference between RKL and LKL (P = 0.843), they did discover that the mean right kidney width was greater than the mean left kidney width (P = 0.004).

In present study, Pearson Correlation Coefficient (r) for right kidney length and Gestational Age by LMP is 0.756, which indicate a positive correlation between RKL and GA by LMP, and the strength of correlation is moderately good. P value is <0.001 indicating that the both the values are significantly correlated. R squared (R^2) value is 0.572 which is a good fit and indicates that this regression model explains 57.2% changes in GA with RKL. Right kidney length in the study by Ramachandran K et al. (2021) [13] has a Pearson correlation coefficient (r) of 0.858, indicating a very strong positive link between RKL and GA.

In present study, Pearson Correlation Coefficient (r) for left kidney length and Gestational Age by LMP is 0.840, which indicate a positive correlation between LKL and GA by LMP, and the strength of correlation is strongly good. P value is <0.001 indicating that the both the values are significantly correlated. R squared (R^2) value is 0.705 which is a good fit and indicates that this regression model explains 70.5% changes in GA with LKL. Left kidney length in the study by Ramachandran K et al. (2021) [13] has a Pearson correlation coefficient (r) of 0.885, indicating a very strong positive correlation between LKL and GA.

In present study, Pearson Correlation Coefficient (r) for mean kidney length and Gestational Age by LMP is 0.877, which indicate a positive correlation between MKL and GA by LMP, and the strength of correlation is strongly good. P value is <0.001 indicating that the both the values are significantly correlated. R squared (R^2) value is 0.769 which is a good fit and indicates that this regression model explains 76.9% changes in GA with MKL. Mean kidney length in the study by Ramachandran K et al. (2021) [13] has a Pearson correlation coefficient (r) of 0.876, indicating a very strong positive correlation between MKL and GA. This result is almost similar with our results. This results also similar to previous studies. The correlation coefficient (r=0.877) observed in our study was compa-

rable with the studies done by Cohen et al (r=0.82) [20] and Schlesinger et al (r=0.859) [21]. Correlation coefficients between gestational age and other biometric indices were also comparable with the previous studies.

CONCLUSION

From the present study we conclude that foetal kidney length is a reliable measure of gestational age. Compared to only the right or left kidney length, the mean kidney length gives a higher assessment of GA. Mean kidney length and gestational age are strongly correlated (r=0.887).

Measuring the foetal mean kidney length using ultrasound is a simple technique to determine the gestational age. For determining gestational age in the third trimester, it is one of the reliable measures. In third trimester pregnancy with uncertain LMP, the length of the foetal kidneys may be extremely helpful in determining gestational age.

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