A Comparative Study of Ultrasonographic Measurement of Foetal Kidney Length and Foetal Transcerebellar Diameter and Its Correlation with Gestational Age On South Indian Population

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ABSTRACT: Gestational Age estimation is most important in maintaining a health record of both the featus and mother and time of delivery. Ultra-sonographic parameters allow physicians and health care providers to predict GA correctly. Among these parameters, transcerebrellar diameter and fetal kidney length allow precise prediction of GA even in fetal abnormalities. Hence, the present study aimed to compare the foetal kidney length (FKL) and transcerebellar diameter (TCD) and its correlation with gestational age on south Indian populations.

I. INTRODUCTION:

Gestational age is an important information which guides the primary care takers to decide the period of screening assessments of the foetus and mother throughout the gestation period.

Over a period of time Ultrasound method has been in the limelight to determine precise gestational age exclusively in the initial trimester. Femur length (FL), Fetal biparietal diameter (BPD), transcerebellar diameter (TCD), foot length, clavicle length (CL) and head circumference (HC) are the common parameters which can be helpful in GA estimation at various stages of pregnancy.[7,8]Among the several sonographic parameters, fetal kidney length and trans cerebellar diameter, are being relied on for determining precise gestational age.

The width and anterior-posterior measurements vary in the fetal kidney when there is intrauterine growth retardation. Hence the length of the fetal kidney is most relied on as this dimension does not vary in any medical circumstances. Further, this is supported with evidence of a sturdy growth of fetal kidney by 1.7mm all over the trimesters without affected by any growth aberrations.[9]

Similarly, the fetal cerebellum can be envisioned with an ultrasound effortlessly. Thus, the posterior fossa imaging becomes an important part of fetal ultrasonography at every scan visit. This parameter, unlike other sonographic parameters, has shown be unaffected by growth retardation.[10]

II. MATERIALS AND METHODS

Study population: All the pregnant women who attended the antenatal OPD of MMCHRI were considered as the study population.

Study design: The current study was a correlational study

Sample size:100

Sample size:
Sample size was calculated assuming the correlation coefficient of TCD with Gestational age as 0.398 as per the study by Sunita Dashottar et al.,. (1) The other parameters considered for sample size calculation were 95% power and 95% confidence level. The following formula was used for sample size calculation.(2)

$$r = \frac{N\sum xy - \sum(x)(y)}{\sqrt{N\sum x^2 - \sum(x^2)][N\sum y^2 - \sum(y^2)]}}$$

INCLUSION CRITERIA:
● Pregnant women attending antenatal OPD of MMCHRI.
• Non anomalous singleton pregnancies without any risk factors between 15 to 40 weeks of gestation
• With normal liquor and without any growth disturbances will be included in the study.
• All the patients had definite date and regular cycles.

EXCLUSION CRITERIA
• Oligohydramnios or polyhydramnios
• >90th percentile or < 10th percentile of estimated fetal weight as per last menstrual period

• 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
- Gestational diabetes mellitus
- Preeclampsia

Methodology:
Informed consent was taken from all the participants.Detailed history and examination were done. Ultrasonographic measurement of foetal transcerebellar diameter(TCD),foetal kidney length(FKL),biparietal diameter(BPD), Femur length (FL) and Head circumference(HC) done by **USG Model Ge Voluson S6(Software version A12.0.3)** by Transabdominal route after emptying bladder .Gestational age was estimated by TCD and FKL, and its accuracy was compared with the gold standard parameters like BPD,FL and HC.

Statistical methods:
Biparietal Diameter, Head circumference, femur length was considered as primary outcome variables. Gestation age was a secondary outcome variable. Age was considered as other explanatory variable.
Descriptive analysis: Descriptive analysis was carried out by Mean and Standard Deviation for quantitative variables, frequency and proportion for categorical variables.
Association between quantitative explanatory and outcome variables was assessed by calculating the Pearson correlation coefficient, and the data was represented in a scatter diagram. Linear regression was performed to assess the outcome parameter using the explanatory variables by forming the linear regression equation. IBM SPSS version 22 was used for statistical analysis.

III. OBSERVATION AND RESULTS

Descriptive analysis of trans cerebellar diameter (cm) and related gestational age (weeks) in the study population (N=100)

Parameter	Mean± SD	Median	Minimum	Maximum	95% C.I	
					Lower	Upper
Trans cerebellar Diameter(Cm)	2.82±0.82	2.70	1.60	4.90	2.65	2.98
Trans cerebellar Diameter (Gestational Age)	26.95±6.02	26.11	18.09	42.16	25.76	28.15

Descriptive analysis of right kidney length (cm), left kidney length (cm) and related gestational age in study population (N=100)

Parameter	Mean±SD	Median	Minimum	Maximum	95% C.I	
					Lower	Upper
Right Kidney Length (Cm)	3.52±1.74	2.95	1.50	9.66	3.17	3.86
Left Kidney Length (Cm)	3.6±1.86	2.95	1.40	8.19	3.23	3.97
Kidney Length (Gestational Age)	26.95±5.0	25.15	20.97	40.53	25.96	27.94

Correlation between gestational age and trans cerebellar diameter, fetal kidney length in the study population (N= 100)

Parameter	Pearson Correlation (r)	P value
Trans cerebellar Diameter vs. Gestational age	0.939	<0.001

Fetal kidney length vs. Gestational age	0.780	<0.001
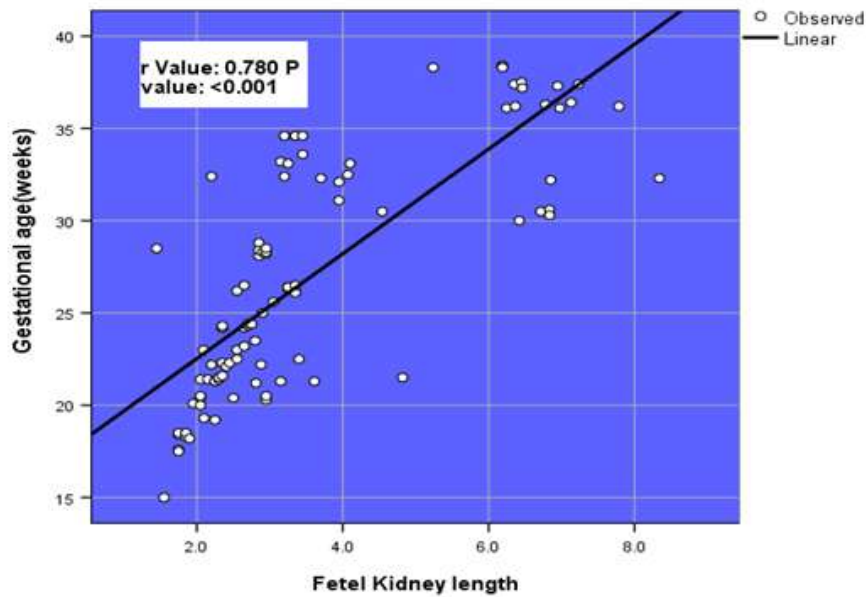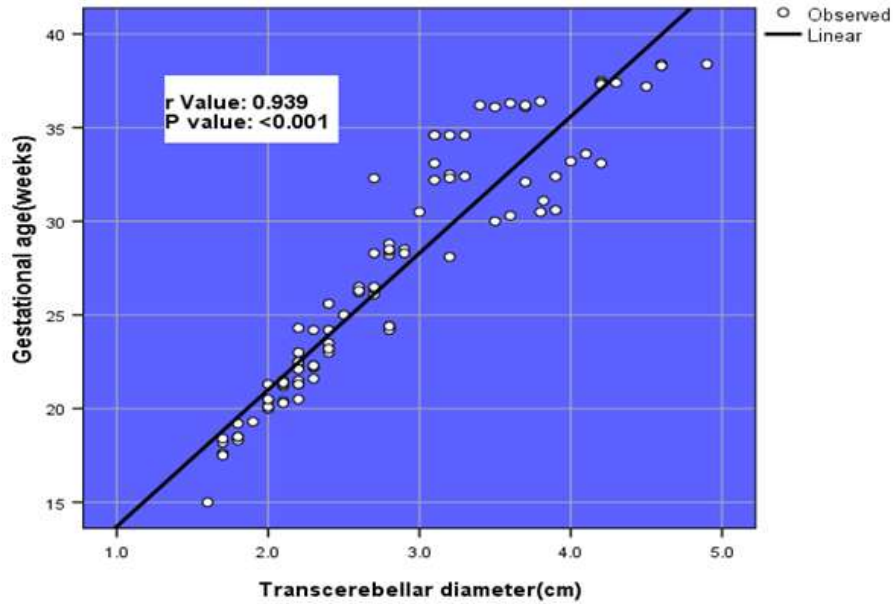
Correlation between trans cerebellar diameter and biparietal diameter, head circumference, femur length in the gestation age more than 28 weeks (N= 44)

Parameter	Pearson Correlation (r)	P value
Biparietal diameter	0.651	<0.001
Head Circumference	0.670	<0.001

Femur Length	0.751	<0.001

Correlation between fetal kidney length and biparietal diameter, head circumference, femurlength in the gestation age up to 28 weeks (N= 56)

Parameter	Pearson Correlation (r)	P value
Biparietal diameter	-0.125	0.358
Head Circumference	0.554	<0.001
Femur Length	0.608	<0.001

Correlation between fetal kidney length and head circumference, biparietal diameter, femur length in the gestation age more than 28weeks (N= 44)

Parameter	Pearson Correlation (r)	P value
Biparietal diameter	0.616	<0.001
Head Circumference	0.643	<0.001
Femur length	0.598	<0.001

Correlation between abdominal circumference and trans cerebellar diameter, fetal kidney length in the gestation age up to 28 weeks (N= 56)

Parameter	Pearson Correlation (r)	P value
Trans cerebellar diameter	0.845	<0.001
Fetal Kidney length	0.531	<0.001

Correlation between abdominal circumference and trans cerebellar diameter, fetal kidney length in the gestation age more than 28weeks (N= 44)

Parameter	Pearson Correlation (r)	P value
Trans cerebellar diameter	0.684	<0.001
Fetal Kidney length	0.691	<0.001

IV. CONCLUSION

The present study analyzed 100 pregnant women with a mean age of was 25.98 ± 3.81 years in the study population, the minimum age was 18 years, and maximum age was 34 years in the study population (95% CI 25.22 to 26.74). The mean Gestational Age score was 26.95 ± 6.4 weeks in the study population, the minimum was 15 weeks, and the maximum was 38.40 weeks in the study population (95% CI 25.68 to 28.22). This study found a strong positive correlation between Trans cerebellar Diameter (TCD) and gestational age (r Value: 0.939, P value: <0.001).In our study, we found a strong positive correlation between Fetal kidney length and gestational age (r Value: 0.780, P value: <0.001).

From the results of our study, we could conclude that TCD and FKL to be most useful predictors for gestational age. However,this study suggests, it is better to use them together as a better tool in estimating gestational age.

LIMITATIONS AND RECOMMENDATIONS

- The present sample size is small and needs further large studies to validate our results.
- The exclusion criteria of this study limited the prediction of TCD and FKL in such conditions.
- Correlation of Standard use of GA estimation LMP with TCD and FKL was not estimated.
- Estimation of GA with biometric parameters at all trimesters was not explored due to the design of the study.

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