Original Research Article

Usefulness of transverse cerebellar measurements by ultrasonography as against conventional parameters in normal pregnant mother between 15 to 40 weeks of gestation

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Abstract

One of the commonest problems that an obstetrician frequently faces is the estimation of fetal maturity, either for the purpose of prolonging pregnancy or for the termination of pregnancy in the presence of complications like severe pregnancy induced hypertension, diabetes mellitus and Rh incompatibility. The means that are widely used for assessing fetal maturity include estimation of gestational age and fetal weight. Fetal maturity is a pre-requisite for inducing labour, especially in high risk pregnancies. This study of ultrasonographic estimation of gestational age by transcerebellar diameter was conducted on 100 normal pregnant women, who did not know their Last Menstrual Period. These 100 women were recruited into the study from routine antenatal clinic in outpatient department and in-patients which were referred from obstetric department admitted to Medical College. It was found that calculation of the gestational age using transverse cerebellar diameter is as useful as other fetal growth parameters in normal pregnancies, especially in women who don't know their last menstrual period. A linear relationship was found during the second trimester between the growth of the cerebellum measured in millimeters and the gestational age in weeks.

Key Word: Transverse Cerebellar Measurements, Ultrasonography, Conventional Parameters

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INTRODUCTION

The capability of diagnostic modalities to identify the various abnormalities within the fetus has many implications. Early diagnosis of a congenital anomaly with a hopeless prognosis allows for termination of pregnancy. Detection of a less severe defect or late determination of a severe malformation may alter the subsequent obstetrical course. Caesarean section may be indicated when continued intrauterine existence is detrimental to the fetal well-being. Some malformation like cleft lip may be followed to normal term delivery with subsequent extra uterine evaluation and therapy.[1] One of the commonest problems that an obstetrician frequently faces is the estimation of fetal maturity, either for the purpose of prolonging pregnancy or for the termination of pregnancy in the presence of complications like severe pregnancy induced hypertension, diabetes mellitus and Rh incompatibility. The means that are widely used for assessing fetal maturity include estimation of gestational age and fetal weight. Fetal maturity is a pre-requisite for inducing labour, especially in high risk pregnancies. It is rather difficult to assess gestational age accurately, especially in our country, as most of the patients will not have an accurate idea of the date of their last menstrual period.[2] Commonly used parameters for assessing the gestational age include crown rump length, biparietal diameter, abdominal circumference and femur length. Out of these biparietal diameter is more reliable in the first trimester and femur length in the third trimester. But these parameters can

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either overestimate or underestimate gestational age in certain conditions like abnormal fetal skull.[3] Transcerebellar diameter measurement is a relatively new concept of assessing the fetal gestational age after 14 weeks when the cerebellum starts developing. It is more reliable than biparietal diameter or femur length in assessing the gestational age as, the development of cerebellum is not affected by factors like abnormal fetal skull or blood supply. Also it is found to be more reliable in normal pregnancy women who don't know their last menstrual period.[4] Hence his study is on pregnant women attending the obstetric unit who are referred to the department of Radio diagnosis for ultrasound examination to evaluate the usefulness of transcerebellar diameter in relation to the commonly used fetal parameters.

METHODOLOGY

A prospective correlation study consisting of 100 normal pregnant women is undertaken to study the degree of relationship between TCD, AC, HC, FL and BPD. This study of ultrasonographic estimation of gestational age by transcerebellar diameter was conducted on 100 normal pregnant women, who did not know their Last Menstrual Period. These 100 women were recruited into the study from routine antenatal clinic in outpatient department and in-patients which were referred from obstetric department admitted to Medical College. A total number of 100 obstetric scans were performed between 15 and 40 weeks of gestation who were referred to the department of Radio-Diagnosis for ultrasonography. Informed consent and acceptance and research ethical committee permission was taken.

Inclusion criteria

Normal singleton pregnancies between 15 and 40 weeks of gestation with unknown last menstrual period.

Exclusion criteria

- Multiple pregnancies
- Congenital malformations
- Known Hypertensives and diabetics.

Examination method

An informed consent from all the patients was taken and the patients were explained about the atraumatic nature and significant diagnostic importance of the procedure, which is being performed. Examination was performed with patient in the supine position. After taking a brief history, obstetrical examination was done and blood pressure was recorded in the recumbent position. Fundal height was measured in the supine position with empty bladder. An ultrasound examination was performed with the patient in the supine position and the synthetic ultragel was applied over the abdomen, to get a good acoustic coupling.

The ultrasound machine used for the study was a real time 2-D ultrasound unit, with a 3.5 and 5MHz convex sector transducer – G.E logic 400 M.D with M and B mode for simultaneous imaging and calculating heart rates in the fetus. Images were recorded using digital camera.

RESULTS

In this study a total of 100 obstetric scans were performed on pregnant women between 15 to 40 weeks of gestation. All the pregnant women did not know their last menstrual period, but had previous history of normal menstrual cycles and had no systemic diseases like diabetes mellitus, hypertension etc. Pregnant women in the age group of 21-25 years formed the bulk, total cases are 45. 52 Primi and 48 Multigravida women were evaluated. Biparietal diameter, head circumference, abdominal circumference, femur length and transverse cerebellar diameter were the fetal parameters assessed and a correlation was built between various fetal growth parameters and transverse cerebellar diameter, which was found to be significant. In our study the fetal cerebellum was visualized sonologically as early as fourteen weeks. Anomogram (for 5^{th} and 95^{th} percentile) showing transverse cerebellar diameter with other fetal parameters like biparietal diameter, femur length, abdominal circumference and head circumference for the corresponding gestational age was outlined. It was found that calculation of the gestational age using transverse cerebellar diameter is as useful as other fetal growth parameters in normal pregnancies, especially in women who don't know their last menstrual period. A linear relationship was found during the second trimester between the growth of the cerebellum measured in millimeters and the gestational age in weeks.

Table 1: Age in years

Age in years	Number	%
<20	15	15
21-25	45	45
26-30	27	27
31-35	13	13
Total	100	100

Table 2: Gravida distribution

Gravida distribution	Number (n=100)	%
Primi	52	52
Gravida 2	26	26
Gravida 3	12	12
Gravida 4	4	4
Gravida 5	6	6

Table 3: Mean pattern of BPD, HC, AC and FL in relation to grades of TCD

Parameters (mean ± sd)	Tcd grades			
	Grade i	Grade ii	Grade iii	P value
BPD	44.05±10.02	72.52±10.00	84.49±6.1	F=50.38 p<0.001
HC	171.86±41.3	270.34±30.78	310.17±14.54	F=92.25 p<0.001
AC	148.57±35.19	247.82±40.58	297.26±26.51	F=37.63 p<0.001
FL	32.85±10.38	55.93±8.67	67.43±4.58	F=67.55 p<0.001

Table 4: Pearson's correlation co-efficient of TCD with BPD, HC, AC, FL and CGA

Combination of parameters	Pearson correlation co-efficient	Significance
TCD (mm) vs. BPD (mm)	0.8949	P<0.001
TCD (mm) vs. HC (mm)	0.8932	P<0.001
TCD (mm) vs. AC (mm)	0.8574	P<0.001
TCD (mm) vs. FL (mm)	0.8864	P<0.001
TCD (mm) vs. CGA in weeks	0.9471	P<0.001

DISCUSSION

In this prospective study of 100 normal pregnant ladies, in our study the sonographic visualization of the fetal cerebellum was present as early as 14 to 15 weeks of gestation. The characteristic image of the cerebellum by ultrasonography appears as two lobules on either side of the midline located in the posterior cranial fossa. In all the examinations cerebellum was seen, however before the late third trimester measurements of the transverse cerebellar diameter were easier to perform. The transcerebellar diameter, biparietal diameter, head circumference, abdominal circumference and femoral length were measured in all the cases to assess the gestational age of the fetus and an attempt was made to detect the correlation between all these parameters and gestational age. An attempt was made to know correlation between trans cerebellar diameter and other parameters. Nomograms for estimating the gestational age from the measured TCD, BPD, FL, AC and HC in normal pregnancy were done. It is observed that the maximum number of pregnant women were in the age group of 21 to 25 years – 45 cases. The age ranged from 18 years to 35 years. Least number of cases observed in the age group of 31 – 35 years. Out of 100 normal pregnancies, 52 were primi-gravida, 26 were gravida-2, 12 were gravida-3,4 were gravida-4, and 6 were gravida-5 Stuart Campbell *et al*[5] first investigated to link the fetal BPD to the Gestational Age. In his study, he has obtained sonographic BPD measurements at varying gestational ages from a large number of normal gravida in whom LMP was known. Using this data he defined the mean BPD values corresponding to each week of gestation. He proposed that delivery occurred spontaneously within 1 week of menstrual expected date of delivery and in 84% of the gravidas with unknown dates of delivery occurred within 9 days of sonographic date of delivery.

Comparison of Present Study With Previous Studies

1)Israel Goldstein *et al*[6]

Combination of parameters	Correlation Co-efficient (r)	Significance (P-value)
TCD mm v/s CGA in weeks	$R^2 = 0.947$	P = 0.0001
TCD mm v/s BPD in mm	$R^2 = 0.894$	P = 0.0001
TCD mm v/s HC in mm	$R^2 = 0.893$	P = 0.0001

2) Richard D. McLeary *et al*[7]

Study of TCD v/s CGA and CGA v/s BPD particularly in breech presentation, multiple gestations and uterine anomalies. They found that the posterior fossa is not affected by pressure effects and that cerebellar diameter is a more accurate reflection of gestational age than biparietal diameter. In normal neonates there was good correlation with central vermian area and gestational age. With experience cerebellar diameter has become a routine measurement.

3) Winston A. Campbell *et al*[8]

Trans cerebellar diameter/Abdominal circumference ratio throughout pregnancy: A gestational age- independent method to assess fetal growth. There was a good correlation between TCD and gestational age (r –0.94). The TCD / AC ratio remained stable during pregnancy. The mean TCD/AC ratio was 13.7 $\pm$ 1.2%, and the fifth and 95th percentile were 19.9 and 15.9. The median ratio was 13.6%. There was strong linear relationship between TCD and AC (r = 0.857) In the current study, Normogram of cerebellar measurements estimating gestational age and predicting the BPD, HC, AC, FL and CGA was generated

Combination of parameters	Correlation co-efficient (r)	Significance (P-value)
TCD (mm) v/s BPD(mm)	$R^2 = 0.8949$	P = 0.0001
TCD (mm) v/s HC (mm)	$R^2 = 0.8932$	P = 0.0001
TCD (mm) v/s AC (mm)	$R^2 = 0.8574$	P = 0.0001
TCD (mm) v/s FL (mm)	$R^2 = 0.8864$	P = 0.0001
TCD (mm) v/s CGA in weeks	$R^2 = 0.9471$	P = 0.0001

In our study we have found a good correlation between TCD v/s BPD, HC, FL, AC and CGA. Though the TCD v/s CGA is more accurate (R^2 = 0.947) Trans cerebellar measurement is also one of the accurate measurements.[9,10]In our study we found that there is a good correlation between TCD and gestational age (R^2 = 0.947) The above discussion highlights the uncertainty in the estimation of gestational age, which is further amplified in cases of fetal growth retardation, which are further hampered by lack of precise estimation of gestational age leading to difficulty in determining whether fetus is truly growth retarded. To solve this dilemma estimation of gestational age by trans cerebellar diameter has been found to be of much advantage.

CONCLUSION

Transverse cerebellar diameter is a better parameter for gestational age assessment than biparietal diameter and femur length as it is not fraught with the problems in the measurements commonly encountered in biparietal diameter and femur length, due to its easily identifiable landmarks.

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