Research Article

Sonographic Estimation of Gestational Age by using Transcerebellar Diameter in Second and Third Trimester of Pregnancy

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Abstract: The accurate knowledge of gestational age is a keystone in an obstetrician's ability to successfully manage the antepartum care of a patient and is of critical importance in ante-natal tests and successful planning of appropriate therapy or intervention. Failure can result in iatrogenic prematurity which is associated with increased perinatal morbidity and mortality. Ultrasonography of fetal measurements is highly reliable in the first and second trimester of pregnancy but reliability of any ultrasound method greatly diminishes as gestation advances. The objective is to estimates GA by using transcerebellar diameter in second and third trimester. A descriptive analytical cross sectional study done in different Khartoum hospitals from February to September 2014. The data was collected, classified, analyzed by using SPSS, results shows that most women under study their ages groups between 20-30years and this forms incidence of about 49%, from central Sudan (32%), house wife (75%), para2-5 (51%), gravid less than 5 (54%), LMP the irgestation age was 25-29 (27%), BPD was 25-29 (28%)and by TCD their gestation age was 30-34 (28%). The accuracy of TCD in detection of GA is constant throughout the second and third trimesters of pregnancy. The study recommended that the transcerebellar diameter can be used as accurate nomogram in the second and third trimester.

Keywords: Ultrasonography, fetal measurements, transcerebellar diameter

INTRODUCTION

The accurate dating of pregnancy is critically important for pregnancy management from the first trimester to delivery and is particularly necessary for determining viability in premature labor and in post-dates deliveries [1]. Prior to the widespread use of ultrasound, caregivers relied on acombination of history and physical examination to clinically determine gestational age. Ultrasound gave clinicians a method to measure the fetus and therefore to estimate gestational age. Much of our current clinical practice is based on studies from the 1980s and 1990s. As new information emerges infields, such as reproductive biology, perinatal epidemiology and medical imaging, our current clinical practice is being challenged. "Certain" menstrual dating, for example is less certain than previously thought. When ultrasound is performed with quality and precision, there is evidence to suggest that dating a pregnancy using ultrasound measurement is clinically superior to using menstrual dating with or without ultrasound, and this has been advocated and adopted in other jurisdictions [2, 3].

Ultrasound biometric measurements determine gestational age based on the assumption that the size of the embryo or fetus is consistent with its age. Biological variation in size is less during the first trimester than in the third trimester. Ultrasound estimation of gestational age in the first trimester is therefore more accurate than later in pregnancy [4].

The determination of gestational age in the first trimester uses the mean gestational sac diameter and/or the crown–rump length. During the first 3 to 5 menstrual weeks anintrauterine pregnancy is first signaled by the presence of a gestational sac [5]. The gestational sac represents the chorionic cavity and its echogenic rim represents the implanting chorionic villi and associated decidual tissue [6]. The smallest gestational sac size that can be clearly distinguished by high frequency transvaginal transducers is 2 to 3 mm,

which corresponds to a gestational age of about 32 to 33 days [7]. The MSD is a commonly used, standardized, way to estimate gestational age during early pregnancy. It is less reliable when the MSD exceeds 14 mm or when the embryo can be identified [8]. The growth of the MSD is approximately 1 mm per day [9]. CRL has lower inter observer variability than MSD and may thus be better for dating a pregnancy [10].

When the yolk sac appears in the gestational sac it provides confirmation of an intrauterine pregnancy and may beinitially visible as early as the start of the 5th week or as late as the 6th week. It grows to a maximal size of 6 mm by 10 weeks and gradually migrates to the periphery of the chorionic cavity. At the end of the first trimester it becomes undetectable. Although the presence of the yolksac is helpful in determining the presence of an intrauterine pregnancy, direct measurement of this structure is not useful in determining gestational age [11].

Direct measurement of the CRL provides the most accurate estimate of gestational age once the embryo is clearly seen. Ideally, either the best CRL or the average of several satisfactory measurements should be used [25].The CRL measurement is reported to be accurate for dating to within 3 to 8 days [9, 12, 13]. The MSD should not be used to estimate gestational age once the CRL can be measured [9, 13, 14].

The narrowest confidence interval appears to be between 7 and 60 mm or CRL[14]. The slope of the embryonic growth curve is small before this time and it can be difficult to clearly identify a very early fetus; thus, it is this committee's expert opinion that reliability and measurability is best when the CRL is at least 10 mm. If more than one scan is performed in the first trimester, the earliest scan with a CRL of at least 10 mm should be used. To avoid performing extra ultrasounds, it is acceptable to time the dating scan to coincide with nuchal translucency screening. Maternal and fetal pathology may affect them, so their inclusion or exclusion in the determination of gestational age requires clinical judgment [14].

In the second and third trimesters, estimation of gestational age is accomplished by measuring the biparietal diameter, head circumference, abdominal circumference and femur length. These measurements are only as good as the quality of the images. Optimal imaging can be difficult in some clinical situations, such as in a late pregnancy abnormal lie when the head is deep in the maternal pelvis, maternal obesity, or multiple gestations. Normal biological variation appears to have more influence on measurements in the second and third trimester. Thus, in the second half of pregnancy these measurements are less reliable than

first trimester CRL and they become increasingly inaccurate as gestation progresses.

The BPD is less reliable in determining gestational age when there are variations in skull shape, such as dolichocephaly or brachycephaly; hence some authors feel that BPD is lesser liable than HC [15, 16, 17]. As a single parameter, HC correlates better to gestational age than the other 3 standard parameters in the second trimester, and as with all others, it becomes less accurate with increasing gestational age [18, 19].

It is more challenging to measure the fetal AC than the other parameters. The abdomen has no bright echoes of bone, it is not always symmetrical, and its size will vary with fetal respiration and central body flexion/extension. Of all the fetal biometric parameters, this measurement has the most variability as it is somewhat dependent on fetal growth factors and body position [19, 20]. Femur length varies somewhat with ethnicity. Short femurs are commonly a normal variant, however this finding may also indicate fetal growth restriction, aneuploidy, and—when severely shortened—skeletal dysplasia [21].

Measurement of the Transcerebellar diameter, foot length, clavicle length, intra/interorbital diameters, kidney length, sacral length, scapula length, as well as the length of other long bones of the extremity have also been evaluated to determine gestational age. Studies have not shown that these parameters improve the assessment of gestational age beyond that achieved with standard biometry, however they may be useful in clinical situations in which traditional biometry is difficult to attain (such as uteroplacental insufficiency) or when fetal abnormalities are present [22, 23].

OBJECTIVES
To estimates GA by using Transcerebellar diameter in second and third trimester.

MATERIALS & METHODS
Descriptive analytical cross sectional study, carried out in ultrasound departments in Khartoum state from February 2014 to September2014. The variables of this study were gestational age, trans cerebellar diameter (TCD), biparietal diameter (BPD) measured in mm.

The data was collected by clinical collection sheet which contain all variables of the study. An ultrasound measurement was made with commercially available real time ultrasound machine "Mindray-Digiprince DP-1100" with a 3.5 MHz convex transducer and "Toshiba power vision 6000".

Inclusion criteria include normal pregnant women's in the second and third trimester, while

incorrect dating, fetuses with anomalies, intrauterine fetal death (IUFD), multiple gestation and medical disorders like diabetes, hypertension were excluded.

Technique of transcerebellar diameter:

The Patients were examined in the supine position with a moderately distended bladder, ultrasound coupling gel was applied. The measurement of TCD was obtained by placing electronic caliper at outer margins of cerebellum. The landmarks of thalami, cavium, septum pellucidum, and their ventricle were identified thereby slightly rotating the transducer below the thalamic plane. The posterior fossa is revealed with the characteristic butterfly like appearance of cerebellum. In all cases cerebellum was seen as two lobules on either side of midline in the posterior cranial fossa. The statistical evaluation between fetal transverse cerebellar diameter and gestational age was assessed [24].

Estimation of Gestational Age:

Ultrasound assessment of gestational age is most accurate in the first trimester of pregnancy. First trimester ultrasound is a useful and reliable tool in the assessment of gestational age. In particular, sonographic measurement of the CRL during the first trimester is the best parameter for estimating gestational age and is accurate within five days of the actual conception date. Estimating gestational age in the 2nd and 3rd trimesters of pregnancy using a combination of cranial measurement, such as the biparietal diameter or head circumference and limbs measurement, such as the femur length the accuracy of estimating fetal age in the 2nd and 3rd trimester decreases as pregnancy progresses due to increasing biological variation. Thus, gestational age estimates done early in the second trimester are more accurate than measurement done later in the second trimester or in the third trimester. In general, the accuracy of gestational age prediction in the 2nd trimester is approximately ±7 days before 20weeks and ±10 days after 20 weeks. The accuracy of fetal age prediction in the 3rd trimester is about ±21 days [24].

RESULTS& DISCUSSION

Frequency distribution of patients according to gestation age depends on TCD were analyzed in to five groups, less than 20 weeks, 20-24 weeks, 25-29 weeks, 30-34 weeks and 35-39 weeks, the most frequent group 30-34weeks (28%).The relationship of gestation age depends on last menstrual period and BPD were analyzed in to five groups, less than 20 weeks, 20-24 weeks, 25-29 weeks, 30-34 weeks and 35-39 weeks, the most frequent group 25-29weeks (27%) and (28%) respectively. No significant difference (P=0.9895), this was differ from John C. Smulin[25], Parphat Goel[26], and Mukesh Singla[27] they have found a difference in the predicted GA in the third trimester; this difference was being due to different normogram between the two ethnic groups [26, 27].

Table-1: Frequency distribution of patients according to age TCD

Age (weeks)	Last menstrual period		TCD	
	Frequency	%	Frequency	Percentage %
<20	18	18	17	17
20-24	17	17	16	16
25-29	27	27	27	27
30-34	24	24	28	28
35-39	14	14	12	12
Total	100	100%	100	100%
P-value	0.9715^{NS}			

Table-2: Interaction relationship of gestation age depends on last menstrual period, BPD and TCD

Age (weeks)	Last menstrual period		BPD		TCD	
	Frequency	%	Frequency	%	Frequency	Percentage %
<20	18	18	17	17	17	17
20-24	17	17	15	15	16	16
25-29	27	27	28	28	27	27
30-34	24	24	24	24	28	28
35-39	14	14	16	16	12	12
Total	100	100%	100	100%	100	100%
P-value	0.9968^{NS}					

The relationship of gestation age depends on last menstrual period and trans cerebellar diameter was analyzed in to five groups, less than 20 weeks, 20-24 weeks, 25-29 weeks, 30-34 weeks and 35-39 weeks, the most frequent group 25-29 weeks (27%) and 35-39 weeks (28%) respectively. Chi-square showed no significant difference (P=0.9715).Interaction relationship of gestation age depends on last menstrual period, BPD and TCD was analyzed into five groups, less than 20 weeks, 20-24 weeks, 25-29 weeks, 30-34 weeks and 35-39 weeks, the most frequent group 25-29weeks (27%) ,25-29(28%) and 30-34 weeks (28%) respectively. No significant difference (P=0.9968) was noticed, this was agree with Mustafa ZM; *et al*[27] they found that the fetal TCD by ultrasound could be used a predictive biometric parameter of GA in the last two trimesters of pregnancy in comparison to other biometric parameter [28].

It is also matches with Orji Moand *et al*[28] was agree with our study in that there was significant correlation between TCD and menstrual GA. So that the TCD is an accurate normogram for GA in the second and third trimesters [29].

CONCLUSIONS
The TCD is predictive normogram in the second and third trimesters. The sonographic features of the cerebellum differ according to gestational age. To obtain accurate TCD measurement it is important to identify butterfly like appearance of cerebellum in posterior cranial fossa. There are different normograms in different ethnic groups. Fetal TCD could be used as predictive biometric parameter of GA in the last two trimesters of pregnancy. The accuracy of TCD in detection of GA is constant throughout the second and third trimesters of pregnancy.

RECOMMENDATION
The trans cerebellar diameter can be used as accurate nomogram in the second and third trimester. Thoughtful attention to technical details and training programs to give accurate results.

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