Section: Anatomy

Original Research Article

ESTIMATION OF FETAL AGE BY SONOGRAPHIC EVALUATION OF UMBILICAL CORD DIAMETER IN RELATION TO PARITY: A TEACHING HOSPITAL BASED STUDY

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Abstract

Background: In order to estimate the curve for umbilical cord diameter with regard to foetal age in primi and multi gestation separately, a ultrasonographic cross-sectional study was conducted. **Materials and Methods:** A total of 55 pregnant women who attended the OPD or were hospitalized as inpatients at various gestational ages for a routine ultrasonographic scan during an uneventful pregnancy. **Result:** In general, the values rise steadily and uniformly up to 33 weeks in primigravida, at which point they reach a plateau in terms of diameter. In multigravida, it is generally true that the diameter rises with foetal age until 35 weeks, at which point it stabilises. For both primigravida and multigravida pregnant women, polynomial (quadratic) regression analysis was used to create equations establishing connections between umbilical cord diameter and foetal age characteristics. **Conclusion:** When measuring BPD, AC, or FL is problematic, such as when a foetus is undersized for its gestational age or has anencephaly, hydrocephalus, or achondroplasia, the umbilical cord's diameter and cross-section area can help determine the gestational age accurately. In multigravida as opposed to primigravida, the rise in cord diameter reaches a plateau at a later gestational age.

INTRODUCTION

During pregnancy, ultrasound is a low-risk, non-invasive investigative technique.[1,2] Prenatal care now includes ultrasounds on a frequent and important basis. First-trimester ultrasounds confirm a normal pregnancy, establish the baby's age and heart rate, detect multiple pregnancies, and pinpoint issues with the placenta, uterus, cervix, and ovaries. Second and third-trimester ultrasounds assess the placenta's growth and position as well as any developmental issues and examine the amniotic fluid and placenta. The blood flow to the foetus is detected by foetal doppler monitoring utilising ultrasound in the final trimester in pregnant women with gestational diabetes and preeclampsia. The stalk that connects the placenta and foetus is formed by the umbilical cord. It reaches the foetal surface of the placenta from the foetal umbilicus. Through this, foetal blood travels to and from the placenta.[3-5] Since many years ago, the postpartum umbilical cord has been evaluated. We can now investigate it intrapartum thanks to ultrasound investigations. Umbilical cord shrinkage has been linked to unfavourable pregnancy outcomes.[6] Significant variations were seen in the mean gestational age, delivery method, newborn weight, and umbilical cord thickness. The diameter can be measured to determine the likelihood of antenatal and prenatal problems.[7] Here, we merely attempted to illustrate the umbilical cord diameters and their correlation with foetal age in healthy primi- and multigravida pregnancies in a region in Haryana, India. Our goal was to determine whether there was any correlation between gestational age and umbilical cord diameter for both primi and multigravida.

MATERIALSANDMETHODS

In collaboration with the department of Obstetrics and Gynecology, the cross-sectional study was conducted in the department of anatomy at the World College of Medical Sciences Research and Hospital, Jhajjar. A total of fifty five (55) pregnant women who attended the OPD or were hospitalised as inpatients at various gestational ages for a routine

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ultrasonographic scan during an uneventful pregnancy. The moms who met the inclusion criteria were informed of the study's purpose and its details before it began. Women who consented to take part signed informed consent forms.

Inclusion Criteria

Consistingof a single pregnancy, a viable fetus, a gestational age previously determined using the last menstrual period's date, if reliable, or a first-trimester ultrasound, intact membranes, a normal amniotic fluid index, and no maternal illnesses like lupus, nephropathy, or previous pregnancies with IUGR or macrosomia.

Exclusion Criteria

Includesfoetal malformations such as oligohydramnios or polyhydramnios, foetuses with signs of intrauterine growth retardation, foetuses that are small for gestational age or large for gestational age, or foetuses that show signs of foetal macrosomia, as well as morphological abnormalities of the umbilical cord.

The examinations were performed using ultrasonographic machines– Philips Affiniti 70 ultrasound machine with a 3.5-5 MHz curvilinear probe. All pregnant women who were more than 14 weeks along had the diameter of their umbilical cords measured within a maximum of 2.0 cm of where it inserted into the foetal abdominal wall. In accordance with the method outlined by Ghezziet al.[8], the diameter of the cord was measured in a free loop of chord close to its entry into the foetal abdominal wall by positioning the markers at its outer borders and using maximum image magnification along its longitudinal axis. The biparietal diameter, abdominal circumferences, and femur length were used to determine the foetal age in addition to other indicators commonly encountered in pregnancies.

Statistical analysis: The information was gathered in a Microsoft Office 2007 Excel worksheet that was predesigned in Washington. Using SPSS, v20, IBM, Chicago, the data were compared between primigravida and multigravida pregnant women who visited the OPD or were admitted as inpatients in a single cross-sectional research. Fetal age in weeks was a continuous independent variable. The umbilical cord's diameter (mm) was one of the dependent variables.

A search of the literature for studies on regression analysis between parameters relating to umbilical cord architecture and foetal growth was conducted. The sample size to test the regression analysis between foetal age in weeks and umbilical cord diameter in mm for primigravida and multigravida patients would be 89 in each arm using sample size calculation statistical software G*Power 3.1.9.2, with error probability 0.05 power (1-) 0.95 and effect size f2 - 0.15 (medium).

Modeling using regression analysis: Based on a review of the literature on regression analysis, a quadratic equation was created using polynomial regression analysis to predict the link between dependent and independent factors for primigravida and multigravida women individually. First, "explore data" was used to analyse the pertinent data, and "scatter plots" were made to check for linearity. Accordingly, the default technique "Enter" for polynomial regression analysis was employed. P value less than 0.05 was considered to be significant.

RESULTS

Except for mothers' ages, all metrics in group B (multigravida) are slightly higher than in group A (primigravida), although these differences are not statistically significant.

Table 1: Shows the parity.

Parity	(Mean±S.D.)	P-value
Primigravida (26)	19.98±6.21	0.01
Multigravida (29)	23.87±7.76	

Regression model results description: For A subset of individuals, y (umbilical cord diameter mm)= -8.326+ 0.310 x – 0.024 x2 , where x is foetal age in weeks (R2 0.457, p value <0.01). Likewise for B subset of individuals, y (umbilical cord diameter mm)= -5.123 + 0.624 x – 0.014 x2 , where x is foetal age in weeks (R2 0.564, p value <0.01). The regression model shows the curve lines of the values of the umbilical cord diameter, according to gestational age in primigravida (A) and multigravida (B).

Table 2: Shows the mother weight in kg.

Mother weight in Kg	(Mean±S.D.)	P-value
Primigravida (26)	51.79±14.32	0.19
Multigravida (29)	53.64±16.06	

In general, the values rise steadily and uniformly up to 33 weeks in primigravida, at which point they reach a plateau in terms of diameter. In multigravida, it is generally true that the diameter rises with foetal age until 35 weeks, at which point it stabilises. For both primigravida and multigravida pregnant women, polynomial (quadratic) regression analysis was used to create equations establishing connections between umbilical cord diameter and foetal age characteristics.

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Table 3: Shows the USG findings.

BPD	(Mean±S.D.)	P-value
Primigravida (26)	26.32±8.57	0.24
Multigravida (29)	27.67±8.92	
AC		
Primigravida (26)	25.93±7.76	0.34
Multigravida (29)	26.86±8.53	
FL		
Primigravida (26)	25.96±7.56	0.46
Multigravida (29)	26.79±8.06	

{Note: Biparietal diameter (BPD), abdominal circumference (AC) & femur length (FL)}.

Table 4: Shows the Umbilical cord diameter and foetal age.

Fetal age in weeks	(Mean±S.D.)	P-value
Primigravida (26)	26.56±8.06	0.26
Multigravida (29)	27.64±8.83	
Umbilical diameter in mm		
Primigravida (26)	09.97±3.45	0.12
Multigravida (29)	10.87±4.42	

DISCUSSION

For a certain group of individuals, y (umbilical cord diameter mm) = -8.326 + 0.310 x - 0.024 x2, where x is the foetal age in weeks (R2 0.457, p value 0.01). Since quite some time, thin cords have been linked to pregnancy difficulties or low birth weight, and Raio et al. have written about this in the literature.[9] Early pregnancies' umbilical cords were initially explored when sonography first became available. Maximum cord diameter was reported by Weissman et al,[10] to be about at 38 weeks, later than those of our experiments. Even so, a correlation was shown. Raio et al.'s research was supported by studies by Predanicet al.[12] The umbilical cord diameter in our current study increases with gestational age up to 33 weeks before plateauing till 35 weeks. The foetal size increased rapidly up to 33 weeks before gradually slowing down till reaching a plateau at 35 weeks, which may be the cause. After that, we saw a decrease in diameter, which may have been caused by a change in form or a compromise in the foetal circulation and the beginning of the switchover of circulation. In multigravida, there has been a slight increase in the mean parameters, and they are also approaching a plateau stage at a later gestational age than a primigravida. The most likely explanation is that the infant had a longer labour than usual. Although there was no evidence of a positive linear link between umbilical cord characteristics and parity, one would have complicated the situation. The study's limitations include observer bias, a brief study period, and a small sample size.

CONCLUSION

These data imply that in situations where measuring BPD, AC, FL is challenging, such as anencephaly, hydrocephalus, achondroplasia, and tiny for age fetuses, the umbilical cord diameter and cross-section area can aid in accurately predicting gestational age. In multigravida as opposed to primigravida, the rise in cord diameter reaches a plateau at a later gestational age.

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