

## Estimation of Fetal Age in Relation to Parity by Sonographic Assessment of Umbilical Cord Cross Section Area.

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### ABSTRACT

**Background:** The cross sectional study was to determine the curve for umbilical cord cross section area with respect to fetal age in primi and multi gravida separately using sonography. **Methods:** 100 uneventful pregnancies of second and third trimester were studied. SPSS, v17, IBM, Chicago, were used for statistical analysis and polynomial regression equations were calculated. **Results:** The regression equation of umbilical cord cross section area to Gestational Age:  $y = -3.143 + 0.286x - 0.004x^2$ , ( $R^2$  0.512, p value <0.001) in primigravida. For multigravida cord cross section area to Gestational Age:  $y = -1.992 + 0.192x - 0.002x^2$ , ( $R^2$  0.563, p value <0.001), where x is fetal age in weeks, y is cord cross section area in  $cm^2$ . **Conclusion:** The cord cross section area increased significantly with fetal age upto 32 weeks, thereafter a plateau was seen in primigravida. No plateau was observed in multigravida.

**Keywords:** Gestational age, Parity, Umbilical cord.

### INTRODUCTION

The umbilical cord extends from the fetal umbilicus to the fetal surface of the placenta, forming the connecting stalk between the fetus and placenta. Fetus gets its nutrition through this. Evaluation of post partum umbilical cord has been performed for many years. Intrapartum studies are now possible using ultrasonography. The decreased thickness of umbilical cord has been associated with complicated pregnancy outcome. Significant differences were also observed in mean gestational age, mode of delivery, birth weight also with umbilical cord thickness. Measurement of the cross section area of the umbilical cord may reveal risk of antenatal and prenatal complications. We have tried here to show the umbilical cord cross section area and their relationship to that of fetal age in uneventful pregnancies of primi and multigravida in a part of West Bengal, India. Our objective was to find if there is any relationship between umbilical cord cross section area to gestational age separately for primi and multigravida.

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### MATERIALS AND METHODS

Prior to initiation, the mothers fulfilling the inclusion criteria were provided with information and nature of study. The women who agreed to participate signed an informed consent. The cross sectional study was carried out in a private clinic in West Bengal, between February 2016 to July 2016, in a total of 100 pregnant women, who had referred to this clinic for a routine ultrasonographic scan at different gestational ages of an uneventful pregnancy.

#### Inclusion criteria

It comprised of a single pregnancy, living fetus, gestational age previously established according to the date of last menstrual period when reliable or according to an ultrasonic scan performed in the 1st trimester, intact membranes, normal amniotic fluid index and no maternal illness like lupus, nephropathy or previously pregnancies with IUGR, and macrosomia.

#### Exclusion criteria

It comprised of maternal diabetes mellitus, arterial hypertension of any etiology, fetal malformations oligohydramnios or polyhydramnios, fetuses with signs of intra uterine growth retardation or small for gestational age or large for gestational age or signs of fetal macrosomia and morphological abnormalities of umbilical cord.

The examinations were performed using two ultrasonographic machines – DC-7 MINDRAY-Color Doppler MX-4C006581 and DC-7 MINDRAY-Color Doppler MX-13001826. using 3.5 MHZ transducer. All the mothers of more than fourteen weeks of gestation, the cross sectional area of umbilical cord were measured, within a maximum distance of 2.0 cm, adjacent to its insertion in the fetal abdominal wall. According to the method used by Raio et al,<sup>[8]</sup> and Weissman et al,<sup>[5]</sup> the elliptical calipers of the ultrasonographic scanner at the outer borders of the cord and is used. The fetal age was measured according to biparietal diameter, abdominal circumferences and the length of femur.

**Statistical analysis**

The data was collected in predesigned Microsoft Office 2007 Excel worksheet, Washington. The data were compared between primigravida and multigravida pregnant women attending in a private clinic in West Bengal in single cross-sectional study using SPSS, v17, IBM, Chicago. The independent continuous variable was fetal age in weeks and fetal weight in kgs. The dependent variables was umbilical cord cross sectional area.

**Sample size:**

Determination for regression analysis study. Literature search was done on articles pertaining to regression analysis between fetal growth and umbilical cord structures parameters. Using sample size calculation statistical software G\*Power 3.1.9.2, with  $\alpha$  error probability 0.05 power (1- $\beta$ ) 0.95 and effect size  $f^2 = 0.15$  (medium), the sample size to test the regression analysis between fetal age in weeks and umbilical cord cross section area in  $cm^2$  for primigravida and multigravida patients would stand for 89 in each arm.

**Regression analysis modeling**

Based on available literature review on regression analysis, polynomial regression analysis was used to develop a quadratic equation for predicting relationship between dependent and independent variables separately for primigravida and multigravida women. The relevant data were first analyzed using “explore data” and creating “scatter plots” to check for linearity. Accordingly polynomial regression analysis using default method “Enter” was used. P value < 0.05 was taken as significant test.

**RESULTS**

The tables show a mild increase in all parameters in group B (multigravida) than in group A (primigravida) but, excepting mothers age, the values are not significant.

**Table 1: Mother’s Statistics**

	N	Mean	Std. Deviation	Std. Error Mean	P VALUE*
Mother_age years	54	20.96	3.047	0.415	<0.001
Mother_weight kgs	54	52.8519	5.85165	0.79631	0.159

**Table 2: Fetal statistics**

	N	Mean	Std. Deviation	Std. Error Mean	P VALUE*
B.P.D cm	54	27.1296	7.46829	1.01631	0.373
A.C cm	54	26.8148	7.36405	1.00212	0.422
F.L cm	54	26.9815	7.36255	1.00192	0.552

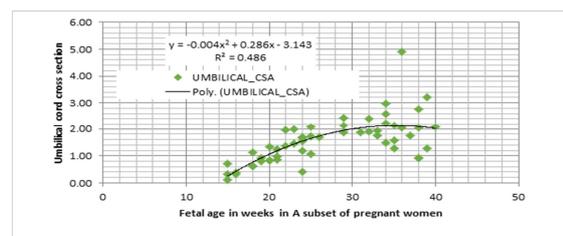
**Table 3: Fetal age, weight and umbilical cord cross section area**

	N	Mean	Std. Deviation	Std. Error Mean	P VALUE*
Fetal_age_wks	54	27.2407	7.74337	1.05374	0.524
Fetal_weight_kg	54	1.2976	1.03866	0.14134	0.648
Umbilical_csa_cm2	54	1.5620	0.84787	0.11538	0.437

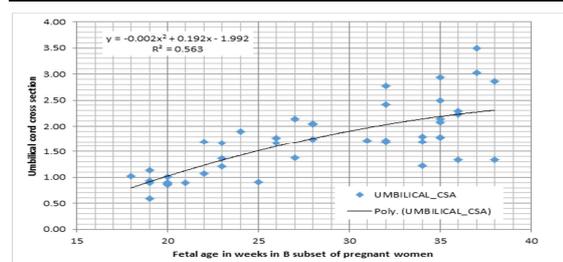
**Regression model results description**

Polynomial (quadratic) regression analysis was done to develop equations for establishing relationships among umbilical cord and fetal growth parameters separately for primigravida and multigravida pregnant women.

Subset A= primigravida, subset B= multigravida pregnant women.



**Figure 1:** For A subset of individuals, y (umbilical cord cross sectional area)=  $-3.143 + 0.286x - 0.004x^2$ , where x is fetal age in weeks ( $R^2 = 0.512$ , p value <0.001).



**Figure 2:** For B subset of individuals, y (umbilical cord cross sectional area)=  $-1.992 + 0.192x - 0.002x^2$ , where x is fetal age in weeks ( $R^2 = 0.563$ , p value <0.001).

## DISCUSSION

Thin cords are related to complications in outcome of pregnancies or low birth weight for quite a long time and were also described in literature by Raio et al.<sup>[8]</sup> With the advent of sonography initially umbilical cord of early pregnancies were studied. Weissman et al,<sup>[5]</sup> reported maximum cord area to be around at 34 weeks, later than those of our studies. Though it also depicted a correlation. Studies by Predanic et al,<sup>[15]</sup> supported that of Raio et al.<sup>[7]</sup> In our present our study we have the umbilical cord cross section area increasing with gestational age upto 32 weeks then becoming plateau like upto 35 weeks. The reason may be upto 32 weeks there was rapid increase in growth of fetus after that rate of increase in fetal size fell gradually reaching a plateau upto 35 weeks. After which we observed a decline in the diameter may be due to change in shape or compromise in fetal circulation & starting switch over of circulation. There has been mild increase in mean parameters in multigravida and also attending no plateau stage like that of a primigravida. A larger birth passage for the baby may be the probable reason. Though no positive linear relationship was found between umbilical cord parameters to that of parity, existence of which would complicate the situation. Limitations of the study being observer bias, small period of study, small sample size.

## CONCLUSION

The increase in cord cross section attends a plateau in primigravida but not in multigravida. Umbilical cord cross-section area help to predict the gestational age correctly in cases of difficulty in measuring BPD, HC, AC, FL, like anencephaly, hydrocephalus, achondroplasia, small for age fetus.



Figure 3: Umbilical Cord Cross Section with Colour Doppler.

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