

SONOGRAPHIC ESTIMATION OF UMBILICAL CORD CROSS-SECTION AREA AND ITS CORRELATION WITH PERINATAL OUTCOME

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DOI: 10.47750/pnr.2022.13.S01.279

Abstract

Umbilical cord cross sectional area is an easily obtained sonographic measurement with highly reliable intra and inter observer reproducibility. This study showed a significant correlation between Umbilical cord cross sectional area and birth weight. There is significant association between lean cord and low APGAR score and meconium stained liquor. Umbilical cord cross sectional area can be combined with other fetal biometric parameters to improve the accuracy of identifying the fetus at risk allowing us to manage effectively and thus improves the perinatal outcome.

Keywords: Umbilical cord cross sectional area, Perinatal outcome.

Introduction

For several decades, the morphological and morphometric aspects of the umbilical cord has been studied and correlated with fetal outcome retrospectively by histopathological analysis.¹ Nowadays Ultrasound is being used routinely for efficient, low-cost and dynamic diagnostic imaging that facilitates treatment planning while avoiding any ionizing radiation exposure.

Umbilical cord is a structure that connects fetus to the placenta. It consists of 2 umbilical arteries and 1 umbilical vein suspended in an extracellular matrix of Wharton's jelly which protects the umbilical cord vessels and it is covered by single layer of amnion. It provides flexibility, mobility, strength to resist compression and allows the fetus to move freely². A reduction in Wharton's jelly may predispose these vessels to compression or bending.

The growth or the thickness of the umbilical cord increases during pregnancy, peaking at 32 weeks, while maintaining a level until about the 34th week and then declining, constitutes an appropriate parameter for verifying the prediction of fetal growth pattern.²

Measurement of cross sectional area of the umbilical cord is an early screening tool for the detection of abnormalities such as IUGR, macrosomia, prolonged labour, fetal distress etc.,

Umbilical cord cross-sectional area is an easily obtained sonographic measurement with highly reliable intra and inter-observer reproducibility. Unlike measuring other conventional biometric parameters, that can be technically difficult in late gestation due to low position of fetal head, abdominal circumference distortion, posterior placement of femur, a successful assessment of umbilical cord area is not influenced by gestational age or amniotic fluid volume.³

A lean umbilical cord at birth has also been associated with oligohydramnios and fetal distress⁴. A large umbilical cord associated with macrosomic baby.³

The purpose of the study is to correlate umbilical cord cross sectional area measured by ultrasonogram at 34 weeks of gestation with perinatal outcome.

AIMS AND OBJECTIVES

1. To study umbilical cord cross sectional area at 34 weeks period of gestation by ultrasound.
2. To correlate it with perinatal outcome

MATERIALS AND METHODS:

Study design:

Prospective observational study

Source of data:

A Prospective Hospital based study of 100 antenatal women attending the Obstetrics and Gynaecology department at Meenakshi Medical College and Research Institute, Kanchipuram were included in the study. Informed written consent is to be taken from all the patients enrolled after explaining the study.

Sample size: 100 antenatal patients

Plan for statistical analysis – IBM-SPSS 21 SOFTWARE.

Duration of study- April 2021 – march 2022

SELECTION CRITERIA:

Inclusion criteria :

1. Singleton pregnancy
2. Gestational age at and above 34weeks
3. Presence of three vessel cord
4. Willing for institutional delivery
5. Intact membranes

Exclusion criteria :

1. Multiple pregnancy
2. Intra uterine fetal demise

3. Presence of fetal anomalies
4. Single umbilical artery

METHOD OF COLLECTION OF DATA:

100 women with singleton pregnancy fulfilling the inclusion criteria will be included in the study. Complete Hemogram, urine microscopy, blood grouping and Rh typing, thyroid profile and Random blood sugar will be done. At first antenatal visit dating scan will be done. Anomaly scan will be done at 20 weeks period of gestation. Patient will be followed up regularly during her antenatal visits, at every 4 weeks till 28 weeks, at every 15 days till 32 weeks and weekly until delivery. At 34th week, with due informed consent, umbilical cord cross sectional area will be measured using PHILIPS CD5, 2-6 MHz abdominal transducer.

Cross sectional area of umbilical cord will be measured by marking outer edges of umbilical cord for thickness and by encircling outer edge of the cord in transverse section, in a free loop of umbilical cord. Patients will be followed up till delivery. If the patient develops PIH, GDM, IUGR or goes in for preterm labour, patient will be managed according to protocol allowing for induction of labour, emergency LSCS in case of obstetrics/fetal indications. If there are no risks, patients will be followed up until term and allowed for spontaneous progression of labour.

In our study, perinatal outcome is measured in terms of 1.Fetal weight 2.Colour of liquor 3.APGAR score.

Newborns will be considered as

1. SGA (small for gestational age) when birth weight is <10th percentile for that gestational age.9
2. Macrosomia when the birth weight >90th percentile for that gestational age.9
3. APGAR score is low if it is ≤ 7.5
4. Meconium stained liquor is considered when the fluid is found to be opaque.5
5. Umbilical cord cross sectional area is considered as lean if it is below 10th percentile and large if it is above 90th percentile.

RESULTS

In present study, 4% were in the age group of 18-20 years, 83% in the age group of 21 to 30 years and 13% in the age group of > 30 years. In the study group 48% are primigravida and 52% are multigravida women. Among study population 11 subjects had gestational diabetes mellitus and 6 subjects had gestational hypertension. In the study population 45% were having normal BMI, 39% were overweight, 11% were obese and 5% were underweight.

In present study, maximum gestational age is 36 weeks, minimum gestational age is 34 weeks, mean gestational age is 34.8 weeks and standard deviation is 0.58. Among the study group maximum umbilical cord cross sectional area is 330 mm², minimum umbilical cord cross sectional area is 107 mm², mean umbilical cord cross-sectional area was 188 mm² and standard deviation is 40.72. In our study maximum birth weight of newborn is 4750 grams, minimum birth weight is 1600 grams, mean birth weight was 2923.6 grams and standard deviation is 572.1.

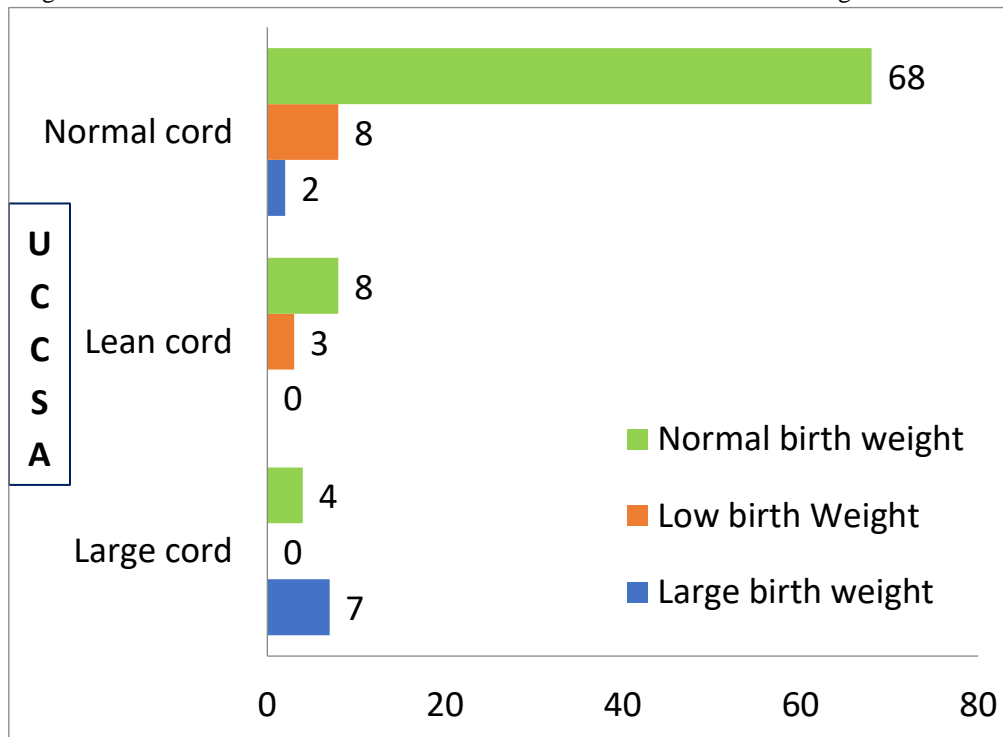
In present study, 78% had normal umbilical cord cross-sectional area, 11% had lean cord and 11% had large cord. 80% of the newborn had normal birth weight (2500-4000g), 11% had low birth weight (<2500g) and 9% had large birth weight (>4000g). In our study, 95% of neonates had APGAR >7 at 5 minute and 5% had APGAR score of < 7 at 5 minute. In present study, 93% had clear liquor and 7% had meconium stained liquor. In the study population, 90% delivered at term and 10% were delivered at pre-term.

Table 1 Correlation of the umbilical cord cross-sectional area and birth weight of newborn (n=100)

UCCSA(mm ²)	Normal birth weight (2500-4000g) N (%)	Low birth weight (<2500g) N (%)	Large birth weight (>4000g) N (%)	Total
Normal cord (143 to 234)	68 (87.2)	8 (10.3)	2 (2.6)	78
Lean cord (<143)	8 (72.7)	3 (27.3)	0 (0)	11
Large cord (>234)	4 (36.4)	0 (0)	7 (63.6)	11

Chi-square value: 48.155 p value: <0.001

Figure 1: Correlation of the umbilical cord cross-sectional area and birth weight of newborn



In present study, (figure 1)

1. 78 neonates (78%) had normal cord, of that, 68 neonates (87.2%) had normal birth weight (2500-4000grams), 8 neonates (10.3%) had low birth weight (<2500grams) and 2 neonates (2.6%) had large birth weight (>4000grams).
2. 11 neonates (11%) had large cord. Of that, 7 neonates (63.6%) had large birth weight (>4000grams) and 4 neonates (36.4%) had normal birth weight (2500-4000grams).
3. 11 neonates (11%) had lean cord. Of that, 8neonates (72.7%) had normal birth weight (2500-4000grams) and 3neonates (27.3%) had low birth weight (<2500grams).

4. Statistical analysis shows that large cord has significant correlation with large birth weight baby with the p value of <0.001.

In present study, 11 (11%) mothers had gestational diabetes, of that 8 babies (72.7%) had large cord, 3 babies (27.3%) had normal cord and none of them had lean cord. There is a statistically significant association between the presence of gestational diabetes mellitus and large cord with the p value of 0.001.

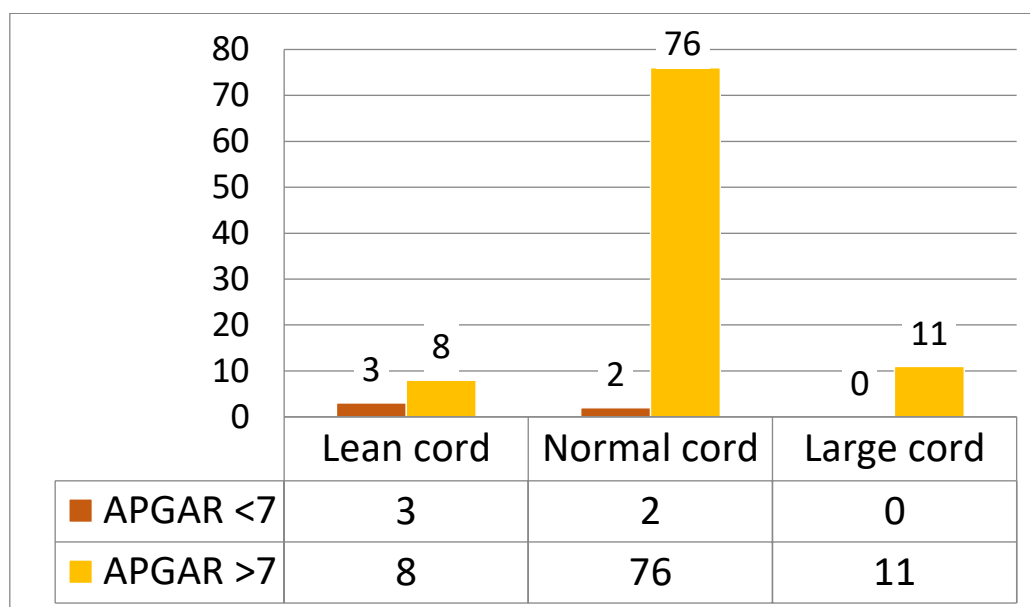
In present study, 6 (6%) of mother had gestational hypertension. of that, 4 Mothers (66.7%) had lean cord and 2 Mothers (33.3%) had normal cord, None of the mother with gestational hypertension had large cord. There is a statistically significant association between the presence of gestational hypertension and lean cord with a p value of 0.001

Table 2 Distribution of the study population according to umbilical cord cross-sectional area and APGAR scoring (n=100)

UCCSA(mm ²)	APGAR <7	APGAR >7
	N (%)	N (%)
Lean cord (<143)	3 (60)	8 (8.4)
Normal cord (143 to 234)	2 (40)	76 (80)
Large cord (>234)	0 (0)	11 (11.6)
Total	5 (100)	95 (100)

Chi-square value: 13.041 p value: **0.001**

Figure 2: Distribution of the study population according to umbilical cord cross-sectional area and APGAR scoring



In present study,

1. 5 (5%) of babies had APGAR <7. Of that, 3 (60%) of the babies had lean cord, 2 (40%) of the babies had normal cord. None of them had large cord

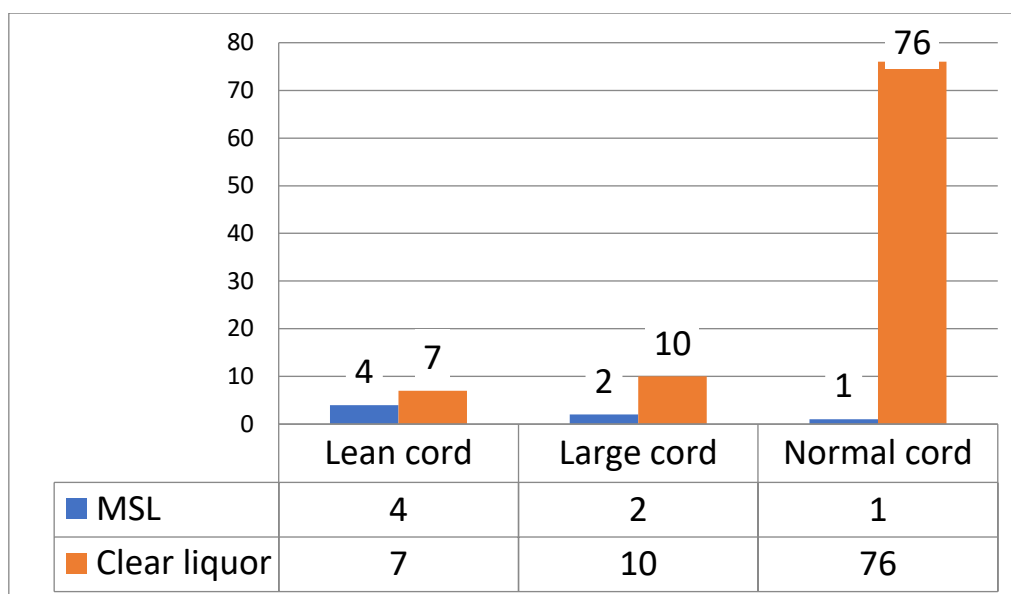
- There is a statistically significant association between the APGAR scoring and lean cord with a p value < 0.001

Table 3 Distribution of the study population according to umbilical cord cross-sectional area and meconium stained liquor

UCCSA(mm ²)	meconium stained liquor	Clear liquor
	N (%)	N (%)
Lean cord (<143)	4 (57.1)	7 (7.5)
Large cord (>234)	2 (28.6)	10 (10.8)
Normal cord (143 to 234)	1 (14.3)	76 (81.7)
Total	7 (100)	93 (100)

Chi-square value: 17.001 p value: <0.001

Figure 3: Distribution of the study population according to umbilical cord cross-sectional area and meconium stained liquor



In present study, 7(7%) had meconium stained liquor. Of that,

- 4 babies(57.1%) had lean cord,2 babies(28.6%) had large cord and 1baby(14.3%) had normal cord
- There is a statistically significant association between the lean cord and babies with meconium stained liquor with a P value < 0.001

Discussion

This prospective observational study was conducted in pregnant women attending the antenatal OPD in the Department of OBG, in our institution. Umbilical cord cross sectional area was calculated in the study group from 34-36 weeks period of gestation and it was correlated with perinatal outcome. Perinatal outcome studied in terms of meconium stained liquor, APGAR score and birth weight.

There is a progressive increase in the umbilical cord diameter and cross sectional area up to 32 weeks of gestation and then reaches a plateau at 34 weeks of gestation. Umbilical cord cross sectional area is considered as a reliable

parameter than diameter, because diameter is not precisely circular throughout the cord and is slightly underestimated. So, we have selected the gestational age group as 34-36 weeks of gestation.

Weissman et al reported nomograms for umbilical cord diameter and they explored the surface area of Wharton's jelly, it tends to reduce towards end of pregnancy due to decrease in umbilical cord water content⁹. Barberi et al reported normograms of the umbilical cord cross sectional area specific for each gestational age from 12- 40 weeks¹⁰.

In present study, 48% are primigravida and 52% are multigravida. 83% of them are in the 21-30 year age group.

Lean cord was defined as umbilical cord cross sectional area less than 10th percentile which corresponds to <143 mm², normal cord as umbilical cord cross sectional area between 10-90th percentile which corresponds to 143-234 mm² and large cord was defined as umbilical cord cross sectional area > 90th percentile which corresponds to >234 mm².

Distribution of lean cord in other studies were 15%(Rakesh et al⁷), 11.1% (Raio et al⁴), 11.5% (Ghezzi et al⁶) and this is similar to our study(11%). In the study conducted by Cromi et al 11.1% had large cord³. And in the study by Lacunza et al 42% had large cord⁸. In present study 11% of the study population had large cord.

In the study conducted by Tahmasebi et al, 66% of babies with meconium stained liquor had lean cord⁵. In Raio et al study, 36.8% of babies with meconium stained liquor had lean cord⁴. In the present study 57.1% of babies with meconium stained liquor had lean cord.

In the study conducted by Tahmasebi et al, 11% of babies with meconium stained liquor had normal cord and 22% of babies with meconium stained liquor had large cord⁵. In the present study 14.3% of babies with meconium stained liquor had normal cord and 28.6% of babies with meconium stained liquor had large cord.

In the study conducted by Raio et al⁴ 5.2% of lean cord baby had APGAR score <7, in Ghezzi et al⁶ study 18% of lean cord baby had APGAR score <7 and in present study 27.2% of lean cord had APGAR score <7 which is in correlation with study by Ghezzi et al.

In the study conducted by Raio et al 1.3% of normal cord babies had APGAR score of <7 at 5 minutes⁴. In present study 2.56% of normal cord babies had APGAR score of <7 at 5 minutes which is similar.

In the study conducted by Cromi et al, 54.7% of the babies with large cord had large birth weight³. In the study by Lacunza et al, 85.5% of the babies with large cord had birth weight⁸.

In the present study 63.6% of the babies with large cord had birth weight had large birth weight.

Conclusion

Umbilical cord cross sectional area can be easily measured in a free loop of umbilical cord and nomograms are available. As the umbilical cord cross sectional area increases the birth weight of the babies also increases. Lean cord babies are at high risk for meconium stained liquor and low APGAR score. Umbilical cord cross sectional area can be combined with other fetal biometric parameters to improve the accuracy of identifying the fetus at risk allowing us to manage effectively and thus improves the perinatal outcome.

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