

A Prospective Study of Umbilical Coiling Index (UCI) and Perinatal Outcome in Term Low-Risk Pregnancies

Akshika Patel¹, Rajrani Sharma², Akanksha Agrawal³, Rama Singh Chundawat⁴, Priyanka Sekhasaria⁵, Nenavath Pravalika Rathod⁶

^{1,6}Post-Graduate Resident, Department of Obstetrics and Gynaecology, Pacific Medical College and Hospital, Bedla, Udaipur, Rajasthan

²Head of Department and Senior Professor, Department of Obstetrics and Gynaecology, Pacific Medical College and Hospital, Bedla, Udaipur, Rajasthan

^{3,4}Associate Professor, Department of Obstetrics and Gynaecology, Pacific Medical College and Hospital, Bedla, Udaipur, Rajasthan

⁵Assistant Professor, Department of Obstetrics and Gynaecology, Pacific Medical College and Hospital, Bedla, Udaipur, Rajasthan, Rajasthan

Received: 20-03-2023 / Revised: 11-04-2023 / Accepted: 05-05-2023

Corresponding author: Dr Akanksha Agarwal

Conflict of interest: Nil

Abstract:

Introduction: An umbilical coil is a vital organ which connects the mother and fetus and its main function is to provide nutrition to the fetus for 9 months. An abnormal umbilical cord may lead to uteroplacental insufficiency, fetal growth restriction, and fetal distress. Many studies on the umbilical coiling index have proven that abnormal UCI leads to adverse perinatal outcomes.

Aims and Objectives: The primary aim of this study is to determine the relationship between the umbilical coiling index and adverse perinatal outcome.

Materials and Methods: The population of the study included 150 pregnant women hospitalized for natural singleton labor with a gestational age (based on last menstrual period [LMP] or ultrasound confirmation by first trimester) of over 37 weeks with the cephalic presentation in Pacific medical college and hospital Udaipur. A Prospective study is conducted. The purposes of the study are explained to pregnant women and informed consent is taken.

Conclusion: There was significant association of hyper coiling (UCI>90th) with LBW(<2.5kg) babies and NICU admission, and hypo coiling (UCI<10th) with meconium-stained liquor. Thus, antenatal detection of coiling index may be helpful to identify the fetus at risk and help in early detection and management.

Keywords: UCI, Hypercoiling, Hypocoiling.

This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

Introduction

The umbilical cord is considered both physical and emotional attachment between mother and fetus. It is protected against compression by Wharton's jelly, amniotic fluid, helical patterns and coiling of vessels. The origin of the umbilical cord

is unknown. The most mysterious character of the human umbilical cord is the twisted or spiral course of its component blood vessels. Mathematically speaking, vessels of the cord are wound as cylindrical helices, rather than spirals, but

both terms are used interchangeably to avoid confusion (Chaurasia and Agarwal, 1979) [1]. The total number of coils in a normal umbilical cord is between 0-40cm. At term, the umbilical cord measures about an average of 55cm (the usual range is 30-100 cm). The umbilical vessel's helical course is seen by the 7th week of gestation in about 95% of pregnancies (Abdulrasul, 2014) [3]. In 1954, umbilical coiling was first quantified by Edmonds, who divided the total number of coils by umbilical cord length in centimetres and called it "The index of a twist", but later Strong et al simplified it by eliminating these directional scores and named it "The umbilical cord index" (Lacro et al, 1987; Patil et al, 2013)[4,5]. The umbilical coiling index (UCI) is defined as the number of umbilical cord twists divided by the length of the cord in centimetres. The UCI at birth is on average 0.17 or 0.009 twists/cm, and normal umbilical cord coiling has been defined as a UCI between 0.07 - 0.30 twists/cm (de Laat et al, 2005)[6]. Methods of classifying UCI in literature are variable. Several studies have evaluated the prevalence of hypo coiling, norm coiling, and hyper coiling of the umbilical cord after birth in various singleton pregnancy populations using predetermined cutoffs (de Laat et al, 2007; Machin et al, 2000)[7,8]. In the study done by Strong et al (1994)[9] normal coiling index is approximately 1 coil/5 cm of umbilical Cord length or 0.20 to 0.24 coils/cm. Many studies have shown that the normal pattern of coiling is at the rate of 5cm equal to the coiling index of 0.2/cm, (Abdulrasul, 2014) [3].

Hypocoiling, Hypercoiling has also been associated with adverse birth outcomes. Hypercoiling of the umbilical cord is commonly defined as a UCI > 90th percentile or greater than 0.30 twists/cm. Studies have reported that the prevalence of hyper coiling ranges from 6.7% to 20.0% in unselected singleton pregnancies. The adverse birth outcomes that have been

associated with postnatal hyper coiling often overlap with those reported for hypo coiling, including low birth weight, low APGAR score at 5 min⁷ and NICU admission (Kashanian et al, 2006)[12]. Despite improved antenatal care, safety during surgery and the use of modern monitoring with ultrasound, doppler and intrapartum fetal monitoring, cord complications remain one of the major unavoidable causes of fetal death compromising umbilical blood flow to a degree sufficient to cause severe hypoxia and death of the fetus.

Abnormal cord parameters associated with a high rate of asphyxia during delivery, non-reassuring fetal status, respiratory distress, fetal growth restriction and thus needing interferences (instrumentations/operative) during delivery (Cunningham et al, 2014; Soliriyet al, 2017) [13,14]. The present study was designed to study the umbilical coiling index (UCI) and perinatal outcomes.

Aim and Objectives

The primary aim of this study is to determine the relationship between the umbilical coiling index and adverse perinatal outcomes.

Primary Objectives:

To Determine the association of UCI with fetal birth weight.

Secondary Objectives:

1. To Determine the association of UCI with Meconium stain liquor
2. To Determine the association of UCI with NICU admission.

Patient Selection:

The population of the study included all the pregnant women hospitalized for natural singleton labour with a gestational age (based on the last menstrual period [LMP] or ultrasound confirmation by the first trimester) of over 37 weeks with the cephalic presentation in Pacific medical college and hospital Udaipur. A

Prospective study is conducted. The purpose of the study is explained to Pregnant women and informed consent is taken.

Inclusion criteria

- Full-term gestation irrespective of parity.
- Singleton pregnancy
- Live baby
- Delivery both by vaginal or LSCS
- Cephalic presentation

Exclusion criteria

- Preterm delivery and premature Rupture of membranes
- Twin Pregnancy
- Intrauterine death
- Preeclampsia
- Women with medical illness
- Fetus with Anomalies
- Rh incompatible pregnancy
- Complications like placenta previa, abruption placenta etc. •

Study protocol:

- A total number of 150 mothers and infant umbilical cords were studied. After birth, the umbilical cord is examined by the researcher:
- Appearance of umbilical cord
- Number of vascular coils are counted
- Total length of the umbilical cord is measured in cm without being stretched.
- The umbilical cord length is measured from the insertion site of the placenta to the umbilicus of the baby.
- An umbilical coil is defined as one complete spiral of 360 degrees of umbilical vessels around each other.
- Then, the umbilical cord coiling index is calculated by dividing the number of vascular coils by the cord length in centimetres.
- Umbilical Coiling Index: Number of coils/total cord length in cm. Frequency distribution of the umbilical coiling index was done by Rana J et al (1995)45.

- They grouped the UCI as follows:
- Normocoiled cords(cords with UCI between 10th to 90th percentile)
- Hypocoiled cords(cords with UCI < 10th percentile)
- Hypercoiled cords (cords with UCI > 90th percentile)

Then, information regarding the following variables was recorded in the data collection forms:

1. Perinatal variables like abnormal fetal HR, excretion of meconium.
2. Neonatal variables like fetal birth weight (in grams), intrauterine growth restriction, fetal distress, and a need for NICU admission. Follow-up of both mother and neonates was done until they were discharged.

Statistical analysis

The results are presented in frequencies, percentages and mean±SD. The chi-square test was used to assess the associations between the umbilical coiling index and perinatal outcome.

The p-value<0.05 was considered significant. All the analysis was carried out on SPSS 16.0 version (Chicago, Inc., USA).

Results and Discussion

The present study was conducted in the Department of Obs and Gyn, Pacific Medical College and Hospital, Udaipur to evaluate the relationship between umbilical coiling index and adverse perinatal outcome. A total of 150 patients were included in the study.

Conclusion

The present study concludes that abnormal UCI is associated with adverse perinatal outcomes. There was a significant association of hyper coiling (UCI>90th) with LBW (<2.5kg) babies and NICU admission, and hypo coiling (UCI<10th) with meconium-stained liquor. Thus, antenatal detection of the coiling index may be helpful to identify the fetus at risk

and help in early detection and management.

The limitation of our study is a small number of cases. Therefore further prospective studies with large sample sizes should be conducted to identify the association between abnormal UCI with adverse perinatal outcomes.

Reference

1. Chaurasia BD, Agarwal BM. Helical structure of the human umbilical cord. *Acta Anatomica*. 1979; 103(2): 226-30.
2. Gupta S, Faridi MMA, Krishnan J. Umbilical Coiling Index. *J Obstet Gynecol India*. 2006; 56(4): 315-9.
3. Abdulrasul EA. Umbilical coiling index as a predictor of adverse perinatal outcome. *International Journal of Advanced Research* 2014; 2(2): 101-7.
4. Lacro RV, Jones KL, Benirschke K. The umbilical cord twist: origin, direction, and relevance. *Am J Obstet Gynecol*. 1987; 157:833-38.
5. Patil NS, Kulkarni SR, Lohitashwa R. Umbilical cord coiling index and perinatal outcome. *J ClinDiagn Res* 2013;7: 1675–1677.
6. de Laat MW, Franx A, van Alderen ED, Nikkels PG, Visser GH. The umbilical coiling index, a review of the literature. *J Matern Fetal Neonatal Med* 2005; 17:93–100.
7. de Laat MW, van Alderen ED, Franx A, Visser GH, Bots ML, Nikkels PG. The umbilical coiling index in complicated pregnancy. *Eur J Obstet Gynecol Reprod Biol*. 2007; 130:66–72.
8. Machin GA, Ackerman J, Gilbert-Barness E. Abnormal umbilical cord coiling is associated with adverse perinatal outcomes. *Pediatr Dev Pathol*. 2000; 3:462–471.
9. Strong TH, Jarles DL, Vega JS et al. The umbilical coiling index. *Am J Obstet Gynecol*. 1994; 170:29-32.
10. Lacro RV, Jones KL, Benirschke K. The umbilical cord twist: origin, direction, and relevance. *Am J Obstet Gynecol*. 1987;157(4 Pt 1):833-8.
11. Ohno Y, Terauchi M, Tamakoshi K. Perinatal outcomes of abnormal umbilical coiling according to a modified umbilical coiling index. *J Obstet Gynaecol Res*. 2016; 42:1457–1463.
12. Kashanian M, Akbarian A, Kouhpayehzadeh J. The umbilical coiling index and adverse perinatal outcome. *Int J Gynaecol Obstet*. 2006; 95:8–13.
13. Cunningham FG, Leveno KG, Bloom SL, Hauth JC, Roves DJ, Spong CY, editors. *William's Obstetrics*. 24th edition. New York: MC Graw Hill; 2014;116-25.
14. Soliriya V, Goyal M, Kachhawaha CP. Perinatal Mortality and Umbilical Cord Parameters: Is there Any Association? *Journal of Pregnancy and Child Health* 2017; 4: 340.