

Accurate diagnosis of cases with umbilical hypo-coiled cord: a study at a single perinatal center

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Abstract

Objectives: To compare whether it is more accurate to diagnose hypo-coiled cords at 20 or 36 weeks' gestation.

Method: This retrospective cohort study was conducted in the Department of Obstetrics and Gynecology at Showa University Hospital. In this study, an antenatal UCI below the 10th percentile was defined as a hypo-coiled cord at 20 and 36 weeks' gestation. After delivery, a hypo-coiled cord was defined as having a UCI < 0.1. The medical records of all neonates born at Showa University Hospital after 36 weeks' gestation between 2011 and 2017 were retrospectively reviewed.

Results: From January 2011 to December 2017, 3400 fetuses were born at our hospital after 36 weeks' gestation and underwent screening at both 20 and 36 weeks' gestation. The positive predictive value (PPV) at 20 weeks' gestation was higher than that at 36 weeks' gestation. After delivery, 65 cases (1.8%) were diagnosed with hypo-coiled cords out of 3400 cases.

Conclusion: Since hypo-coiled cords affect the prognosis of newborns, it is important to accurately evaluate the presence of hypo-coil cords before birth. In the present study, ultrasonographic evaluation of hypo-coil cords at 20 weeks' gestation had a higher detection rate than evaluation at 36 weeks' gestation.

Introduction

The structure of the umbilical cord confers natural protection from compressive forces during labour. Abnormal coiling of the umbilical cord is associated with adverse perinatal outcomes. In a previous report, hyper-coiled cords were found to be associated with foetal growth restriction (FGR) (1). Machin GA. et al reported the frequency and clinical correlations of abnormally coiled cords among 1329 cases referred to our placental pathology services. Twenty-one percent of cords were hyper-coiled cord and 13% were hypo-coiled cord. (2) In addition, hypo-coiled cords were associated with meconium staining, Apgar scores at 1 and 5 min of <4 and <7, respectively, non-reassuring foetal status (NRFS), more caesarean section, and greater risk of NICU admission. (1)(3)

Hasegawa et al. reported that foetal heart rate tracing from the first stage of labour is indicated in cases with a prenatal diagnosis of velamentous insertion or hyper-coiling of the cord. (4)

An abnormal umbilical coiling index increases the risk of NRFS and FGR. (5) In our previous report, hypo- and hyper-coiled cords were related to NRFS and emergency caesarean sections. (3)

In the present study, we performed antenatal ultrasound screening using a checklist before delivery for all pregnant women who delivered at our hospital. Ultrasound evaluations of umbilical cord and placental abnormalities and foetal biometry were performed in pregnant women at 36 weeks' gestation. Women who underwent ultrasound screening were divided into risk level groups according to their abnormalities. In our risk level groups, cases with hyper-coiled cords were included in the high-risk group. However, cases with hypo-coiled cords were not subjected to risk classification in our checklist. In previous studies, no

opinion has been reported on the timing of hypo-coiled cord diagnosis during pregnancy. It is difficult to correctly evaluate hypo-coiled cords in the third trimester. It is important to correctly assess hypo-coiled cords before birth.⁶⁾

Although it is considered important to assess hypo-coiled cords before delivery, there have been various reports on the timing of assessment, including mid-pregnancy, late pregnancy, and at the onset of labour, and there is no consensus regarding what gestational age is best for the diagnosis of hypo-coiled cords.⁷⁾⁸⁾ The objective of this study was to compare whether it is more accurate to diagnose hypo-coiled cords at 20 or 36 weeks' gestation.

Material And Methods

This retrospective cohort study was conducted in the Department of Obstetrics and Gynecology at Showa University Hospital. The subjects of this study were women who underwent ultrasound screening at both 20 and 36 weeks' with singleton pregnancies delivered after 36 weeks' gestation at our institution between January 2011 and December 2017.

The antenatal umbilical coiling index (UCI) was calculated by measuring the distance between two adjacent coils of the umbilical artery from the right outer surface of the vascular wall to its next twist (antenatal coiling index = $1/\text{distance}$ in centimeters, as reported by Degani.⁹⁾

In this study, an antenatal UCI below the 10th percentile was defined as a hypo-coiled cord at 20 and 36 weeks' gestation based on a previous report¹⁰⁾. A hypo-coiled cord at 20 weeks' gestation was defined as a pitch length > 36 mm, which was greater than 90% of the pitch of the umbilical cord length in all cases measured at 20 weeks' gestation. Similarly, at 36 weeks' gestation, a hypo-coiled cord was defined as a pitch length > 46 mm, which was greater than the 90th percentile of the pitch of the umbilical cord length in all cases measured at 36 weeks' gestation.

The coiling index of all umbilical cords was measured and calculated by an obstetrician after delivery. In the present study, a hypo-coiled cord was defined as having a UCI < 0.1 after delivery. The medical records of all neonates born at Showa University Hospital after 36 weeks' gestation between 2011 and 2017 were retrospectively reviewed. Postnatal evaluation of cases defined as hypo-coiled cords were performed on medical records. Cases with a single umbilical artery were excluded from the study. This study was approved by the ethics committee of our hospital (No. 1182). Informed consent was obtained in writing from all patients before conducting ultrasound scanning. Patient confidentiality was protected, and no personal data were collected in the present study.

Results

From January 2011 to December 2017, 3400 foetuses were born at our hospital after 36 weeks' gestation and underwent screening at both 20 and 36 weeks' gestation. Hypo-coiled cord diagnosis at the time of screening at 20 and 36 weeks' gestation are shown in Tables 1 and 2, respectively. The positive predictive

value (PPV) at 20 weeks' gestation was higher than that at 36 weeks' gestation. After delivery, 65 cases (1.8%) were diagnosed with hypo-coiled cords out of 3400 cases.

Discussion

In a previous report, hypo-coiled cords were significantly associated with interventional delivery due to NRFS, meconium-stained liquor, 5-min Apgar scores < 7, small for gestational age (SGA) neonates, foetal anomalies, need for admission to the neonatal intensive care unit (NICU), foetal heart rate abnormalities, and foetal death.⁷) In addition to our previous report, hypo-coiled cords are related to NRFS and emergency caesarean sections. We reported that hypo-coiled cords have poor outcomes similar to hyper-coiled cords.³)⁴)

Our previous study did not find any significant association between gravidity, fertility, and infertility. Therefore, it is unlikely that a hypo-coiled cord was due to maternal background.³) Therefore, it is not possible to identify the high-risk group of hypo-coiled cords based on maternal background.

The diagnosis of hyper-coiled cords is easy because the pitch of the umbilical cord is short, so it is not framed out. In the third trimester, as the foetus grows, the frequency of physiological uterine contractions increases, and the amniotic fluid space appears relatively narrow. Diagnosis of a hypo-coiled cord is difficult. In this study, hypo-coiled cords were diagnosed more frequently at 20 weeks' gestation than at 36 weeks' gestation. The amniotic fluid space was preserved at 20 weeks' gestation rather than at 36 weeks' gestation, and the space between the foetus and the umbilical cord was considered more suitable at 20 weeks' gestation for the evaluation of the umbilical cord than at 36 weeks' gestation. In this study, an antenatal hypo-coiled cord at 36 weeks' gestation was defined as a length > 46 mm. At 36 weeks' gestation, the foetus grows by the day, so the hypo-coiled cord will frame out of the ultrasound screen and cannot be accurately assessed. There are no reports on how and when to find hypo-coiled cords. The placenta and umbilical cord grow significantly during pregnancy. In this study, we suggest that hypo-coiled cords are difficult to diagnose in the third trimester.

Under the assumption that the coiling index is fully developed by the end of the first trimester of pregnancy and remains unchanged thereafter, rather than the cord lengthening between established coils, the cord lengthens between established windings; therefore, the true cord index should be predictable at the second trimester ultrasound.

In conclusion, since hypo-coiled cords affect the prognosis of newborns, it is important to accurately evaluate the presence of hypo-coiled cords before birth. In the present study, ultrasonographic evaluation of hypo-coiled cords at 20 weeks' gestation had a higher detection rate than evaluation at 36 weeks' gestation.

Declarations

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CONFLICT OF INTEREST

The authors declare no conflicts of interest.

Author Contribution

Hiroko Takita: Protocol/project development

Data collection or management

Data analysis

Manuscript writing/editing

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Tables

Table 1: Diagnosis of hypo-coiled cords at the 20-week screening

	Hypo-coiled cords after delivery	The other cord after delivery	Total
Hypo-coiled cord by antenatal UCI (>90 th percentile) at 20 weeks' gestation	46 cases	294 cases	340 cases
The other cord by antenatal UCI (<90 th percentile) at 20 weeks' gestation	19 cases	3041 cases	3060 cases
Total	65 cases	3335 cases	3400 cases

Positive predictive value of hypo-coiled cords at 20 weeks' gestation: 13.5%

Table 2: Diagnosis of hypo-coiled cords at the 36-week screening

	Hypo-coiled cord after delivery	The other cord after delivery	Total
Hypo-coiled cord by antenatal UCI (>90 th percentile) at 36 weeks' gestation	16 cases	324 cases	340 cases
The other cord by antenatal UCI (<90 th percentile) at 36 weeks' gestation	49 cases	3011 cases	3060 cases
Total	65 cases	3335 cases	3400 cases

Positive predictive value of hypo-coiled cords at 36 weeks' gestation: 4.7%