

## A Hospital-Based Study Evaluating the Impact of Umbilical Cord Abnormalities on Neonatal Outcome: A Retrospective Study

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### Abstract

**Aim:** The aim of the present study was to assess the impact of umbilical cord abnormalities on neonatal outcome.

**Material & Methods:** A retrospective study was conducted in Department of Obstetrics and Gynaecology. 200 pregnant women with singleton pregnancy who delivered after 28 weeks of gestation during 1 year period, who were diagnosed and documented as having umbilical cord abnormalities either antenatally or during and after delivery were included in the study after taking informed and written consent.

**Results:** The age of majority of patients was in the range of 21-28 years as this group is most fertile. Primigravida comprised of 40% whereas 60% were multigravida. 65% patients had normal vaginal delivery whereas 35% patients required Caesarean section. Of all the abnormalities of umbilical cord, the most common abnormality encountered is Nuchal cord (cord around the neck) with 70% cases in our study. Abnormal cord length i.e. Long (>100cm) and short (<40cm) was seen in 12% cases. Rare abnormalities like vasa previa, velamentous insertion and cord prolapse was seen in 1% cases each. Single umbilical artery was seen in 3% cases. Cord knot which includes true as well as false knots was seen in 5% cases. Coiling abnormality which includes hyper as well as hypo coiled cord was seen in 7% cases. Majority of the patients had APGAR score >7 at 1 and 5 minutes. 71% fetus had live birth without any complication and did not require NICU admission. 20% required NICU admission. 4% had early neonatal death, 2% late neonatal death whereas 3% was still birth.

**Conclusion:** Umbilical cord abnormalities are a stress factor for fetus, where stillbirth can occur due to combination of risk factors. This is especially important because most of these still births occur relatively late in pregnancy in a setting of otherwise normal foetuses and pregnancies. Therefore, early detection and continued surveillance will help to prevent such sudden fetal loss.

**Keywords:** Umbilical cord abnormalities, Nuchal cord, Cord knots, Cord prolapse, Still birth.

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### Introduction

The umbilical cord is a conduit between developing embryo or fetus and placenta. [1] "Intrauterine life, which is sustained only by two small arteries and a tortuous vein coursing through a long flexible cord, hangs by a very delicate thread." [2] The growth and wellbeing of a foetus depends up on the normal blood flow through the umbilical-cord from the mother. Umbilical cord abnormalities usually describe situations where fetal blood flow is reduced or interrupted due to altered structure or function of umbilical cord. It has been estimated that about one-third of births have some type of umbilical cord abnormalities. Disruption of the umbilical cord supply line is a major source of harm to the developing foetus. It is estimated that one in every three or four deliveries has an umbilical cord abnormality or anomaly which can be identified. [3]

When there are umbilical cord abnormalities, they disrupt the normal blood flow to the fetus, exchange

of gases, and supply of nutrients from the mother to the fetus leading to adverse perinatal outcome. [4] Complications associated with long or short umbilical cord may explain this enigma. Excessively short cords have been associated with a delay in second stage of labor, irregular fetal heart rate, placental abruption, rupture of umbilical cord, inversion of uterus, birth asphyxia, and cord herniation. Excessively long umbilical cords are associated with cord prolapse, torsion, true knot entanglement around the fetus, and delivery complications. There are more cases of fetal distress, fetal anomalies, and respiratory distress. [5]

During the antenatal period, intermittent obstruction or vasospasm of the cord often leads to fetal growth restriction (FGR), intrauterine foetal hypoxia, foetal distress and intrauterine brain damage. In labour, complications such as failure to progress in the second stage of labour, foetal distress

and birth asphyxia can occur and most of the times the reason for these complications are not apparent. [6] Intrapartum hypoxia leads to fetal asphyxia, acidosis, neonatal neuronal injury, long-term morbidity, and death. [7] Hence intrapartum fetal monitoring is done to identify the early signs of fetal hypoxia and to take the necessary steps at the earliest in order to prevent the sequelae of fetal hypoxia.

APGAR scoring practice has been ordinarily formulated to quickly summarize the condition of newborn against infant mortality. [8] Shortly after birth the APGAR score is done at 1 and 5 minutes of age to evaluate the newborn status. This is widely used and is universally accepted technique. In spite of improvement in antenatal care and use of modern monitoring techniques such as ultrasonography, 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 enough to prejudice their life.

Hence the aim of this study is to assess the impact of umbilical cord abnormalities on neonatal outcomes.

#### Material & Methods

A retrospective study was conducted in Department of Obstetrics and Gynaecology, PMCH, Patna, Bihar, India. 200 pregnant women with singleton pregnancy who delivered after 28 weeks of gestation during 1 year period, who were diagnosed and documented as having umbilical cord abnormalities either antenatally or during and after delivery were included in the study after taking informed and written consent.

#### Inclusion Criteria:

- Maternal age between 18-35 years.
- Primigravida or multigravida.
- Singleton pregnancy. Pregnancy of 28 weeks onwards.
- Antenatal diagnosis of umbilical cord abnormalities by USG and/or Doppler.
- Women delivered by vaginal route or c section with gross umbilical cord abnormalities.

#### Exclusion Criteria:

- Pregnancy complicated by obstetrical, medical and surgical disorders.
- Fetal congenital anomalies detected at prenatal ultrasonography.
- Oligohydramnios/ polyhydramnios.

- Multiple gestation.
- Rh incompatibility/ fetal hydrops.
- Diagnosed intrauterine fetal death at time of first ultrasonographic examination.

#### Methodology

Convenience sampling technique was used and hundred mothers who met the inclusion and exclusion criteria were taken for the study. In labour, the labour progress was assessed using a partograph. Based on the partographic findings, a diagnosis of prolonged labour was made. The fetal heart rate was monitored using conventional method and by intermittent /continuous cardiotocography (CTG). The CTG was carefully analysed for foetal heart rate abnormalities. The mode of delivery by the vaginal route/caesarean section or instrumental delivery and the indications for caesarean section was noted. At the time of delivery, the following findings were noted: the presence or absence of loop of cord around the neck, trunk, shoulder, and limbs, if present, the number of loops of cord, and whether the cord was loose or tight. After the delivery of the foetus, the cord was clamped at two places and cut in between and the baby was separated. After the delivery of the placenta, using a flexible inch tape the length of the cord was measured in two portions; from the placental attachment to the proximal cut end and from the foetal umbilicus to the distal cut end and were added. The Cord was examined for abnormalities such as false and true knots, cysts, and haematomas. The type of insertion of the cord on the placenta was also noted. With regards to the new born parameters, sex of the baby, weight of the baby, Apgar score at 1 and 5 minutes and the need for admission into new born Intensive care Unit (NICU) were noted. The association between the cord length and the parameters such as nuchal coiling, FHR changes, mode of delivery, duration of labour, APGAR at birth and NICU admissions were analysed and the statistical significance was derived.

#### Statistical Analysis

Descriptive statistics was computed for all numerical data, in terms of percentage and mean. The significance was tested using Chi-square test. For all the statistical analysis, a p-value at <0.05 was considered to indicate as significant difference at 5% level of significance.

#### Results

**Table 1: Distribution of patients according to parity and mode of delivery**

| Parity            | N%       |
|-------------------|----------|
| Primigravida      | 80 (40)  |
| Multigravida      | 120 (60) |
| Mode of delivery  |          |
| Vaginal           | 130 (65) |
| Caesarean section | 70 (35)  |

The age of majority of patients was in the range of 21-28 years as this group is most fertile. Primigravida comprised of 40% whereas 60% were multigravida. 65% patients had normal vaginal delivery whereas 35% patients required Caesarean section.

**Table 2: Umbilical cord abnormalities**

| Umbilical cord abnormalities | N   | %  |
|------------------------------|-----|----|
| Nuchal cord                  | 140 | 70 |
| Abnormal cord length         | 24  | 12 |
| Cord prolapse                | 2   | 1  |
| Single Umbilical artery      | 6   | 3  |
| Cord knot                    | 10  | 5  |
| Vasa previa                  | 2   | 1  |
| Coiling abnormality          | 14  | 7  |
| Velamentous insertion        | 2   | 1  |

Of all the abnormalities of umbilical cord, the most common abnormality encountered is Nuchal cord (cord around the neck) with 70% cases in our study. Abnormal cord length i.e. Long (>100cm) and short (<40cm) was seen in 12% cases. Rare abnormalities like vasa previa, velamentous insertion and cord

prolapse was seen in 1% cases each. Single umbilical artery was seen in 3% cases. Cord knot which includes true as well as false knots was seen in 5% cases. Coiling abnormality which includes hyper as well as hypo coiled cord was seen in 7% cases.

**Table 3: Neonatal outcome**

| APGAR SCORE | @1 MINUTE |    | @5 MINUTE |    |
|-------------|-----------|----|-----------|----|
|             | N         | %  | N         | %  |
| <4          | 12        | 6  | 10        | 5  |
| 4-7         | 14        | 7  | 10        | 5  |
| >7          | 174       | 87 | 180       | 90 |

Majority of the patients had APGAR score >7 at 1 and 5 minutes.

**Table 4: Perinatal outcome**

| Perinatal outcome    | N (%)    |
|----------------------|----------|
| Live birth           | 142 (71) |
| NICU admission       | 40 (20)  |
| Early neonatal death | 8 (4)    |
| Late neonatal death  | 4 (2)    |
| Still birth          | 6 (3)    |

71% fetus had live birth without any complication and did not require NICU admission. 20% required NICU admission. 4% had early neonatal death, 2% late neonatal death whereas 3% was still birth.

### Discussion

The growth and wellbeing of a foetus depends up on the normal blood flow through the umbilical cord from the mother. When there are umbilical cord abnormalities, they disrupt the normal blood flow to the fetus, exchange of gases, and supply of nutrients from the mother to the fetus leading to adverse perinatal outcome. During the antenatal period, intermittent obstruction or vasospasm of the cord often leads to fetal growth restriction (FGR), intrauterine foetal hypoxia, foetal distress and intrauterine brain damage. In labour, complications such as failure to progress in the second stage of labour, foetal distress and birth asphyxia can occur and most of the times the reason for these

complications are not apparent. [6] In these situations, careful examination of the umbilical cord may reveal significant findings which may be the causal reason for these intra partum events. At term, the normal cord is about 50-60 cms in length and 1-2 cm in diameter. However, there is considerable variation in the length of the umbilical cord, ranging from no cord (achordia) to length up to 300 cms. A long cord is defined as a cord length of >100 cms and in a short cord, the cord length is <30 cms. There could also be true knots in the umbilical cord which can compromise the well-being of the baby. Variations in the umbilical cord length such as long and short cords may be associated with adverse perinatal outcome and maternal intrapartum complications. [9]

The age of majority of patients was in the range of 21-28 years as this group is most fertile. Primigravida comprised of 40% whereas 60% were

multigravida. 65% patients had normal vaginal delivery whereas 35% patients required Caesarean section. Short cords are associated with fetal movement disorders and intrauterine constraint, placental abruption, cord rupture, and emergency caesarean deliveries for non reassuring fetal heart rate. [10] Although short cords have been associated with inability of some the fetuses to deliver vaginally, there are reports on vaginal delivery with cords as short as 13 cm, which is much shorter than the normal range. [11] Among cord knots, adverse neonatal outcome in the form of still birth was associated with true knot. True knots occur due to active fetal movements and cause still birth due to venous stasis causing thrombosis, fetal hypoxia, fetal neurological morbidity and death. [12]

Of all the abnormalities of umbilical cord, the most common abnormality encountered is Nuchal cord (cord around the neck) with 70% cases in our study. Abnormal cord length i.e. Long (>100cm) and short (<40cm) was seen in 12% cases. Rare abnormalities like vasa previa, velamentous insertion and cord prolapse was seen in 1% cases each. Single umbilical artery was seen in 3% cases. Cord knot which includes true as well as false knots was seen in 5% cases. Coiling abnormality which includes hyper as well as hypo coiled cord was seen in 7% cases. Similar to our study Balkawade et al [13] study also showed 67.9% of nuchal coiling in cases with long cords.

Majority of the patients had APGAR score >7 at 1 and 5 minutes. 71% fetus had live birth without any complication and did not require NICU admission. 20% required NICU admission. 4% had early neonatal death, 2% late neonatal death whereas 3% was still birth. At time of delivery, presence of a cord around the neck or the body/leg/arms is a common finding seen in 25-30% of cases. Though most of the babies are born healthy, perinatal complications can develop if the cord is tight around the neck, or the cord is wrapped around the neck more than once or there is less amniotic fluid causing cord compression. The potential antenatal complications associated with nuchal cord may be chronic intrauterine hypoxia leading to FGR, intrauterine death due to complete cord occlusion. In labor, it can lead to FHR abnormalities, birth asphyxia, prolonged second stage of labor, increased operative interventions and long term sequelae could be neurodevelopmental delay. Though, nuchal cords were seen predominantly in the long cord length group, single nuchal cord also occurred in the short cord length group. Rogers et al have shown that nuchal cord can occur with short cords, in which case they tend to wrap around the infant's neck more tightly. [14] Bashir et al have not shown significant difference between the baby outcomes having nuchal cord or without nuchal cord. [15]

Nuchal cords are often identified during an obstetrical ultrasound. Nuchal cords are identified by taking multiple views of the fetal neck. A nuchal cord is diagnosed when the umbilical cord is seen encircling at least three-quarters of the fetal neck. If the cord encircles at least half of the neck, it may be classified as suspicious for the presence of a nuchal cord. Using Gray-scale and color Doppler imaging, the sensitivity of ultrasound in diagnosing a nuchal cord when there was more than one loop present was 60% compared to 37% when only one loop was present. [16] True and false knots can occur in the umbilical cord. False knots have not been reported to cause any adverse perinatal outcome. However, true knots have been reported to lead to a 4-fold increase in fetal loss, presumably because of compression of the cord vessels when the knot tightens. [17]

### Conclusion

Umbilical cord abnormalities are a stress factor for fetus, where stillbirth can occur due to combination of risk factors. This is especially important because most of these still births occur relatively late in pregnancy in a setting of otherwise normal fetuses and pregnancies. Therefore, early detection and continued surveillance will help to prevent such sudden fetal loss.

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