

# Maternal Risk Factors and Outcomes of Umbilical Cord Prolapse: A Population-Based Study

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## Abstract

**Objective:** Umbilical cord prolapse (UCP) is a rare event believed to be associated with adverse outcomes. The purpose of our study was to use a large administrative database to better identify incidence, predictors, and outcomes of births with UCP.

**Methods:** We carried out a retrospective cohort study using data from the National Center for Health Statistics— Linked Birth Infant Death and Fetal Death (United States) data files during the years 2003–2005. The incidence, predictors, and outcomes of births with UCP were compared to births with no UCP. Logistic regression analysis was performed to estimate the adjusted effect of UCP on maternal and neonatal outcomes.

**Results:** There were 16 126 cases of UCP among 10 040 416 births, for an incidence of 16.1 cases per 10 000 births. While most cases occurred at term and in women with one or two previous births, early gestational age, grand multiparity, prolonged labour, and malpresentation were the strongest risk factors. UCP was associated with an increased risk of placental abruption, excessive bleeding, Caesarean sections, lower Apgar scores, requiring assisted ventilation, neonatal seizures, hyaline membrane disease, and fetal injuries. Deliveries by Caesarean section were associated with a greater risk of fetal injuries than vaginal delivery (18.5% vs 8.7%; OR 2.6, 95% CI 2.3 to 2.9,  $P < 0.001$ ).

**Conclusion:** Although there are established risk factors, UCP occurs most commonly in low risk women at term. When possible, vaginal delivery is preferred in women with UCP because it appears to be associated with a lower risk of fetal injury.

## Résumé

**Objectif :** Le prolapsus du cordon ombilical (PCO) est un événement rare que l'on estime être associé à des issues indésirables. Notre étude avait pour objectif d'utiliser une base de données

administrative de grande envergure pour mieux identifier l'incidence, les facteurs prédictifs et les issues des accouchements en présence d'un PCO.

**Méthodes :** Nous avons mené une étude de cohorte rétrospective au moyen de données issues de la base de données *National Center for Health Statistics— Linked Birth Infant Death and Fetal Death* (États-Unis) pour la période 2003–2005. Nous avons comparé les accouchements en présence d'un PCO aux accouchements n'ayant pas présenté cette complication en fonction des paramètres suivants : incidence, facteurs prédictifs et issues de grossesse. Une analyse de régression logistique a été menée pour estimer l'effet corrigé du PCO sur les issues maternelles et néonatales.

**Résultats :** Nous avons recensé 16 126 cas de PCO au sein d'un groupe de 10 040 416 naissances, ce qui représente une incidence de 16,1 cas sur 10 000 naissances. Bien que la plupart des cas soient survenus à terme et chez des femmes qui avaient déjà connu un ou deux accouchements, les facteurs de risque les plus fortement associés au PCO ont été un âge gestationnel précoce, une grande multiparité, un travail prolongé et une présentation anormale. Le PCO a été associé à un risque accru de décollement placentaire, de saignements excessifs, de césarienne, de faibles indices d'Apgar, de mise en œuvre d'une ventilation assistée, de convulsions néonatales, de maladie des membranes hyalines et de lésions fœtales. Les accouchements par césarienne ont été associés à un risque accru de lésions fœtales, par comparaison avec les accouchements vaginaux (18,5 % vs 8,7 %; RC, 2,6; IC à 95 %, 2,3 à 2,9;  $P < 0,001$ ).

**Conclusion :** Bien que des facteurs de risque aient été établis, le PCO se manifeste plus souvent qu'autrement au terme de la grossesse chez des femmes exposées à de faibles risques. Dans la mesure du possible, la tenue d'un accouchement vaginal est à privilégier chez les femmes qui présentent un PCO, puisque cette intervention semble être associée à un risque moindre de lésion fœtale.

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**Key Words:** maternal risk factors, neonatal morbidity, umbilical cord prolapse

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## INTRODUCTION

Although umbilical cord prolapse (UCP) is an uncommon condition, with an incidence ranging between 0.1 to 0.6%, it is a major obstetrical complication.<sup>1–12</sup>

UCP is diagnosed when the cord can be seen or palpated during a vaginal examination, and it is often accompanied by a decelerating fetal heart rate.<sup>13</sup> The main risk factors currently associated with UCP are breech presentation, multiparity, malpresentation, polyhydramnios, and multiple gestation, particularly in the second-born twin.<sup>2,4,8–10,12,14,15</sup> Prematurity is also a major risk factor for UCP because the fetuses are often small and in a non-vertex presentation.<sup>2,9,12</sup> UCP is associated with adverse neonatal outcomes, such as low Apgar scores and low cord pH values.<sup>1–3,6,7,9–11,14–16</sup> There is also a significant increased risk of mortality in babies born following UCP.<sup>6,10,12,15,17</sup>

Rates of UCP are declining because of better diagnosis and improved obstetrical care. Emergency Caesarean sections performed after a diagnosis of UCP have significantly reduced neonatal morbidity and mortality. Most previously conducted studies of UCP have been small case series with insufficient statistical power to estimate the true incidence of UCP in the general population. Due to the infrequent occurrence of the condition, many other risk factors and outcomes for UCP have not been evaluated. The objective of our study was to provide more reliable estimates of the incidence of UCP, its associated risk factors, and related maternal and neonatal outcomes.

## **METHODS**

We used data from the National Center for Health Statistics (United States Centers for Disease Control and Prevention) – Linked Birth Infant Death and Fetal Death data files to carry out a retrospective cohort study of all births that were registered between January 2003 and December 2005. Information on approximately 4 million annual births of residents and non-residents of the United States are typically included in the database. The territories Puerto Rico, Guam, and the Virgin Islands were excluded from our cohort. Furthermore, our analyses did not include births of United States citizens outside the country.

Our outcome of interest was UCP, which was obtained from the maternal birth certificate. We included all live births, and excluded all deliveries prior to 24 weeks' gestational age, stillbirths, and all delivery records which did not record whether or not UCP occurred. The incidence of UCP was measured for each year, and the maternal characteristics of women with and without UCP were compared. Logistic regression was used to estimate the odds ratios (OR) and 95% confidence intervals (CI) for associated risk factors and maternal and neonatal outcomes among women with and without UCP. We considered  $P$ -values  $< 0.05$  to be statistically significant. All analyses were conducted using SAS enterprise guide 4.2

(SAS Institute Inc., Cary, NC). This study exclusively used publicly available data; hence, according to the Tri-Council Policy statement (2010), institutional review board approval was not required.

## **RESULTS**

A total of 16 126 births complicated by UCP were identified throughout the study period. The incidence of UCP in our cohort population remained stable throughout the three year study period. The incidence was 16.3, 17.0, and 14.7 per 10 000 births for the years 2003, 2004, and 2005, respectively. Baseline characteristics among pregnant women with and without cord prolapse are shown in [Table 1](#). Women with UCP were more likely to be of American Indian/Alaskan native race, to be multiparous, to have a breech presentation, to have a prolonged labour, and to be carrying a male fetus.

The maternal and neonatal outcomes associated with UCP are shown in [Tables 2](#) and [3](#), respectively. Patients who had UCP were almost 11 times more likely to undergo a Caesarean section than those without UCP. Further, births complicated by UCP were associated with placental abruption, preterm premature rupture of membranes, meconium-stained amniotic fluid, and excessive bleeding. The use of forceps and vacuum was not found to be associated with UCP. Infants born following UCP were found to have significantly poorer neonatal outcomes, with more than a five-fold increase in the risk of seizure and a four-fold increase in the risk of suffering fetal injury. Among women with UCP, women who delivered by Caesarean section had a considerably higher risk of fetal injury than women who delivered vaginally (18.5% vs 8.7%; adjusted OR 2.6, 95% CI 2.3 to 2.9,  $P < 0.001$ ).

## **DISCUSSION**

We aimed to provide a more reliable and representative estimate of the incidence of UCP in the United States, including its risk factors and maternal and fetal outcomes, by conducting one of the largest population-based retrospective cohort studies to date. We included 16 126 women identified as having UCP over a three year period, compared with 709 women with UCP in the previous largest reported study.<sup>18</sup> Our large study population enabled us to identify additional risk factors not mentioned in previous reports.<sup>1–12</sup> The risk factors for UCP identified in our study were: maternal age  $\geq 35$ , preterm birth, multiparity, male sex of newborn, breech presentation, multiple gestation, and prolonged labour. Further, we showed that women who have UCP in labour are also likely to have placental abruption, excessive bleeding,

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