

Evaluation of Complications and Risk Factors for Umbilical Cord Prolapse, Followed by Cesarean Section

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ABSTRACT

Background: Considering the rarity of umbilical cord prolapse (UCP) and lack of accurate data about the risk factors and health outcomes, we aimed to evaluate cases of cesarean section (CS) due to UCP in order to reduce treatment costs and provide information about the mortality and morbidity associated with this condition.

Methods: Of 35,259 cases of CS performed in four hospitals during 2004-2012, 103 cases of UCP were selected as the case group; on the other hand, 318 cases without UCP were classified as the control group. Information was extracted from patients' records and analyzed by SPSS version 18.

Results: Prevalence of UCP was estimated at 0.2%. In the case group, cord prolapse in the active phase of labor was reported 1.4 times (81% vs 57% - $P < 0.00$), engagement 8 times (14% vs 2% - $P < 0.001$), transverse presentation 8 times (6% vs 2% - $P < 0.002$), grand multiparity 3.9 times (4% vs 0 - $P < 0.001$), oligohydramnios 4.7 times (5% vs. 0 - $P < 0.0001$, and polyhydramnios 5.9 times (6% vs 0 - $P < 0.001$). UCP was more prevalent in post-term deliveries ($P < 0.043$). One-minute Apgar score < 7 was 3 times more prevalent in neonates of the case group ($P < 0.00$). Prepartum vaginal bleeding was 4 times more common in the case group, compared to the control group; also, decreased fetal movement and heart rate drop were more prevalent in the case group. Mortality rate was 5.2% in the case group and 1.7% in the control group. Overall, the control group had a better general health at discharge, compared to the case group.

Conclusion: A statistically significant correlation was detected between UCP and gestational age, active phase of labor, fetal presentation, engagement, parity, and amniotic fluid volume.

Keywords: Complications, CS, Risk factors, Umbilical cord prolapse

Introduction

Umbilical cord prolapse (UCP) is a rare obstetric emergency, defined as the descent of umbilical cord to the lower segment of the uterus. In this condition, the cord is either located near (hidden UCP) or beneath (obvious UCP) the presented organ (1, 2). Hidden UCP is not palpable in pelvic examination, while obvious UCP, which is mostly accompanied by membrane rupture and umbilical cord displacement in the vagina (often out of the vaginal orifice), is detectable in physical examination (1, 3).

UCP near or beneath the presented organ intermittently compresses the cord between the presented organ, cervix, and pelvic inlet (or vaginal channel). As a result of this compression, fetal blood circulation is disturbed, and hypoxia, brain damage, and fetal death may occur depending on the duration and severity of compression.

Incidence of prolapse in normal umbilical cords (35-80 cm) is approximately 0.04%, while it

reaches up to 4-6% in longer cords (> 80 cm) (1). Nearly 50% of UCPs occur in the second stage of labor. Additionally, in obvious UCP, exposure to air causes irritation and cooling, resulting in the vasospasm of cord vessels (1).

A normal fetus, which is at risk due to cord compression, shows vigorous movements, which are easily detectable by a physician. Detection of these movements is of paramount importance given the consequent complications and mortality associated with UCP. Factors contributing to the incidence of UCP are as follows: multiparity, breech presentation, immaturity, low fetal weight, abnormal fetal presentation, polyhydramnios, multiple pregnancy, umbilical cord presentation, and long umbilical cord.

The main complications of UCP include decreased blood supply and circulation, as well as hypoxia. More attention should be paid to these adverse outcomes, which can lead to fetal death or

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late complications such as cerebral palsy and mental retardation (1, 4). Another complication associated with UCP is asphyxia, which is related to fetal acidosis (34%), low Apgar score (0-3) in the first 6 minutes of birth (47%), abnormal fetal movement, loss of consciousness, and seizures (1,5).

By the identification and management of risk factors, we can prevent UCP to a great extent. However, the only recognized treatment is emergent CS, resulting in bleeding, anesthetic need, and infection in both mother and fetus. Unfortunately, no previous study has evaluated this phenomenon in Iran. However, in studies conducted in other countries, some of the risk factors and late-onset complications have been illustrated.

Considering the rarity of UCP and lack of accurate data about the risk factors and health outcomes, we aimed to evaluate cases of CS, performed due to UCP at Arash, Mirza-Kuchak-Khan, Valiasr, and Shariati hospitals. This study could pave the way for taking more effective measures in order to prevent this complication. In addition, the obtained results could help reduce treatment costs and the associated mortality.

Methods

In this case-control, retrospective study, we evaluated deliveries performed at Valiasr, Mirza-Kuchak-Khan, Arash, and Shariati hospitals over 9 years (2004-2012). A total of 35,259 c-sections were performed during this period, among which 103 cases were due to UCP. Overall, 103 cases of CS due to UCP were selected as the case group, and 318 cases of CS, unrelated to UCP, were classified as the control group.

Data were collected from patients' records available in the hospitals. Variables were extracted and recorded in patient information forms. The two groups were matched in terms of different variables, and unrelated factors were excluded from the study. The evaluated variables were as follows: gestational age, maternal age, active phase of labor (with the presence of UCP), fetal birth weight, Apgar score at birth, fetal presentation, parity, rupture of membranes, fetal gender, neonatal complications (e.g., respiratory distress syndrome, prenatal infection, hypothermia, and prenatal mortality), maternal complications (e.g., placental abruption and vaginal bleeding), reduced fetal movement, fetal heart rate drop, and amniotic fluid volume.

This study was scientifically, ethically, and financially approved by the Research Committee of School of Medicine at Tehran University of

Medical Sciences. The collected data were analyzed by SPSS version 18. Tables of frequency distribution and graphs were used, and Chi-square test was performed for the comparison between variables.

Results

In this study, of 35,259 cases of CS performed in 4 hospitals, 103 cases were due to UCP (prevalence= 0.2%). Abnormal fetal presentation was a risk factor for UCP. With respect to the obtained results, there was a significant association between fetal presentation and the incidence of UCP. In fact, transverse presentation was 3 times more common in the case group, compared to the control group. However, the incidence rates of breech and cephalic presentations were quite similar in both groups.

In general, low birth weight is considered an influential factor for the incidence of UCP. However, in this study, no significant association was found between low birth weight and the incidence of UCP. Similarly, the incidence of UCP was not significantly correlated with maternal age or fetal gender.

Another influential variable, mentioned as a risk factor for UCP in previous studies, is parity. Grand multiparity was 3.9 times more frequent in cases with UCP.

Regarding gestational age, rate of preterm deliveries was higher in the case group. While 1.9% of neonates in the case group were post-term, no post-term deliveries were reported in the control group. However, no significant relationship was found between post-term deliveries and the incidence of UCP.

Although amniotomy was performed more frequently in the case group, no significant difference was reported between the two groups. However, there was a significant association between engagement and the incidence of UCP; in fact, engagement was 8 times more frequent in the case group, compared to the control group.

Amniotic fluid volume was categorized into normal, oligohydramnios, and polyhydramnios. In the case group, oligohydramnios and polyhydramnios occurred 4.7 and 5.9 times more than controls and there was a statistically significant difference between the two groups.

One-minute Apgar score was considerably lower in the case group, compared to the control group. In the case group, one-minute Apgar score < 7 was three times more common in the control group. On the other hand, 5-minute Apgar score was not significantly different between the two groups.

Table 1. Frequency of the studied variables

	Case	Control	P-value
Prepartum vaginal bleeding			
Yes	20(19.4%)	16(5%)	0.001
No	83(80.6%)	302(95%)	
Decreased fetal movement before birth			
Yes	8(7.8%)	4(1.3%)	0.002
No	95(92.9%)	314(98.7%)	
Fetal heart rate drop before birth			
Yes	2(1.9%)	0(0%)	0.05
No	101(98.1%)	318(100%)	
Amniotic fluid volume in mothers			
Polyhydramnios			
Normal			
Oligohydramnios	5(5.9%)	0	0.0001
Yes	76(89.4%)	318(100%)	
No	4(4.7%)	0	
Early fetal membrane rupture			
Yes	26(25.2%)	55(17.3%)	0.07
No	77(74.8%)	263(82.7%)	
Gender			
Male	58(56.3%)	58(56.3%)	0.468
Female	45(43.7%)	152(47.8%)	
One-minute Apgar score			
3>	5(4.9%)	8(2.5%)	0.001
3-7	22(21.6%)	20(6.3%)	
>8	75(73.5%)	290(91.2%)	
Five-minute Apgar score			
3>	4(3.9%)	8(2.5%)	0.095
3-7	4(3.9%)	3(9%)	
>8	95(92.2%)	307(96.5%)	
Neonatal respiratory distress syndrome			
Yes	1(1%)	14(4.4%)	0.131
No	102(99%)	304(95.6%)	
Early sepsis			
Yes	4(3.9%)	9(2.8%)	0.52
No	99(96.1%)	309(97.2%)	
Hypothermia			
Yes	2(1.9%)	0(0%)	0.05
No	101(98.1%)	318(100%)	
General health condition at discharge			
Good	69(89.6%)	221(92.9%)	0.002
Discharged with personal consent	4(5.2%)	0(0%)	
Death	4(5.2%)	17(7.1%)	
Detachment			
Yes	2(1.9%)	3(0.9%)	0.6
No	101(98.1%)	315(99.1%)	
Gestational age			
Preterm			0.43
Term	23(22.3%)	68(21.4%)	
Post-term	78(75.7%)	250(78.6%)	
Maternal age			
18-35	2(1.9%)	0(0%)	0.28
<35	88(85.4%)	284(89.3%)	
Active phase of labor			
Yes	83(80.6%)	182(57.2%)	0.001
No	20(19.4%)	136(42.8%)	
Neonatal weight			
>1500g	6(5.9%)	29(9.4%)	0.329
1500-2500g	9(8.9%)	38(12.3%)	
<2500g	86(85.1%)	243(78.4%)	
Engagement			
Yes	14(13.9%)	4(1.7%)	0.001
No	87(86.1%)	234(98.3%)	
Fetal presentation			
Breech	9(8.8%)	38(12.1%)	0.0002
Cephalic	84(82.4%)	261(83.4%)	
Tranverse	6(5.9%)	6(1.9%)	
Face	0(0%)	8(2.6%)	
Umbilical cord	3(2.9%)	0(0%)	
Parity			
>2	48(46.6%)	134(42.1%)	0.001
2-5	51(49.5%)	184(57.9%)	
<5	4(3.9%)	0(0%)	
Amniotomy			
Yes	51(49.5%)	139(43.7%)	0.304
No	52(50.5%)	179(56.3%)	

Also, there was no significant difference regarding cardiopulmonary resuscitation between the two groups. With respect to maternal complications, although vaginal bleeding was highly common among mothers with cord prolapse, the bleeding rate was 4 times higher in the control group.

Although premature rupture of membranes was more frequently reported in the control group, there was no significant difference between the two groups. Also, no significant association was detected between the incidence of detachment and UCP. Moreover, fetal heart rate drop (bradycardia) and decreased fetal movements were more significant in the case group.

Neonates in the case group were more hypotonic than the control group. In fact, prevalence of hypotonia was 1.9% in the case group, while no such cases were reported in the control group. However, the incidence rates of sepsis and respiratory distress syndrome were similar in the two groups.

Overall, the general health of neonates in the control group was better at discharge, compared to the case group. In 29.9% of controls neonates, general health was good at discharge, and mortality rate was estimated at 1.7%. On the other

hand, 89.6% of neonates in the case group had a good general health (5.2% were discharged with their own consent), and mortality rate was estimated at 5.2%; data analysis showed significantly better results in the control group. It should be noted that a significantly higher number of mothers (approximately 1.4 times higher) with UCP were in their active phase of labor at admission.

Discussion

UCP is defined as the descent of umbilical cord to the lower segment of the uterus; the cord might be located either near or beneath the presented organ (1). UCP is a rare event, occurring in less than 1.2% of all deliveries. In 3 recent reports, prevalence of UCP was 1 in 385, 1 in 702, and 1 in 277 cases, respectively (1). According to a study by Bozhinova in 1998, the incidence rate of UCP was estimated at 0.1% (6). In our target population, the prevalence of UCP was 1 in 342 cases (0.2%).

According to previous studies, incidence of UCP in most cases is strongly associated with abnormal fetal presentation (e.g., breech presentation at the onset of delivery in approximately 50% of cases), multiparty > 5 (10% of cases), abnormal placenta such as low lying placenta, long umbilical cord, membrane rupture, hydramnios, obstetric maneuvers such as forceps delivery, pelvic tumors, displacement of the presented organ in physical examination (10-15% of cases), small fetus, and birth weight < 2500 g (30-50% of cases) (7, 8).

Based on the results of our study, there was a significant association between fetal presentation and the incidence of UCP. Transverse and umbilical cord presentations were three times more common in the case group, compared to the control group. However, the incidence rates of breech and cephalic presentations were similar in both groups. In fact, one of the limitations of our study was the fact that the two groups were matched in terms of different variables.

In our study, considering the effects of multiparty on birth weight, higher rate of multiparty in the case group resulted in the low birth weight of these neonates. Multiparty can be an influential factor, since fetal head descent is not possible due to membrane rupture. Also, laxity of uterus and abdominal wall muscles increase the prevalence of abnormal presentation. In a study conducted by Ozcan, multiparty was 1.6 times more common in the case group, compared to the control group (9). Similar to previous studies, in the current research, parity was considered as one

of the risk factors for UCP, and the incidence of grand multiparty in subjects with UCP was 3.9 times higher.

In a study performed by Alumni et al. during 1998-2009, prevalence of UCP was 1.25 in 1000 deliveries, and 42% of prolapses occurred in cases with amniotomy (10). However, in Ozcan's study on 77 cases in 2002, no significant association was found between UCP and amniotomy (9); this finding was similar to our results.

UCP is more prevalent in preterm deliveries, since when the fetal head is small, there is more space in mother's pelvis, which causes one ring of the umbilical cord to prolapsed. Dare in 2000 found that UCP is 4 times more prevalent in preterm deliveries (11). In a study conducted by Obeidat in 2010, it was shown that UCP occurs more frequently in women above 25 years of age, preterm deliveries, multiparous mothers, and low birth weight deliveries (12). In our study, no association was found between prematurity and the incidence of UCP; also, no significant relationship was found between post-term deliveries and the incidence of UCP.

In a study conducted by Boyle in 2005, the incidence rate of UCP was 2.6 in 1000. Moreover, the incidence rate of obvious cord prolapse in patients with induced labor was 40-50% higher than the general population (13). In our study, a significant correlation was found between the active phase of labor and the incidence of UCP.

Both types of UCP (hidden and obvious) lead to mortality and some significant complications due to the intermittent compression of umbilical cord and fetal hypoxia. When fetal heart rate is disturbed after the rupture of fetal membranes (either spontaneously or deliberately), UCP is highly suspected (8,14). Our collected data about the fetal heart rate showed that the incidence of fetal bradycardia was 1.9% in the case group. Therefore, there was a significant difference between the case and control groups in terms of fetal bradycardia.

In a study in 1997, "Crash LSCS protocol" was regulated in order to facilitate the rapid conduct of CS in emergency cases. Moreover, the effect of this protocol on the management of UCP was evaluated. Within one year, approximately 25 emergency cases of UCP were detected, which included 21% of 118 emergency cases and 0.74% of the total number of cases with CS. Perinatal mortality rate was about 15% among term neonates. All the neonates were born by CS within 10 min of UCP, and the mortality rate was less than 5% (15).

However, in another study, it was shown that even if delivery is performed immediately after UCP, further complications are inevitable (16). In a study conducted by Khan RS, it was shown that diagnosis to delivery interval (DDI) is not the only influential factor for the health outcomes of neonates with UCP (17). In a retrospective study, Murphy and Mackenzie reported 123 consecutive cases of UCP. Prenatal mortality was estimated at 9% (12 in 123 cases), and all deaths were due to severe prematurity or congenital malformations; also, 8% of mortalities were due to asphyxia (18). In the current study, neonates in the case group were more hypotonic; however, the incidence rates of sepsis and respiratory distress syndrome were identical in the two groups. In a study conducted in 2003, 39.6% of neonates had 1-min Apgar score < 7, whereas 4.5% of the subjects had 5-minute Apgar score < 7 (19). In our study, 1-minute Apgar score < 7 was 3 times more common in the control group; however, the 2 groups were not significantly different in terms of 5-minute Apgar score.

Generally, in this study, the prevalence of UCP was 0.2%. According to data analysis, no significant difference was seen regarding the need for CRP between the 2 groups. Also, UCP was significantly correlated with gestational age, active phase of labor, fetal presentation, engagement, parity, or amniotic fluid volume. Moreover, UCP was not significantly correlated with maternal age, amniotomy, number of embryos, birth weight, premature rupture of membranes, or the incidence of sepsis and respiratory distress syndrome. Also, according to our study, neonatal mortality rate was 1.7% in the control group and 5.2% in the case group. Data analysis showed significantly better results in the control group. Since UCP is a rare condition, more extended studies with a larger sample size would facilitate the evaluation of risk factors and outcomes and provide an opportunity for generalizing the findings.

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