Chapter 8

Umbilical Cord Prolapse in primary midwifery care in the Netherlands; a case series

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ABSTRACT

Summary aim of this study was to gain insight into umbilical cord prolapse (UCP) reported by primary care midwives in the Netherlands. Eight cases of UCP were reported by midwives who participated in a postgraduate training programme developed for Dutch community-based midwives called 'CAVE' (pre-hospital obstetric emergency course). Cases were analysed using midwifery charts, ambulance report forms and discharge letters. Procedures to alleviate cord pressure, ambulance timing, mode of delivery and neonatal outcomes were inventoried. Diagnosis to delivery interval (DDI) and risk factors were identified. Six cases of UCP occurred at home. Risk factors such as malpresentation (breech) and/or unengaged presenting part were found in four cases, but only two (unengaged fetal head) were known to the midwife prior to birth. Retrograde bladder filling (2/8), manual elevation of the fetal head (7/8) and Trendelenburg position (1/8) was applied. DDI varied from 13-72 minutes. One infant died of severe birth asphyxia; the other infants recovered and were discharged in good condition. We conclude UCP at home leads to an increased DDI, but no association with a less favourable perinatal outcome was found. Continuing multidisciplinary training is encouraged and multidisciplinary guidelines should be developed and implemented.

INTRODUCTION

Umbilical Cord Prolapse (UCP), occurs in 2 of 1000 births. [1,2] Compression and spasm of cord vessels caused by cold or manipulation, can lead to asphyxia and perinatal death (91 per 1000 births). [1-4] Risk factors for UCP are malpresentation (e.g. breech or transverse position), preterm birth, (grand) multiparity, polyhydramnion, low birth weight and spontaneous (SROM) or artificial rupture of membranes (AROM) in case of unengaged fetal head. [1-3,5,6, 9-11] Manual elevation of the presenting part, Trendelenburg position and retrograde bladder filling are effective methods to relieve cord pressure. [1, 6, 9-11] Wrapping warm swabs around the cord to prevent reactive vasoconstriction are not proven to be beneficial. [12] When cord compression leads to an abnormal fetal heart pattern, birth within 30 minutes is indicated, either vaginally or by caesarean section (CS). [1,2] But, when cord pressure is sufficiently relieved to achieve a reassuring fetal heart pattern, birth within 60 minutes may still be acceptable. [12]

Almost one third of Dutch women give birth in primary care, of which 60% at home. [13] These are women at low risk of complications that indicate referral to secondary care, as described in the Dutch obstetric indication list. [14]

In order to reduce diagnosis-to-delivery interval (DDI), obstetrical emergency training is of great importance and should be regularly updated. [12,15,16] Studies have shown the effectiveness of obstetric emergency courses. [11] In the Netherlands, postgraduate courses such as MOET (Managing Obstetric Emergency and Trauma) for obstetricians and the pre-hospital emergency course, CAVE, for midwives are provided. [1,17]

UCP is not registered in the Dutch Perinatal Registry and therefore prevalence and mortality rates of UCP in the Netherlands are unknown. In addition, there are no national guidelines available concerning UCP. Protocols concerning ambulance care in obstetric emergencies do exist for ambulance personnel and birth attendants. [1,18,19] The Dutch government has set a statutory limit that ambulance referrals, from the initial call to the ambulance dispatcher to hospital arrival, should not exceed 45 minutes. [18,19,20,22] Both the geographic characteristics of the country and excellent road networks allow 99.7% of patients to reach an obstetric department within this time frame. [23]

The management and outcome of UCP in the Netherlands have not been evaluated yet. As home birth is an important part of the Dutch obstetrical system, we were interested in the management and outcomes of UCP occurring in primary midwifery care. We aimed to gain insight into UCP reported by primary care midwives in the Netherlands.

METHODS

This study received ethical approval from the Leiden University Medical Centre ethical board (Study code: P11.105).

Data collection

From April 2008 to April 2009, primary care midwives who attended the CAVE course were requested to participate in this study. Upon inclusion, midwives were asked to report obstetric emergencies such as post-partum haemorrhage (PPH), shoulder dystocia, umbilical cord prolapse, unexpected breech birth, (pre) eclampsia, and resuscitation of the newborn or mother. The midwives who agreed to participate in this study reported all obstetric emergencies for twelve consecutive months. The participants received a monthly e-mail linked to a password-protected Internet site. When reporting an obstetric emergency, the participant was asked to fill out a detailed case registration form (CRF) containing information on received care during pregnancy and birth, and maternal as well as neonatal outcome. Anonymous medical files, discharge letters and laboratory results were requested. If data were incomplete or inconclusive, the attending midwife was contacted for the missing documents. In this paper we report the case-series of UCP in this cohort. Medical files of UCP were assessed for parity, age, gestational age and fetal presentation (cephalic or breech and engagement in the pelvis). Items specifically concerning management of UCP, such as procedures to alleviate cord compression, time of onset of ambulance care, on-scene time by the ambulance, arrival in hospital (if applicable) and mode of delivery (vaginal or CS), were collected. Neonatal outcomes concerning mortality and morbidity (Apgar score, neonatal intensive care admission, birth asphyxia) and maternal complications were collected. The DDI was calculated for every case. We defined DDI as starting from the moment the diagnosis was made by either the woman when the umbilical cord was visualised outside the vagina or by the midwife during vaginal examination. We identified risk factors for UCP as noted on midwifery, ambulance and hospital charts.

Data was collected and transferred to Microsoft Excel 2010 (Microsoft, Redmond, Washington, USA). Medians and ranges were calculated using IBM Statistics Data Editor (SPSS), version 21 (SPSS Inc., Chicago, IL, USA).

RESULTS

All midwives (n= 584) who registered for the CAVE course were asked to participate, of which 548 (92%) agreed to contribute to this study. 312 obstetric emergencies were reported from April 2008 to April 2010: 192 cases of PPH (62%), 55 cases of shoulderdystocia

(17%), 45 cases of resuscitation of the newborn (14%), nine cases of unexpected breech birth (3%), eight cases of UCP (3%) and three other complications (1%).

Eight cases of UCP were reported during the study period. Of the eight reported cases, six occurred at home, one in a birthing centre and one was diagnosed after referral to secondary care because of meconium stained liquor. In this case UCP was managed by the obstetrician with the referring midwife present at birth. In three cases the umbilical cord was visible outside the vagina, while in five cases UCP was diagnosed through vaginal examination. Table 1 provides the relevant characteristics and a summary of each case. One case of UCP occurred at home in the preterm period (33+6 weeks) and the other five occurred during planned homebirths at term after spontaneous rupture of membranes. In four cases, the fetus was in vertex position with a sufficiently engaged head. In two cases a vertex position with a not sufficiently engaged fetal head was found. In the final two cases, breech presentation was an unexpected finding.

In one case UCP occurred after AROM (with engaged fetal head), in the other seven the membranes ruptured spontaneously. In all cases fetal condition was assessed prior to performing procedures; fetal bradycardia was found in three cases, with no abnormalities in the other five. Upon arrival of the midwife, procedures such as manual elevation of the presenting part (7/8), bladder filling (2/8), Trendelenburg position(1/8) and warm swabs (1/8) were performed (Table 1). In case 1, provided by a midwife who did not participated in the CAVE course yet, no procedures were performed to alleviate cord compression. The midwife reported in the medical file that procedures were considered, but fetal condition was assessed as optimal and immediate referral was preferred.

On arrival in hospital, CS was performed in seven cases (of which six with general anaesthesia) and one infant was delivered vaginally by vacuum extraction.

One infant was admitted to the neonatal intensive care unit and deceased four days after CS following severe birth asphyxia. The other seven infants recovered and were discharged from hospital in good clinical condition. No maternal morbidity was reported.

Table 2 shows relevant time intervals of midwifery, ambulance and obstetrical care in reported cases. In five cases the midwife was present at time of UCP. In the three cases where the midwife was not present (case 2, 4 and 5), she arrived at the woman's home in 11-15 minutes. In these cases, because spontaneous rupture of membranes (SROM) was the beginning of birth, this was the first contact with the midwife. In all cases of UCP at home, the ambulance was called within 10 minutes after diagnosis. In two cases (cases 4 and 5), the midwife called ambulance services immediately after she spoke to the woman on the phone (as UCP was diagnosed by the woman). As a result, in one case (case 5) the ambulance arrived at the scene before the midwife. In case 2, the midwife diagnosed UCP upon arrival and subsequently requested ambulance services which arrived in 16 minutes. Time between arrival of the ambulance at the scene of UCP and arrival in

hospital ranged from 15 to 40 minutes. The time spent on the scene by the ambulance personnel ranged from 3 to 33 minutes. In both cases where retrograde bladder filling was applied (case 4 and 5), the on-scene time was 20 minutes. In one case (case 3), the fire department was called in to airlift the woman from her home, as the stairs were too steep to carry the woman and midwife (who was continuously elevating the fetal head) downstairs by ambulance stretcher. In this case, on-scene time was 33 minutes. In the three remaining cases, the on-scene time was 3-5 minutes.
Time between hospital arrival and birth ranged from 6 to 37 minutes. The overall DDI varied from 13 to 72 minutes (median 41 minutes). The shortest DDI was found in the two cases of UCP that occurred in hospital and birthing centre. In the six cases of UCP at home, DDI ranged from 31- 72 minutes. The DDI of the infant that later deceased was 47 minutes (case 5). Two infants with an Apgar score < 7 at five minutes had a DDI of 47 and 71 minutes respectively. Six infants with an Apgar score of ≥ 7 at five minutes had a DDI of 13 to 72 minutes (median 31 minutes).
Risk factors for UCP were assessed for all cases (Table 3). Seven women were multiparous, but no grand multiparity was found. In two cases (case 1 and case 6), a risk factor for UCP (non-engaged fetal head) was known to the midwife prior to labour. In both cases, the midwife had instructed the woman to lie down immediately after spontaneous rupture of membranes and call the midwife. Prior to birth, the midwives had found no reason why the fetal head was not engaging (e.g. low-lying placenta), in agreement with the obstetric indication list. In case 1, the midwife was called after rupture of membranes and the fetal head was assessed as sufficiently engaged. At dilatation of 5 cm no umbilical cord was palpable. Surprisingly, however, at eight cm dilatation UCP was found. In case 6, the woman called the midwife with contractions and intact membranes. Upon arrival, SROM and UCP occurred. In cases 2 and 4, unexpected breech positions were found by the midwife upon arrival. No polyhydramnion was diagnosed in any of the cases.

DISCUSSION

This study of eight cases of UCP seems to indicate that the increased diagnosis to delivery interval (DDI) associated with UCP at home does not lead to less favourable perinatal outcomes. In all cases, the women were immediately referred to secondary care, and procedures such as retrograde bladder filling, manual elevation of the fetal head and Trendelenburg position were performed. All but one infant was born through caesarean section, one infant died of severe birth asphyxia. Risk factors such as malpresentation (breech) and/or unengaged presenting part were found in four cases, but in only two cases (unengaged fetal head) this was known to the midwife prior to birth.

Strengths and limitations

This is the first study on UCP in primary midwifery care in the Netherlands. Ambulance care in the Netherlands concerning obstetric referral has been studied, but this is the first time ambulance transfer specifically for UCP has been evaluated. [20, 24] A study on referral after UCP in a country such as the Netherlands, where primary midwifery care is embedded in the health care system and there is good cooperation with both paramedic personnel and obstetricians, has not been performed. It is probable that this well organised system contributes to more timely arrival of medical assistance (midwife and ambulance paramedics). Subsequently, as midwives are trained to perform the necessary procedures to alleviate cord compression if needed, fetal condition can be stabilised before transfer to hospital. As described in other studies, if procedures to reduce cord compression are applied, the urgency to deliver immediately might be less of an issue. [2, 25] Although only eight cases were studied, these factors as described above could explain that no direct relation between DDI and perinatal outcomes was found.

Earlier studies have reported that a prolonged DDI in case of UCP increases the risk of low Apgar score, stillbirth and neonatal death. [3, 26] Other studies, however, found no direct relation between DDI and perinatal outcomes (perinatal mortality and NICU admission), but prior hypoxia, CTG abnormalities, intra uterine growth restriction and prematurity were found to influence outcomes. [10,27,28] UCP occurring outside hospital setting has not been structurally evaluated, but has sporadically been mentioned in publications. In virtually all cases mentioned in these studies, long DDI's (over 100 minutes) and high perinatal mortality is reported. [3, 29] We suspect that these results are based on research conducted in care systems where no assistance at home is provided to reduce cord pressure and no quick referral to hospital is possible. It is evident that DDI will be longer when a patient needs to be transferred to hospital per ambulance.

UCP is a rare complication, which comprised only 3% of all obstetric emergencies from home birth settings during the study period. Consequently, the data set for this study is small. Even with so few cases however, we believe it provides valuable insights into the management of UCP by midwives, ambulance services and obstetricians.

Interpretation

In this study we found the shortest DDI in the two cases of UCP that occurred in hospital and birthing centre (cases 7 and 8). But, with an overall median DDI of 41 minutes, the Dutch health care system seems to be able to act within acceptable limits. In the case where the infant deceased (case 5) the DDI was 47 minutes. Although this is in the upper half of DDI's found, case 2, 3 and 4 had longer DDI's (56, 72 and 71 minutes respectively) and all had favourable perinatal outcomes. In this study, we found that DDI alone does not give adequate explanation for adverse perinatal outcomes.

Risk factors such as malpresentation (breech) and/or unengaged presenting part were found in four cases, but in only two of these, the condition (unengaged presenting part) was known to the midwife prior to birth. In the other four cases no risk factors were present, except for AROM in one case, which could have possibly resulted in UCP. Our results show that UCP may occur in a low-risk population without any warning signs. In such a situation, quick and adequate measures by the midwife are of great importance.

In three cases the umbilical cord was visualised outside the vagina. UCP might be a much more dangerous complication when the umbilical cord extends outside the vagina, in this study we found lower Apgar scores in all these cases. It is possible that the cord had been prolapsed for a longer time, but went unnoticed, and that the fetal condition had already deteriorated. Additionally, spasm of cord vessels when exposed to cold contributes to acute hypoxia of the unborn child. Also, as the fetal head provides more cord compression (compared to breech position), cephalic position increases the risk of hypoxia. In these cases, immediate relief of cord pressure and reducing cord spasm is crucial.

Although retrograde bladder filling is effective, it is time-consuming. However, the time it takes for the ambulance to arrive provides the midwife with the opportunity to perform this procedure. When the ambulance is already present the midwife can decide not to perform bladder filling, but immediately transfer to hospital. For example, case 5 illustrates both how UCP can occur without any other warning sign (such as contractions), and the procedural dilemma facing the midwife. In hindsight, the fetal condition in this case was already very poor when the midwife arrived. The ambulance had arrived before the midwife and immediate referral might have been more effective than retrograde bladder filling.

In case 3, airlifting the woman evidently caused a great amount of delay. In retrospect, retrograde bladder filling might have been more effective as the woman may have been able to be carried down by ambulance stretcher or could have walked down the stairs herself. Decision-making by the midwife in assessing the time needed to transfer is of great importance and should continue to be addressed in obstetric emergency training programs.

The midwives who had attended the CAVE course were recently trained (within 12 months) and updated on the latest insights into management of UCP. Virtually all midwives in the Netherlands have now participated in the CAVE course and it is well established that training has a positive effect on management of obstetric emergencies. [11] We believe that, although a small amount of cases was reported and studied, our findings accurately reflect the current management of UCP occurring in primary midwifery care in the Netherlands.

In case of imminent UCP (regardless of whether the woman is in primary or secondary care) both the woman and medical personnel could consider calling in a midwife to perform these procedures in anticipation of transfer to hospital. Further studies must be performed to explore the additional value of midwifery assistance at home versus direct transfer by ambulance.
As birth in primary care is still preferred by many women in the Netherlands, and UCP does occur in these women at low risk, we recommend development and implementation of multi-disciplinary guidelines for UCP management in a community setting. In addition, even if women are in secondary care, UCP can occur at home (e.g. preterm rupture of membranes) and such guidelines could prove invaluable.

Key Conclusions

UCP at home leads to an increased DDI, but no association with a less favourable perinatal outcome was found. We strongly believe that optimal skills of UCP-management can have a significant positive influence on perinatal outcomes. Training care providers in management of obstetric emergencies and effective decision-making is therefore essential. Continuing multidisciplinary training is encouraged and multidisciplinary guidelines should be developed and implemented.

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Table 1. Maternal, foetal and labour characteristics in cases of umbilical cord prolapse

Case	Parity, gestational age	Place of UCP	Position of UCP	Presentation and position	AROM SROM	Dilatation of cervix (cm)	Foetal condition (assessed prior to manoeuvres)	Performed manoeuvres to alleviate cord compression	Mode of delivery	Apgar score	Neonatal mortality	DDI Diagnosis to delivery interval
1	P1, 38+2	Home	Inside vagina	Vertex, not engaged	SROM	8-9	Normal foetal heart beat[1]	None	VE	9/10/10	no	35
2	P0, 33+6	Home	Outside vagina	Breech, not engaged	SROM	7-8	80-100 bpm	Manual elevation, warm gauze	CS	4/7/10	no	56
3	P1, 39+3	Home	Inside vagina	Vertex, engaged	AROM	4	Normal foetal heart beat[1]	manual elevation, Trendelenburg position	CS	10/10	no	72
4	P0,40+4	Home	Outside vagina	Breech, not engaged	SROM	5	Normal foetal heart beat[1]	Manual elevation, retrograde bladder filling	CS	2/6/8	no	71
5	P1, 40+1	Home	Outside vagina	Vertex, engaged	SROM	4	70-80 bpm	Manual elevation, retrograde bladder filling	CS	2/4/6	Deceased	47
6	P1,40+1	Home	Inside vagina	Vertex, not engaged	SROM	4	110 bpm	Manual elevation	CS	5/10/10	no	31
7	P1, 40 +0	Birthing center[2]	Inside vagina	Vertex engaged	SROM	5	Normal foetal heart beat[1]	Manual elevation	CS	9/10/10	no	20
8*	P2, 40+2	Hospital MSL[3]	Inside vagina	Vertex engaged	SROM	7	Normal foetal heart beat[1]	Manual elevation	CS	7/9/10	no	13

* Care was provided by the obstetrician, but the referring midwife was present
[1] Normal foetal heart beat = 110 - 160 with variability as assessed by the midwife using a doptone. [2] birthing clinic adjacent to hospital
[3] Meconium stained liquor.
SROM = spontaneous rupture of membranes; AROM= artificial rupture of membranes; VE= Vacuum extraction; CS = caesarean section

Table 2. Timing of midwifery, ambulance and obstetrical care in reported cases of UCP (in minutes).

Case nr	Parity and gestational age (weeks + days)	Place of UCP	Arrival of midwife after UCP	Ambulance call after UCP	Ambulance arrival after UCP	On scene time Ambulance	Arrival in hospital after UCP	DDI Diagnosis to delivery interval
1	P1, 38+2	Home	0	2	15	4	30	35
2	P0, 33+6	Home	11	16	28	3	43	56
3	P1, 39+3	Home	0	10	20	33†	35	72
4	P0, 40+4	Home	15	5	21	20	61	71
5	P1, 40+1	Home	17	3	14*	20	33	47
6	P1,40+1	Home	0	1	6	5	25	31
7	P1, 40 +0	Birthing center[1]	0	-	-	-	9	20
8	P2, 40+2	Hospital MSL[2]	0	-	-	-	-	13

* Ambulance was at the scene before the midwife arrived
[1] Birthing clinic adjacent to hospital; [2] Meconium stained liquor
† The fire department was called in to airlift the woman from her home

Table 3. Assessed risk factors for UCP

Case nr	(grand) Multiparity (≥ 5 births)	Malpresentation (breech, transverse and unstable lie)	Unengaged presenting part	Prematurity < 37 weeks	AROM	Low birth weight, (less than 2.5 kg)	Polyhydramnion
1	no	No (vertex)	Yes*	no	no	no	no
2	no	Breech*	yes	yes	no	yes	no
3	no	No (vertex)	no	no	yes	no	no
4	no	Breech	yes	no	no	no	no
5	no	No (vertex)	no	no	no	no	no
6	no	No (vertex)	Yes*	no	no	no	no
7	no	No (vertex)	No	no	no	no	no
8	no	No (vertex)	no	no	no	no	no

* The unengaged position or breech position was known by the midwife previously to the onset of birth.

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