Original Article

Umbilical cord prolapse - A review of diagnosis to delivery interval on perinatal and maternal outcome

Rozilla S. Khan, Tahira Naru, Faryal Nizami
Department of Obstetrics and Gynaecology, Aga Khan University Hospital, Karachi, Pakistan.

Abstract

Objective: To determine the significance of the Diagnosis to Delivery Interval (DDI) on perinatal outcome and maternal complications in patients with umbilical cord prolapse.

Methods: This was a case series of 44 patients identified with "Umbilical cord prolapse" during a 10-year period at the Aga Khan University Hospital. Data was retrieved for gestational age, foetal presentation, DDI, incision to delivery time, delivery method, apgar score, birth weight and outcome, and maternal complications. The influence of DDI on perinatal mortality, apgar scores at 5 minutes, neonatal intensive care unit (NICU) admission and maternal complications resulting from mode of delivery with cord prolapse was assessed.

Results: The hospital based incidence of cord prolapse was 1.4 per 1000 deliveries. The mean DDI was 18 minutes, with 64% of women delivering within this time. Of the 13(29 %) neonates transferred to NICU with < 7 apgar score at 5 minutes, 10/13(76%) delivered within the mean DDI. There were 4 perinatal deaths, of which 2 were term pregnancies with birth asphyxia, whereas 2 were ≤ 28 weeks. There was no statistically significant impact of DDI on 5-minute apgar scores, perinatal mortality, NICU admissions and maternal complications in patients with cord prolapse

Conclusions: DDI may not be the only critical determinant of neonatal outcome. Most neonates with poor apgar scores had DDI within the average time. Artificial rupture of membranes should be performed cautiously with pre-existing CTG trace abnormalities. In-utero resuscitative measures may help reduce further cord compression and improve outcome (JPMA 57:487:2007).

Introduction

Umbilical cord prolapse is a life-threatening emergency for the foetus as the blood flow through the umbilical vessels is compromised by cord compression. The incidence of umbilical cord prolapse has been reported as 1 in 160-714 deliveries.[1,2] Delay in management has been associated with a perinatal mortality of 36 to 162 per 1000 births, mainly due to prematurity, birth asphyxia and occasionally congenital anomalies.[3,4]

A number of unavoidable risk factors have been reported to be associated with cord prolapse. They include malpresentation, multiple gestations, prematurity, multiparity, premature rupture of membranes, polyhydramnios and a small foetus.[4,5] Some studies have reported a remarkably high correlation between cord prolapse and obstetric interventions such as foetal scalp electrode application, insertion of an intrauterine catheter, attempted external version, and manual rotation of the foetal head.[5,6] It has also been suggested that induction of labour is associated with increased risk.[6,7] Prompt diagnosis and immediate delivery of the foetus are essential to reduce perinatal mortality and morbidity.[8,9] Alleviation of pressure on the umbilical cord until delivery can be achieved through measures such as manual disengagement of the presenting part, raising the maternal pelvis and filling the maternal bladder.[10,11] If the cervix is not completely dilated, prompt delivery by caesarean section offers the best chance for a favourable foetal outcome.[12,13]

The time taken to safely achieve such a delivery is important in order to limit the duration of cord compression. The response time between diagnosis of cord prolapse and the actual delivery of the baby has been termed the "Diagnosis to Delivery Interval" (DDI).[14] The German Society of Gynaecology and Obstetrics recommend a decision to delivery time of less than 20 minutes, while the American College of Obstetrics and Gynaecology believe incision time of 20-30 minutes to appropriate for emergency caesarean section.[15-17] Rapidity of delivery is associated with risks of surgery, inexperience of the operator in out-of-hour's emergency situation and complications of anaesthesia.[18-20]

This study was aimed to assess the impact of DDI on perinatal outcome and maternal complications following umbilical cord prolapse.

Patient and Methods

This study was a case series conducted at the Aga Khan University Hospital, a tertiary care unit with an average of 3,000 deliveries per year.

The information was retrieved from charts coded as umbilical cord prolapse. There were 44 cases identified among 29,908 deliveries during a 10-year period from January 1996 to December 2005. Maternal and foetal charts were assessed for parity, age, gestational age, foetal presentation, status of membranes (spontaneous or artificial rupture of membranes), DDI, time from incision to delivery, mode of delivery, neonatal weight, apgar scores, type of anaesthesia, neonatal outcome, and maternal complications. With multiple pregnancies, only the twin with the prolapsed cord was included in the study. A diagnosis of cord prolapse was made if the umbilical cord was either visualized or palpated ahead of the presenting part with absent membranes. Preterm birth was defined as birth before 37 completed week's gestation. A paediatrician at the level of experience of year 3 or 4 resident, or a paediatric fellow attended all deliveries. Neonatal asphyxia was identified by the neonatologist on clinical /metabolic grounds.

Data was recorded on standardized data sheet and analyzed on statistical package for social science software (SPSS 14.0, SPSS Inc., Chicago, IL) The demographic data, clinical features and outcome of deliveries with cord prolapse was assessed by gestational age < 37years and ≤ 37 weeks gestation, and DDI of < 20minutes and ≤ 20 minutes. Univariate analysis was performed by using Pearson Chi-square or Fisher's exact test corresponding to proportion whenever appropriate. Odds ratio (OR) and 95% CI (Confidence Interval) were estimated to identify the strength of association with independent factors. P-value < 0.05 was considered significant.

Results

A total of 44 cases of umbilical cord prolapse were identified from 29,908 deliveries, during the 10-year period. The hospital-based incidence of cord prolapse was 1.4 per 1000 deliveries, which is approximately 1 in 714 deliveries.

Table 1 describes the maternal, foetal characteristics and intrapartum characteristics of the patient. The mean and SD of maternal age was 28.7 ± 4.7 years (range 21 - 41 years). The umbilical cord prolapse was more common in multiparous women, 21 (47.7%) having a body mass index (BMI) ≤ 30 kg/m^2. The mean and SD of gestational age was 36 ± 3.2 weeks (range 27-41 weeks), 29 (66%) pregnancies were ≤ 37 weeks gestation and 16 (36.4%) were < 37 weeks gestation. All the term babies were more than 2500 gm, and 11/16 babies born < 37 weeks, weighed <2500 gm. Malpresentations, 8(18%) were equally prevalent among preterm 3 (18.8%) and term 4 (14%) pregnancies. Cord prolapse occurred with artificial rupture of membranes (ARM) in 19/44 (43%). Significantly, in 36 (81.8%) women, the station was at - 3cm or higher. No manoeuvre was performed in 3 2(72.7%) patients. The foetus was

Table 1. Maternal, foetal demographic and labour characteristics.

	n=44	%
Age		
20-29 years	25	56.8
30-39years	17	38.6
≥ 40years	2	4.5
Parity		
Primiparous	10	22.7
Multiparous	34	77.3
Body mass index(kg/m^2)		
19-25	10	22.7
26-29	13	29.5
≥ 30	21	47.7
Foetal presentation		
Vertex	36	81.8
Non vertex	8	18.2
Foetal Number		
Singleton	39	88.6
Twins	5	11.4
Status of membranes		
Spontaneously ruptured	25	56.8
Artificially ruptured	19	43.2
Station of presenting part at diagnosis		
Above ischial spines	42	95.5
Below spines	2	4.5

Table 2. Comparison by gestational age.

	<37 weeks (n=16)	%	≥37 weeks (n=28)	%	Significance
Type of Labour					
Spontaneous	11	68.8	9	32.1	p = 0.019 *
Augmented/Induced	5	31.3	19	67.9	
Mode of delivery					
LSCS	14	87.5	25	89.3	p = 1.000
Vaginal	2	13.5	3	10.7	
Level of person performing delivery					
Resident	8	50	5	17.9	p = 0.040*
Consultant	8	50	23	82.1	
Diagnosis to delivery					
≤20 min	11	68.8	17	60.7	p = 0.594
> 20 min	5	31.3	11	39.3	
Apgar score at 5min					
<7	7	43.8	7	25	P = 0.199
≥7	9	56.3	21	75	
CTG abnormalities					
Pathological	9	56.3	21	75	P = 0.199
Normal	7	43.8	7	25	

* p value < 0.05 Statistically significant

Table 3. Diagnosis to delivery interval on perinatal and maternal outcome.

Variables of significance	≤20 Minutes n=28 (%)	>20 minutes n=16 (%)	Statistical significance (p-value)	Odds Ratio (95%C.l.)
Apgar score at 5 minutes				
≤7	11 (61)	3 (19)	0.159	0.36(0.08 - 1.55)
>7	17 (39)	13 (81)		
Perinatal mortality				
Yes	2 (7)	2 (12)	0.614	0.54(0.07 - 4.25)
No	26 (93)	14 (88)		
NICU Admissions				
Yes	10 (36)	3 (19)	0.314	2.4(0.55-10.52)
No	18 (64)	13 (81)		
Level of person conducting the delivery				
Resident	7 (25)	6 (38)	0.496	0.56(0.15-2.09)
Consultant	21 (75)	10 (62)		
Maternal Complications*				
Yes	8 (29)	4 (25)	1.000	1.2(0.29-4.85)
No	20 (71)	12 (75)		

C.l. : confidence interval
* Complication including: pyrexia, anaemia, septicemia, abdominal wound infection

delivered by caesarean section in 39/44 women while, in 5 women a vaginal delivery was achieved.

On analysing the patients with cord prolapse by gestational age of the foetus (Table 2), predictably in the group born preterm (<37 weeks), most of the women went in spontaneous labour (P = 0.019), and were delivered by the resident (P= 0.029) due to the urgent, unpredictable nature of presentation of preterm labour with cord prolapse, with good perinatal outcome. The DDI (P = 0.594) (mean time18 minutes) and apgar scores were similar for both the groups, and there was no statistically significant difference between the groups.

A diagnosis to delivery interval of ≤ 20 minutes occurred in 28(63.7%) patients and > 20 minutes in 16 patients (36.3%). On analyzing the DDI of ≤ 20minutes and > 20 (Table 3) with the variables of perinatal outcome as assessed by 5 minute apgar score, and maternal complications, of 14 (31.8%) neonates with an apgar score <7 at 5 minutes, 11(79%) delivered within 20 minutes of diagnosis and 3 (21%) neonates after 20 minutes. Of the 13 (29.6%) neonates admitted to the NICU for observation, 5 had severe asphyxia at birth (Apgar score 3 at 5 min). There were 4 neonatal mortalities; two neonates were < 28 weeks gestation, weighing between 800-900gm. Both of the term neonates had severe hypoxia and were delivered by caesarean section. In one case, despite the DDI interval of 8 minutes the neonate had severe asphyxia. A pathological trace prior to cord prolapse at ARM may account for the poor apgar at delivery. In the other case, the DDI interval was 28 minutes as there was an unsuccessful attempt at

instrumental vaginal delivery. There was no statistically significant influence of DDI on perinatal mortality, low 5-minute apgar scores, or NICU admission (Table 3).

Maternal complications included a drop of haematocrit >10% in 7 patients, septicaemia, wound sepsis in 2 patients, pyrexia in 3 patients, 32 (73%) patients did not have any complications. There was no statistically significant influence of DDI on maternal complications. (Table 3)

Discussion

Cord prolapse is one of the few obstetric events that can transform a normal labour and delivery into a tragic outcome, as delay in management is associated with a significant increase in neonatal morbidity and mortality.[1-3] While a high mortality rate is expected with cord prolapse occurring outside hospital, reports have suggested that even if the neonates were delivered immediately, the complication rates remained elevated.[4] Unlike earlier studies, the main obstetric characteristics and events associated with cord prolapse in this study were vertex presentation (81%), term pregnancy (64%), in women with an elevated BMI (47%) and multiparity (77%).[4-6] Similarly, interventions such as induction of labour, and ARM have been associated with cord prolapse.[6,7] The greater frequency of cord prolapse in mutiparous patients can be accounted for by the late engagement of the foetal presenting part and vertex presentation may be the result of bias of a selected population, in tertiary centers.[2,3] In modern obstetrics, very few malpresentations go undetected until term or are identified in early labour. Only 52% of patients were in spontaneous labour and ARM was performed at a high foetal station in 50% cases. Identification of funic presentation by antenatal ultrasound has not met with success, as it is poorly predictive of intrapartum cord presentation or prolapse.[21,22] An alternative approach could be of an early intra-partum ultrasound scan or colour doppler in high-risk women, prior to amniotomy at a high station.[23]

This study suggested that DDI alone is not the only factor contributing to neonatal asphyxia. Prior hypoxia, CTG abnormalities, intrauterine growth restriction, prematurity may also be contributive. Of neonates with poor 5 minute apgar scores, 11/28, had a diagnosis to delivery interval well within 20 minutes, whereas 30/44(68%) of the neonates had good apgar scores at birth. Similarly there was no statistical significance of DDI on perinatal mortality, or on NICU admissions.

In order to determine whether there was a difference in the incision to delivery time and DDI of operators at different levels of experience, the data was assessed for surgery by either residents or consultants. However, we did not find any significant difference between deliveries conducted by residents or consultants on the incision to delivery time or DDI. Emergency caesarean section under general anaesthetic was performed in 39 (87%) women however there was no anaesthesia related morbidity in this series. With a completely dilated cervix, the dilemma is of either a vaginal delivery or a caesarean section. Several studies have quoted a favourable foetal outcome with caesarean sections even in the late second stage of labour.[12,13] Any course of action needs to take into account prior evidence of hypoxia and the likelihood of achieving delivery without difficulty.

Manoeuvres such as manual cord reduction, elevation of the presenting part of the foetus, or pelvic elevation may be potentially useful in resuscitating the foetus in-utero and improving perinatal outcome. One series of 51 cases employed both a tocolytic (ritodrine) and bladder filling to relieve cord compression.[25] Manoeuvres were performed in 12 women (27.3%) with good outcome. While preparing for delivery, the impact of these manoeuvres, alone or in combination, on improving apgar scores and neonatal outcome needs further evaluation.

Despite an experienced person performing the procedure, 27% of the mothers in this study had some morbidity. The commonest maternal complication was postpartum haemorrhage. Abdominal wound infection occurred in two women despite prophylactic antibiotics. However there was no statistically significant difference of the DDI on maternal complications.

Conclusion

In conclusion, most cases of umbilical cord prolapse in a modern obstetric setting occur with foetuses in singleton, vertex presentations, in spontaneous labour at term. Risk factors such as multiparity, maternal obesity, induction of labour and aminotomy contribute to delayed engagement, difficulty in assessing foetal station, and high poorly fitting presenting part of the foetus. Knowledge of risk factors may help in anticipating complications in high-risk patients. The DDI is a major factor, but is not the only critical determinant of neonatal outcome, as most neonates with poor apgar scores had DDI within the average time. Artificial rupture of membranes should be performed cautiously with pre-existing CTG trace abnormalities, or deferred to a lower station. With a fully dilated cervix and anticipated difficult delivery, caesarean section remains the optimal mode of delivery. In-utero resuscitative measures such as tocolytics, raising the maternal pelvis and manual elevation of the presenting part may help to prevent further cord compression and improve outcome.

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