Audit of 'Crash' Emergency Caesarean Sections Due to Cord Prolapse in Terms of Response Time and Perinatal Outcome

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Abstract

***Objective**: The objective was to audit 'crash' emergency caesarean sections (CS) with respect to response time (the diagnosis to delivery interval [DDI]) and perinatal outcome. **Materials and Methods**: The computerised database at the Singapore General Hospital (SGH) delivery suite was used to identify all cases of 'crash' emergency CS activated for the diagnosis of cord prolapse from 1992 to 2002. Patients' case notes and neonatal charts were reviewed and the following variables were evaluated: parity, gestational age at the time of delivery and the DDI. Neonatal outcome was measured by Apgar scores at 1 and 5 minutes, cord pH and admission to the neonatal intensive care unit (NICU). **Results**: A total of 34 cases of umbilical cord prolapse were identified from 29,867 deliveries, giving an incidence of 0.11% (1 in 900). The median gestational age was 38.5 weeks (range, 25 to 41 weeks). The median time from diagnosis to delivery was 20 minutes (range, 10 to 40 minutes). Seventy-six percent (19/30) were delivered within 30 minutes. The time of diagnosis was not recorded for 5 cases. Sixty-three percent of neonates had an Apgar score ≤7 at 1 minute of life, increasing to 97% at 5 minutes. There were 3 NICU admissions for reasons of prematurity. There was no perinatal mortality. Cord pH was not performed for 47% of (14/30) neonates. Among the remaining 16 neonates, an umbilical cord pH of ≤7.20 was found in 62% (10/16). There was poor correlation between the DDI and umbilical cord pH. **Conclusion**: Three-quarters of our 'crash' emergency CS for cord prolapse were performed within 30 minutes with a good perinatal outcome. However, we have identified areas for improvement to optimise further the operational efficiency of 'crash' emergency CS.*

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Key words: Diagnosis-to-delivery interval, Neonatal outcome, Umbilical cord pH

Introduction

Umbilical cord prolapse is an uncommon intrapartum event with a reported incidence of 1 in 160 to 714 deliveries.[1] Predisposing factors include fetal malpresentation, prematurity, small fetal size, multiple gestation, polyhydramnios and membranes rupture prior to head engagement.[2]

The diagnosis of umbilical cord prolapse is suspected in the presence of repetitive and/or severe decelerations of fetal heart rate and confirmed when a pulsatile umbilical cord is felt during digital vaginal examination. During cord prolapse, cord compression by the presenting part interrupts the supply of oxygenated blood flow to the fetus, resulting in acute fetal distress. Rapid action is therefore critical in ensuring fetal survival. Unless vaginal delivery is imminent, delivery is effected by performing a 'crash' emergency caesarean section (CS).

We conducted a retrospective study to audit 'crash' emergency CS performed for umbilical cord prolapse at the Singapore General Hospital (SGH) with the aim of evaluating the response time [diagnosis to delivery interval (DDI)], perinatal outcome and areas for improvement.

Materials and Methods

We used the SGH perinatal centre computerised database to identify all cases of 'crash' emergency CS due to cord prolapse from 1992 to 2002. All patients' case notes and neonatal charts were reviewed. The indications for CS, demographic and study results were checked against the data from the operating theatre's computerised database, which records all surgical procedures performed.

The following outcomes were analysed:

1) DDI: DDI is the time at which decision was made for

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emergency CS and the time when the baby was delivered.[3]

2) Neonatal outcome in terms of Apgar scores at 1 and 5 minutes of life, and arterial umbilical cord pH.

Results

There was a total of 29,867 deliveries between January 1992 and December 2002, with 34 cases of cord prolapse, giving an overall incidence of 0.11% (1 in 900 deliveries). Data were only available for 30 patients. All were booked with the obstetric unit and had uncomplicated pregnancies up to the point of diagnosis. There were no multiple pregnancies. All neonates were appropriately grown for gestational age and there were no fetal anomalies observed. All crash CS were performed with a neonatologist in attendance.

Twenty-two (73%) of the patients were multiparous. Twenty-three (77%) patients were at term at the time of delivery and 20 (67%) fetuses were in cephalic presentation. (Table I).

The time of diagnosis of cord prolapse was recorded in only 25 (83%) of patients to allow for the calculation of the DDI. The range of the DDI was between 10 and 40 minutes, with a median value of 20 minutes.

Nineteen (63%) neonates had an Apgar score ≤7 at 1 minute and 29 (97%) neonates had an Apgar score ≤7 at 5 minutes. Three (10%) neonates required intubation and were admitted to the neonatal intensive care unit (NICU); these babies were premature with gestational ages between 27 and 31 completed weeks. The remaining neonates were admitted to the neonatal high dependency unit (NHDU) for routine observation in accordance to protocols for neonates born from 'crash' CS (Table II).

The umbilical cord pH was not recorded in 14 (47%) patients. In the remaining 16 patients in whom the cord pH was recorded, 6 (38%) had a cord pH <7.20. Nineteen (76%) deliveries were achieved with a DDI of <30 minutes (Table III). The correlation between the DDI and mean umbilical cord pH values is shown in Figure 1.

TABLE I: CHARACTERISTICS OF PATIENTS WITH CORD PROLAPSE (N = 30*)

Patient characteristics	No. (%)
Parity	
Nulliparous	8 (27)
Multiparous	22 (73)
Gestation	
<37 weeks	7 (23)
>37 weeks	23 (77)
Presentation	
Vertex	20 (67)
Non-vertex	10 (33)

Note: *Data unavailable for 4 patients

TABLE II: NEONATAL OUTCOME IN TERMS OF APGAR SCORE AND CORD PH

Neonatal outcome	No. (%)
Apgar at 1 min	
<7	11 (37)
>7	19 (63)
Apgar at 5 min	
<7	1 (3)
>7	29 (97)
Cord pH*	
<7.20	6 (38)
>7.20	10 (62)
Admission location	
Neonatal intensive care unit	3 (10)
Neonatal high dependency unit	26 (87)
Nursery	1 (3)

Note: *Cord pH not performed for 14 patients

TABLE III: MARKERS OF PERINATAL OUTCOME BY DDI INTERVAL

DDI (min)	No. (%)	Apgar 1' <7	Apgar 5' <7	Cord pH <7.20
0 to 10	1 (4)	0	0	0
11 to 20	10 (40)	2	0	2
21 to 30	8 (32)	0	0	4
31 to 40	6 (24)	0	0	0
Unrecorded	5 (-)	0	1	Not done
Total	30 (100)	2	1	6

DDI: diagnosis to delivery interval

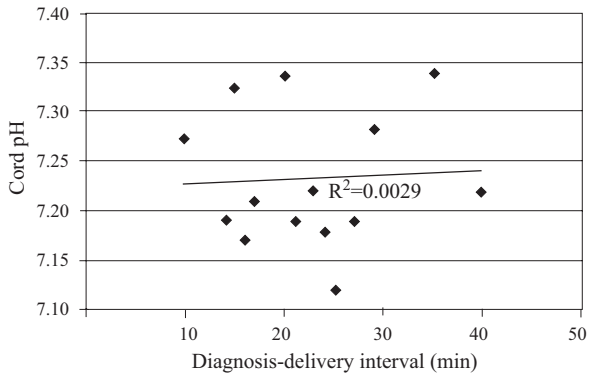

Fig. 1. Relationship between diagnosis to delivery interval and mean arterial cord pH values.

Discussion

The incidence of cord prolapse at our perinatal centre is 1 in 900 deliveries (Table I), comparable to data published from other institutions.[4]

Our findings are consistent with current literature in that

the majority of cord prolapses occur in multiparous patients with term, vertex pregnancies, as the low incidence of prematurity and malpresentation results in these predisposing factors contributing little to the overall picture, as the quoted incidence of premature deliveries is between 5.8% and 10.6%,[5] and that of non-vertex presentation at term is 3% to 4%.[6]

Previous studies have recommended that emergency CS, regardless of indications, should be performed within 30 minutes from the time decision was made.[7,8] Although used as a standard in many audits, this figure is arbitrary and is not evidence or indeed scientifically based.[9] Not withstanding these limitations, it is nonetheless the yardstick employed by most respected authorities, including the Royal College of Obstetricians and Gynaecologists (RCOG)[10] and medicolegal bodies.[11,12] In this study, our unit achieved this target in 19 (76%) cases, with 10 (40%) of the 25 patients delivered between 11 and 20 minutes.

We were interested in studying the 6 cases in which the DDI exceeded 30 minutes. Two of these involved a delay during the transfer of patients from the labour ward to the major operating theatre. Documentary deficiencies did not permit a more meaningful analysis of the remaining 4 cases delivered beyond 30 minutes. Although the DDI is used as a measure of obstetric management efficiency and efficacy, our results show that there is poor correlation between the DDI and the neonatal acid-base status at birth.[13] The 2 neonates, with a 1-minute Apgar score of <3, were delivered quickly within 20 minutes of diagnosis. This lack of correlation is not surprising as the point in time when the cord prolapse occurred may well precede the time of clinical diagnosis, so that the period of fetal hypoxia may be longer than the recorded DDI.

Much has also been written about the limitations of using Apgar for the prediction of neurologic outcomes of the newborns as there are several other factors that can account for low Apgar scores such as gestational age, maternal medication, type of analgesia and the person who assigned the score.[14] Both the American College of Obstetricians and Gynecologists[15] and the American Academy of Pediatrics[16] have also challenged the use of the Apgar score alone to define birth asphyxia. In an attempt to more objectively define immediate newborn condition, several investigators have recommended the use of umbilical blood acid-base determinations.[17-20] As part of risk management, the RCOG recommends that umbilical artery acid-base status be performed as a minimum after an emergency CS,[21] especially when fetal distress is suspected by the presence of decelerations on electronic fetal monitoring.

A pH of less than 7.20 from fetal blood sampling (FBS) is categorised as posing an "immediate threat to life of the mother or fetus" in the National Sentinel Caesarean Section Audit Report and we have used the same in our audit.[10] In our study, 6 neonates were identified with a cord pH less than 7.20; all were delivered within the target DDI (2 were delivered between 11 and 20 minutes while the other 4 were delivered between 21 and 30 minutes). Of the 6 delivered after 30 minutes, none had acidosis (cord pH 7.22 to 7.34). There are several reasons for this lack of correlation between the DDI and cord pH. Firstly, the sole reliance on newborn acid-base status has its shortcomings as a reliable marker of birth asphyxia, in part due to the unrealistically high pH values used to define pathologic acidosis. Indeed, the majority of newborns born with an umbilical cord pH <7.20 will be vigorous at birth and not have obvious neonatal sequelae.[20,22] Secondly, it has been postulated that the inevitable anxiety generated in the mother when a 'crash' CS has been initiated triggers an outpouring of maternal catecholamines, causing constriction of the placental vascular bed leading to a reduced oxygen exchange across the placenta with temporary acidosis for the fetus.[11] Thirdly, acidosis in itself may be a reflection of physiological adaptation to the stress of delivery and asphyxia.[23]

Not surprisingly too, the precise relationship between umbilical blood data and Apgar score remains ill defined.[17] Sykes et al,[18] using a lower cut-off pH of 7.11 to define pathologic acidosis, reported that 81% of infants with low 5-minute Apgar scores (<7) were not acidotic at birth; conversely, 73% of those who were acidotic had normal Apgar scores. In a separate study, Sykes et al[24] also demonstrated that even with striking biochemical abnormalities, there is a much lower incidence of Apgar scores below 7 than might be anticipated.

We observed the failure to record the decision time in 5 (17%) cases and the cord pH in almost half (47%) of the cases. In this increasingly consumerist and litigious society, such inadequate documentation of evidence of fetal well being when there was a suspicion of fetal distress in the immediate post-delivery period is an area of concern, and certainly an area for improvement.

Based on our findings, we have made the following recommendations. Firstly, we aim to reinforce dated and signed documentation with the introduction of CS time sheets[3] (Fig. 2) to ensure the routine recording of events and performance of cord pH. Secondly, the DDI can be improved by implementing protocols for management of cord prolapse and frequent trial runs, given that cases requiring 'crash' CS are infrequent and that first-line medical staff are usually junior doctors. Thirdly, we aim to conduct a prospective trial to assess the improvement in documentation and DDI with the introduction of the emergency CS time sheets to complete the audit loop.[10]

Conclusion

Cord prolapse is an obstetric emergency warranting

Patient Name:		Patient ID.:	
Date:		Entry by:	
			Reasons for delay
Decision	At:		
	By:		
Anaesthetist	Called at:		
	Arrived at:		
Paediatrician	Called at:		
	Arrived at:		
Patient	Arrived at:		
Baby	Delivered at:		

Fig. 2. The emergency Caesarean section time sheet.

immediate delivery. Our audit of emergency 'crash' CS for cord prolapse demonstrates that a good perinatal outcome can be achieved and we have identified further areas of improvement of the perinatal outcome. Labour protocols must be in place and frequently rehearsed to ensure that staff are confident in dealing with situations requiring 'crash' CS. Good perinatal outcomes in terms of Apgar scores and cord pH can be expected.[25]

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