

FOETAL SALVAGE IN CORD PROLAPSE*

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Introduction

Presentation and prolapse of the umbilical cord are frequent obstetrical emergencies associated invariably with a high foetal mortality. Rhodes (1956) has estimated that in England and Wales, prolapse of the cord is responsible for about 1,500 perinatal deaths annually, and 1 in every 16 still births. A high proportion of the foetuses are viable and devoid of lethal congenital abnormalities, and should theoretically at least be saved.

Regime of Investigation

This publication is a preliminary report, and it is based upon study of all cases of cord prolapse (including cord presentation) delivered in the Aberdeen Maternity Hospital during the two-year period of 1959 to 1960. During this period there were 7593 deliveries (Table I) and of these 85 per cent (Table IV) were hospital booked cases, i.e., patients who have had their ante natal care by members of the hospital staff. The remaining 15 per cent

(Table IV) were emergency admissions into hospital from the North-Eastern Regional area of Scotland. As there is relatively little migration of this population (allowing for the natural increase of population) and the incidence of prolapse of the cord in each of the two years is very similar, the findings presented in this study could be regarded as representative for this hospital.

Results

The incidence of cord prolapse in the hospital 2-year series is 1 in 115 cases (Table I) and cord prolapse is responsible for 5.6 per cent of all the hospital perinatal deaths. However, after omitting 2 stillbirths and 2 first-week neonatal deaths (Table XI) where cord prolapse was only incidental, this percentage falls to 4.3 per cent.

Table II shows that cord prolapse is associated with many obstetrical complications. Foetal malpresentations, especially complete breech presentation, was found to be a con-

TABLE I
Incidence and Results

	Total Cases	No. of Prolapsed Cords	Incidence	Perinatal Death Rate
Deliveries	7593	66	0.87%	Gross Perinatal Death Rate. = 5.6 per cent.
Gross S.B.	207	11	5.3%	
Gross 1st week NND.	117	7	6.0%	
Corrected S.B. due to Cord Prolapse	9		4.4%	Corrected Perinatal Death Rate = 4.3 per cent.
Corrected 1st week NND. due to Cord Prolapse	5		4.3%	

S.B. = Still births

NND. = Neonatal Deaths.

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publication is a preliminary report of an M. D. Thesis Project, now being undertaken at the University of Singapore.

TABLE II
Predisposing Causes of Cord Prolapse

Predisposing Causes	No. of Cases	Percentage
Malpresentations	29	43.9
Prematurity	19	28.8
Twins	15	22.7
Artificial Rupture of Membranes	15	22.7
Hydramnios	5	7.6
Disproportion	4	6.1
Minor Degree of Placenta Prævia	3	4.5
Fœtal Abnormality	1	1.5
Unusually Long Cord (No record)	—	—
Other Causes (Minor)	12	16.2

TABLE III
Fœtal Salvage Rate

Total No. of Cord Prolapse Cases	66
Total No. of Perinatal Deaths	18
Uncorrected Perinatal Mortality	27.3%
Perinatal Deaths not due to Cord Prolapse (Table XI)	4
Corrected Perinatal Mortality	21.2%

TABLE IV
Fœtal Mortality Studies in Hospital Booked and
Emergency Admissions

Percentage of Hospital Booked Deliveries at Aberdeen Maternity Hospital during the 2-year period	85%
Percentage of Emergency Admission Deliveries at the Aberdeen Maternity Hospital during the 2-year period	15%
Percentage of Cord Prolapses occurring in the Hospital Booked Deliveries	85%
Percentage of Cord Prolapses occurring in the Emergency Deliveries	15%
Percentage of Salvageable Fœtal Deaths from Cord Prolapse in the Hospital Booked Cases	50%
Percentage of Salvageable Fœtal Deaths from Cord Prolapse in the Emergency Deliveries	27.8%
Ratio of Fœtal Mortality in the Hospital Booked Deliveries with Cord Prolapse is	$\frac{50 \text{ per cent}}{85 \text{ per cent}} = 0.6\%$
Ratio of Fœtal Mortality in the Emergency Deliveries with Cord prolapse is	$\frac{27.8 \text{ per cent}}{15 \text{ per cent}} = 1.9\%$

tributary factor in more than 40 per cent of the cases. Prematurity, twins and artificial rupture of the membranes were each found to be responsible in about 25 per cent of cases. Hydramnios has not been a major factor (7.6 per cent), probably because of the low incidence (1 in 300 deliveries) of this condition. No record of foetal cord length has been kept, and hence its importance cannot be evaluated. "Other Minor Causes" are varied, and their significance difficult to evaluate.

The uncorrected perinatal mortality is 27.3 per cent and when those deaths not due to prolapse of the cord are omitted, the rate falls to 21.2 per cent.

Clinical data as presented in Table IV has not been made available from other series reviewed. Yet it presents a very illuminating feature. Despite the fact that the ratio of hospital booked deliveries/emergency admission deliveries, and the ratio of cord prolapses occurring in these two groups of deliveries are constant (85 per cent: 15 per cent) it is found that the foetal mortality is thrice as high (1.9: 0.6) in the emergency admissions with cord prolapse. Further reference to this point will be made in the discussion.

TABLE V
Foetal Mortality and Maternal Age

Maternal Age	Under 25 years	25 to 29 years	30 years and over
No. of Prolapsed Cords	18	21	27
No. of Perinatal Deaths	2	7	9
Mortality Rate	11%	33%	33%

Table V shows a rise of the perinatal mortality in cord prolapse with maternal age.

TABLE VI
Foetal Mortality and Parity

Parity	1st	2nd	3rd & over
No. of Prolapsed Cords	17	19	30
No. of Perinatal Deaths	2	5	11
Mortality Rate	12%	26%	37%

Although the bulk of the deliveries and the cord prolapse cases (over 60 per cent) occurred in patients under third parity, it is evident from Table VI that the perinatal mortality is lowest in Parity 1 and 2, and rises steeply thereafter.

TABLE VII
Foetal Mortality and Presentation

Foetal Presentation	Cephalic	Breech	Shoulder
No. of Prolapsed Cords	43	16	7
No. of Perinatal Deaths	6	7	4
Mortality Rate	14%	44%	57%

Table VII shows that the foetal mortality with vertex presentation is the lowest (14 per cent). In the breech cases prematurity is a very important contributory factor to the high mortality, and delayed hospital admission is an important factor in the shoulder presentations.

TABLE VIII
Foetal Mortality and Weight

Foetal Weight	Under 5½ lb.	5½-6½ lb.	Over 6½ lb.
No. of Prolapsed Cords	19	15	32
No. of Perinatal Deaths	10	3	5
Mortality Rate	53%	20%	16%

Besides being an important predisposing factor to cord prolapse (Table II) it is apparent from Table VIII and XI that the co-existence of prematurity with cord prolapse carried a fetal mortality of over 50 per cent.

TABLE IX

Fœtal Mortality and Time-Lag between Detection of Cord Prolapse and Delivery

Detection—Delivery Time Lag	Under 1 hour	Between 1–2 hours	Over 2 hours
No. of Prolapsed Cords	49	7	10
No. of Perinatal Deaths	8	2	8
Mortality Rate	16%	29%	80%

On studying the case records, the exact time of prolapse of the cord was difficult to

ascertain in most instances, and estimation of the Detection-Delivery time interval is the most likely to serve as a measure of the Prolapse-Delivery time interval. Table IX shows that the fetal mortality is lowest (16 per cent) if delivery is effected within 1 hour of detection, and fetal prognosis is very poor after the 2-hour time lag.

Table X shows that delivery by Cæsarean Section gives the lowest perinatal mortality (7 per cent). But if the dictum of "Immediate Delivery on Diagnosis" is to be implemented then certainly delivery by forceps, breech extraction, or internal version and breech extraction can be effected more rapidly than Cæsarean Section when the diagnosis is made in the second stage of labour. Two of the breech extraction deaths were abnormal fetuses and further two were dead in utero on admission, hence the corrected fetal mortality in the breech extraction series is 21 per cent, and similarly the corrected mortality for the internal version series is 33 per cent.

TABLE X

Fœtal Mortality and Treatment

Method of Treatment	Caesarean Section	Forceps Delivery	Breech Ex- traction	Internal Version & Breech Ex- traction	Spontaneous Deli- very	Cranio- tomy	Decapita- tion
No. of Prolapsed Cords	28	13	14	4	5	1	1
No. of Perinatal Deaths	2	2	7	2	3	1	1
Mortality Rate	7%	15%	50%	50%	60%	100%	100%

TABLE XI

Causes of the 18 Fœtal Deaths based upon Autopsy Findings

Fœtal Deaths due primarily to Intra Uterine Asphyxia following Prolapse of the Cord	8
Fœtal Deaths due partly to Asphyxia following Prolapse of the Cord and partly to Prematurity	6
Total	14
Fœtal Deaths where Prolapse of the Cord was incidental	4

Causes of Death were as follows:—

- Case 1: Anencephalic Fœtus (Stillbirth).
- Case 2: Macerated Premature Stillbirth.
- Case 3: Oesophageal Atresia. Died 2nd day post-operatively.
- Case 4: Oesophageal Atresia. Died 2nd day post-operatively.

Autopsy on all perinatal deaths in Aberdeen Maternity Hospital is a routine procedure, and Table XI summarises the autopsy findings of the 18 perinatal deaths in this study. "Prolapse of the Cord" is contributory or responsible for only 14 of the 18 deaths, giving a corrected perinatal mortality of 21.2 per cent.

Discussion

The incidence of prolapse of the cord in hospital deliveries has been stated to vary very widely from 1 in 74 deliveries to 1 in 1018 deliveries (Slate and Randall, 1956), but most hospital series display an incidence of about 1 in 200 deliveries (Myles, 1959). The high incidence of 1 in 115 deliveries for Aberdeen Maternity Hospital is probably due to the heavy concentration of abnormal, and relatively large number of emergency obstetrical cases from a large surrounding area, in the hospital.

Table XII summarises the Fœtal Mortality Rate for Cord Prolapse cases, as reported in various publications on this subject. They all refer to "Hospital Deliveries" rather than to the total population. Further, in only four of the thirteen series quoted, has correction been made for foetal deaths where cord prolapse is incidental and not the cause of the

death. In the present series and in those of Rhodes (1956) and Cox (1951) the number of cord prolapse cases reviewed is less than 100, but the others are much larger. The uncorrected foetal mortality varies widely from 11.4 per cent to 52 per cent. The Aberdeen Maternity Hospital rate of 27.3 per cent and corrected rate of 21.2 per cent is the second lowest. The very low foetal mortality rate of 11.4 per cent attained by Cox (1951) at the Liverpool Maternity Hospital seems to have been due to a planned attack at "Fœtal Salvage in Cord Prolapse," conducted by an organised obstetrical team led by Cox personally. As a result of this experience he advocated a policy of "Immediate Delivery on Diagnosis, including the wider use of Cæsarean Section in those cases where immediate vaginal delivery was not possible. The Cæsarean Section rate was 37.1 per cent (Table XIII) in his small series.

Since then several others, namely Rhodes (1956), Myles (1959) and Seligman (1960) have fully concurred with Cox's view, that to attain maximal foetal salvage the principle of "Immediate Delivery on Diagnosis" has to be implemented, provided that at the time of diagnosis the foetus appears to be free from congenital abnormalities, and is of viable maturity. Thus obstetrical procedures, such as manual replacement of the cord, Duhrssen's incision

TABLE XII
Review of Fœtal Mortality Rates

Source	Uncorrected Fœtal Mortality Rate	Corrected Fœtal Mortality Rate
Rodes (1956)	52 %	—
Bourgeois (1941)	49.7%	40.6%
Cope (1951)	47.5%	—
Mengert and Longwell (1940)	46.6%	—
Kurzrock (1932)	43.9%	—
Slate and Randall (1956)	42.8%	—
Morgan (1948)	40.0%	—
Fenton and D'Esopo (1951)	37.5%	—
Myles (1959)	36.4%	—
Brandeberry and Kistner (1951)	35.3%	29.3%
Seligman (1960)	28.0%	—
Personal Study (Table III)	27.3%	21.2%
Cox (1951)	11.4%	11.4%

TABLE XIII
 Review of Relationship of Cæsarean Section to Fœtal
 Mortality

Source	Uncorrected Fœtal Mortality Rate	Cæsarean Section Rate
Rhodes (1956)	52 %	6 %
Cope (1951)	47.5%	12 %
Fenton & D'Esopo (1951)	37.5%	3.5%
Myles (1959)	36.4%	19.4%
Seligman (1960)	28 %	28 %
Personal Study (Tables III & X)	27.3	42.4%
Cox (1951)	11.4%	37.1%

of the cervix, Braxton Hick's version and hydrostatic bags, have been largely abandoned in most hospitals. All such procedures are associated with very high fœtal mortality due to asphyxia, resulting either from the delay of delivery, from cord spasm, or excessive manipulation (Fenton *et al.*, 1951; Tables VI and VII). Table IX clearly shows that the fœtal mortality is lowest if delivery is effected within one hour of diagnosing cord prolapse (16 per cent) whereas the mortality is extremely high after a 2-hour lapse (80 per cent). Similar conclusions were reached by Fenton *et al.*, (1951) who showed a fœtal mortality rate of over 70 per cent after a 3-hour lapse.

In implementing the policy of "Immediate Delivery on Diagnosis," vaginal delivery, either by forceps or breech extraction, or internal version and breech extraction immediately the diagnosis is made, is now the usual practice both in this hospital and in most other centres, provided the usual prerequisites for a safe vaginal delivery are fulfilled. Under these circumstances, I am of the opinion that "Pudendal Block Anæsthesia (Regional)," is superior to a general anæsthetic for the following reasons:—

- (1) It greatly lessens the attendant risk of a general anæsthetic to the mother, especially since the operation has to be done on the unprepared patient.
- (2) It can be done quickly by the obstetrician himself. This is of immense importance, in cord prolapse, because it

shortens the Detection-Delivery time lag by at least 30 minutes.

Seligman (1960) has stated that "although immediate delivery is indicated in these cases, even more skill and care than usual must be taken, since the fœtus is already in a precarious state and degrees of trauma, which do not affect the healthy fœtus, may be sufficient to jeopardise its existence." In his study he found that traumatic vaginal delivery was responsible for more than 20 per cent (6 out of 28 deaths) of the perinatal deaths. In the present limited series, none of the perinatal deaths were due to traumatic delivery (Table XI).

Where the fœtus is alive, normal and viable at the time of diagnosis, but where an immediate vaginal delivery is not advisable, then immediate Cæsarean Section gives the best results from the point of view of the child at least. Myles (1959) had a fœtal mortality of 6.2 per cent, and Seligman (1960) a mortality of 7.1 per cent with Cæsarean Section, and Cox (1951) had no perinatal deaths in 13 cases treated by Cæsarean Section. In this study, 2 out of 28 babies born by Cæsarean Section died (Table X).

Table XIII shows that there is some correlation between the incidence of Cæsarean Section and perinatal mortality since the very high death rates are associated with a low Cæsarean Section rate and vice versa. The exceptional perinatal death rate of 11.4 per cent reported by Cox was achieved with a Cæsarean Section rate of 37.1 per cent.

Conclusion

It is apparent from this review that prolapse of the cord is still a very dangerous complication for the baby and contributes substantially to perinatal mortality. High standards of obstetrical technique can prevent many of the deaths. The first essential is early detection of the condition and the immediate delivery of the baby either by the vagina or by Caesarean Section.

The best results will be attained only in those highly efficient hospitals where there is good team work. A skilled obstetrician and anaesthetist must be available at very short notice, and the paediatrician has an important role to play in the resuscitation of the severely asphyxiated neonate and in the subsequent care of the baby especially when it is premature (Table VIII). It is clear, therefore, that in this respect at least home confinement is much more dangerous than hospital.

There seems to be general agreement that if the cord prolapses before full dilatation of the cervix, the best chance for the fetus is provided by immediate Caesarean Section. The main drawback to the wider use of Caesarean Section for prolapse of the cord is the danger to the mother. Under modern conditions this risk is slight, but even so it must always be weighed against the possibility that the baby may not survive, no matter what method of delivery is employed.

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