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PROLAPSE OF THE CORD*

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PROLAPSE of the cord is associated with a very high fetal loss, much of which is avoidable. Salvage depends on early diagnosis, and this in turn depends on intelligent anticipation of its likelihood in particular circumstances.

It is the purpose of this study to analyze our experience at the Vancouver General Hospital with prolapse of the cord, and to focus particular attention on the circumstances that are associated with its development.

DEFINITION

A prolapsed cord is one that lies beyond the presenting part. Three degrees may be distinguished.

1. *An occult form:* in which the cord is at or near the girdle of resistance, but not within reach of the examining finger.

2. *Forelying:* where it is palpable through the cervical os but in the bag of waters.

3. *External:* where the cord protrudes through the cervix, and lies in the vagina, or outside the vulva, with the membranes ruptured.

MATERIAL

Fifty-five cases of prolapse of the cord occurred at the Vancouver General Hospital over a 10-year period in 48,885 deliveries. This incidence of 1:900 is lower than most reported series,[1-6] probably because high standards of documentation were not adopted in the Vancouver General Hospital until 1957, and because cases in which the fetus weighed under 1500 g. were not included.

FETAL MORTALITY

There were 16 perinatal deaths out of 55 cases, which represents a 29% mortality rate. In three instances the fetal heart could not be heard on admission, so that the corrected fetal loss was 26%. The mortality rates reported by other authors[1-3, 7, 8] average approximately 40%. We think that our somewhat better results are due to the more frequent recourse to Cesarean section in the years when this study was carried out.

PREDISPOSING FACTORS AND THEIR SIGNIFICANCE

In general, any factor interfering with the close application of the presenting part to the lower uterine segment may predispose to prolapse of the cord. The factors responsible for such poor application may involve primarily the fetus, the mother, or the cord. Finally, the physician may, by certain manipulations, disturb this application and be responsible for prolapse.

(A) FETAL FACTORS

(i) *Presentation of the Fetus*

Table I illustrates the incidence of cord prolapse in the various presentations.

The absolute incidence is highest in vertex presentations, since this presentation occurs in over 90% of cases.

The highest relative incidence is in shoulder presentation, then in breech presentation, and lastly in vertex presentation.

TABLE I.—FETAL PRESENTATION AND INCIDENCE OF CORD PROLAPSE

Presentation	*Number of cases*	*Incidence*
Vertex	31	56%
Breech	21	38%
Transverse	3	5%

The footling breech is particularly dangerous. Even though the footling variety of breech is involved in only about 10% of breech presentations,[9] it was this variety of breech that was associated with prolapse in 95% of the breech cases in this series (20 of 21). It is calculated from this experience that when a footling breech presents there is a 10% chance of prolapse of the cord. Similarly, it has been observed by others[15] that the 53% mortality in breech situations (complete and incomplete varieties) is due to anoxia following prolapse of the cord. These considerations highlight the importance of very close supervision of labour,

TABLE II.—FETAL MORTALITY AND PRESENTATION

Presentation	*No. of cases*	*Still-born*	*Fetal mortality*
Vertex	31	7	28%
Breech	21	5	23%
Transverse	3	3	100%

with repeated sterile pelvic examinations, when the breech presents, and particularly if it is of the footling variety. It has been stated that the fetal loss due to cord prolapse is less in breech than in vertex presentations at an equivalent stage of dilatation. This is because in breech presentations the cord lies adjacent to soft parts and is subject to less compression, and as prolapse tends to occur near full dilatation, delivery is usually possible without great difficulty. Table II illustrates that there was only a slight difference in mortality between vertex and breech presentations in this series. All three of the transverse presentations were premature, and in two of these death occurred prior to delivery.

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(ii) *Maturity*

TABLE III.—MATURITY AND FETAL MORTALITY

Maturity	*No. of cases*	*% incidence*	*Fetal deaths*	*% fetal mortality*
Premature	12	21%	8	66%
Term	43	78%	8	18%

The mortality rate was four times higher when the baby was premature. Only three of these infants weighed less than 3 lb. and all were theoretically salvable because the fetal heart was clearly audible on admission.

Premature infants withstand trauma badly, and have little resistance to anoxia. In the case of a small infant an additional factor that contributes to fetal mortality is the natural reluctance on the part of the attendant to resort to Cesarean section for fear of exposing the mother to an unnecessary hazard when the prognosis for the fetus is already severely jeopardized.

It should, however, be remembered that prematurity is in itself an important predisposing cause of cord prolapse, even when the presentation is normal, because the small size of the presenting part in relation to the pelvis creates a space which facilitates descent of the cord. Indeed it is when the fetus is premature and small that the attendant should be particularly alerted to the possibility of cord prolapse. This, of course, applies to the delivery of twins, in which prolapse occurred in two instances in this series. Both instances involved the second twin, and since delivery was not a problem both survived without difficulty.

(iii) *Height of the Presenting Part*

In 36 cases in which the admitting room staff observed the presenting part to be high, prolapse occurred three times more frequently. Furthermore, when the presenting part is high the fetal mortality rate is also greater because of the obviously increased mechanical difficulties in delivery. Therefore it is our policy to perform a pelvic examination with sterile precautions whenever the admitting nurse or intern reports that the presenting part is high, or that it cannot be felt or distinguished with certainty.

TABLE IV.—HEIGHT OF PRESENTING PART AND FETAL MORTALITY

Station	*No. of cases*	*% incidence*	*Fetal mortality*
Engagement	14	25%	7%
Non-engagement	36	65%	35%

(B) MATERNAL AND OBSTETRICAL FACTORS

(i) *Stage of Cervical Dilatation*

The chances of prolapse increase as dilatation increases, but, conversely, perinatal mortality decreases. The highest fetal loss occurs in early labour, and in the experience of some[10] it is still higher even before labour begins (83%). In this series prolapse occurred in eight cases before onset of labour, with the loss of only one baby. Once again this is probably because in six instances the infant was immediately delivered by Cesarean section. In six instances the prolapse became obvious when the membrane ruptured prior to labour, which emphasizes the importance of pelvic examination at the time of premature rupture unless the vertex is deeply engaged.

TABLE V.—EFFECT OF DILATATION OF CERVIX ON INCIDENCE OF PROLAPSE

Dilatation of cervix	*No. of cases*	*Incidence*
8 - 10 cm.	31	56%
6 - 8	7	12%
3 - 6	5	9%
0 - 3	4	7%
Not in labour	8	14%

The inverse ratio between the degree of dilatation and fetal loss is shown graphically in Fig. 1. It emphasizes again that prolapse is most serious in the presence of degrees of dilatation at which the baby is not immediately deliverable, and that in such situations immediate Cesarean section offers the best prognosis.

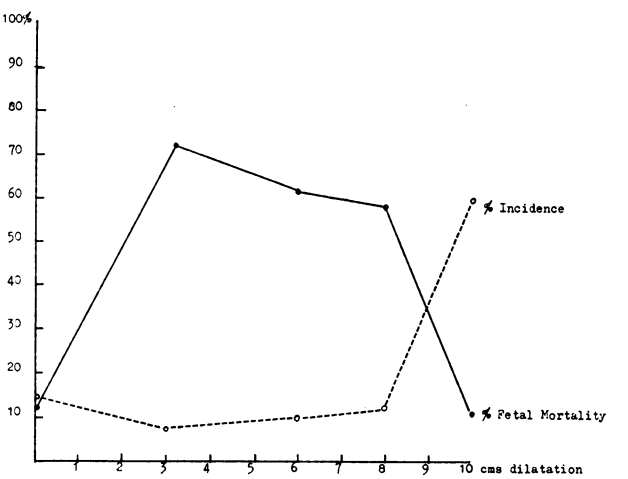

Fig. 1.—Stage of cervical dilatation in relation to fetal mortality.

(ii) *Parity and Age*

There was a disproportionate number of multiparas with this complication—44, as compared with only 11 primigravidas. In common with recent observations of others[1, 3, 10] a higher fetal mortality was noted among multiparous patients. There was also a sharp rise in the perinatal mortality rate in multiparas with advancing years, which did not apply to primiparas.

(C) CORD FACTORS

(i) *Length of Cord*

Data on cord lengths were not available in this study, but it is generally considered that the length of the cord and its normal position are factors of etiological significance in cord prolapse. Mengert and Longwell[2] reported that prolapse was encountered six times more frequently when the cord exceeded 75 cm. in length. Ahlgren[11] found the mean length of the cord to be 67.8 cm. in 149 cases of prolapse, while in a control study the mean length was found to be 64.1 cm., a difference that was not significant. However, it was found that in the study group 23% had cords of 80 cm. or longer while in the control group the cord attained this length in only 12%.

(ii) *Blood Pressure of the Cord*

Recent experimental investigations by Heinisch[12] suggest that the blood pressure of the cord vessels bears an important relationship to the position of the cord. He has shown that at pressures equivalent to normal fetal blood pressure the cord tends to coil and to be held up, but at low blood pressures there is a tendency for the cord to become slack and to sink downward. This would imply that, even disregarding the complications that may accompany it, prolapse of the cord may in itself be an indication of fetal distress.

(D) IATROGENIC FACTORS

(i) *Interval Between Diagnosis and Management*

The time interval that elapses between diagnosis and treatment is a crucial factor.

Fenton and D'Esopo in 1952 reported that the mortality for those infants delivered within 30 minutes of diagnosis was 10%, while the mortality rate at one hour was 45%.

TABLE VI.

Time interval	*No. of cases*	*A*	*SB*	*% incidence*	*% fetal mortality*
0-60 min.....	45	37	8	71%	15%
60 min.+.....	7	2	5	13%	70%

A=Born alive. SB=Stillborn.

In this series, the mortality rate among infants delivered within one hour of diagnosis was 15%, while in the smaller group in which the interval exceeded one hour, only two of the seven infants survived.

(ii) *Surgical Induction*

Six of the 55 prolapsed cords (11%) in this series resulted directly from artificial rupture of the membranes by the doctor. In five of these six cases the presenting part was not well engaged, and in some cases it was high, at the time the membranes were ruptured. This is a clear reminder that the rules regarding artificial rupture of the membranes should be observed at all times.

Similarly, instances of prolapse followed manual rotation where the presenting part was disengaged to perform the rotation.

DIAGNOSIS

To improve fetal mortality due to cord prolapse it is important that the diagnosis be made early; and to make an early diagnosis one must be thinking of it, particularly in situations where predisposing conditions exist. Unless the cord is hanging out of the vulva, a certain diagnosis can be made only by pelvic examination, which should always be done in the following situations:

1. When there are signs of fetal distress.
2. When the membranes rupture if the presenting part is high.
3. Whenever membranes rupture before the onset of labour.
4. In *all* cases of malpresentation when labour starts and when the membranes rupture (whether the presenting part is engaged or not).
5. In twins and in cases of prematurity when labour starts and when the membranes rupture.

It is not enough to rely on signs of fetal distress such as slowing of the fetal heart or the appearance of meconium to make the diagnosis, because the cord at first may not be subjected to immediate compression, and until such compression occurs signs of fetal distress do not become evident. Furthermore, if the diagnosis is not made until the fetus is suffering distress, the distress of anoxia, the latter of itself would considerably reduce the chances of survival. Conversely, when signs of fetal distress do appear, the attendant should keep the possibility of cord involvement in mind in searching for the cause of such distress.

When the cord lies beside the head or is stretched tight around the neck, a pelvic examination does not reveal the cause. Recently, simple clinical tests have been described which help to reveal such complications of cord involvement. Biskind[4] has pointed out the importance of excessive fetal movement with marked slowing of the fetal heart during a uterine contraction, or when the presenting part is pushed into the pelvis, particularly at the time of rupture of the membranes.

Fielding and Rosenfield[13] also observed in a case of occult prolapse that the fetal heart sounds disappeared when the vertex was displaced to one side, and speculated that such a test might be of some diagnostic value.

Hon[14] has described in detail a method of employing similar principles with the use of a fetal electrocardiogram.

We believe that it is quite practical to employ the following manipulation to reveal the same information by means of auscultation of the fetal heart rather than by fetal electrocardiography.

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The test recommended by Hon is as follows:

1. After allowing at least 60 seconds for the fetal heart to stabilize following a uterine contraction, the left hand is placed over the uterine fundus and firm pressure is applied for 10 seconds along the axis of the uterus.

2. The presenting part of the fetus is then grasped with the right hand, and pushed toward the pelvic inlet for at least 20 seconds (up to 50 seconds depending on response). Following release, the fetal heart is observed for 40 seconds.

3. The maneuver is then repeated with pressure on the presenting part applied in different directions to explore the entire pelvic brim for possible malposition of the umbilical cord.

4. A rest period of at least 60 seconds should be allowed between manipulations.

There remain two further factors in relation to diagnosis, the first of which is the presence or absence of pulsation of the cord. It should be remembered that in the absence of cord pulsation the fetus may still be alive, and careful auscultation for heart sounds or fetal electrocardiography should be carried out before abandoning hope for fetal survival.

Secondly, the association of congenital abnormalities such as hydrocephalus with cord prolapse should be borne in mind, and an effort should be made to exclude these before embarking on Cesarean section.

MANAGEMENT

Table VII indicates the methods of management adopted in this series, and the results that were obtained in the salvable cases. Of interest is the relatively high Cesarean section rate and its association with a low fetal mortality rate. The one fetal death that occurred was in a breech presentation in which the fetal heart was heard just prior to commencing an emergency Cesarean section that was performed in the case room. The patient was in strong labour and it is suspected that death occurred during induction under general anesthesia and was probably due to compression of the cord. This emphasizes the importance of having an assistant push the presenting part up from below while the surgeon prepares to operate.

TABLE VII.—METHOD OF MANAGEMENT AND FETAL MORTALITY

Procedure	*No. of cases*	*Incidence %*	*Fetal deaths*	*% fetal mortality*
Cesarean section....	12	23%	1	8%
Forceps.....	12	23%	2	16%
Breech extraction...	17	32%	4	23%
Dührssen's incisions.....	2	3%	1	50%
Version and extraction.....	2	3%	1	50%
Spontaneous, with or without cord replacement.....	6	11%	3	50%
Bag.....	1	1%	1	100%

Of the two deaths in those delivered by forceps one was clearly due to an error in obstetrical judgment, the baby being delivered by high forceps when there was strong evidence of cephalo-pelvic disproportion, while the other was due to a delay in the interval between diagnosis and delivery.

Of the four deaths in the breech extraction group, two were associated with prematurity and one was classed as a difficult breech extraction. In the spontaneous group, two of the deaths occurred in premature babies. Three of this group were treated by cord reposition; one of these was stillborn and two were born alive but were severely asphyxiated at birth.

Of the two babies delivered with Dührssen's incisions, one was stillborn; the other was limp and asphyxiated and had a stormy neonatal course. The one case treated by insertion of bag was also premature, while in the version and extraction group both were full-term deliveries.

DISCUSSION

The successful management of cord prolapse depends on several factors, among the most important of which is the state of cervical dilatation when the diagnosis is made. It is at this time that a decision must be made regarding a definite course of management. As already shown, there is a very high fetal mortality associated with all forms of conservative management where the diagnosis is made early in labour, or for that matter until full dilatation is reached. All authors agree that Cesarean section should be performed in almost all cases that have not reached full dilatation, the only contraindications to Cesarean section being:

1. Where immediate delivery by the vaginal route is possible without injury to mother or fetus.
2. Where the fetal heart fails to recover after pressure on the cord is relieved.
3. Where there is a known abnormality of the fetus, and
4. Where the fetus is so premature that its chances of survival are poor.

The management of this complication in the presence of prematurity poses a special problem, and a careful assessment should be made of the size of the baby before Cesarean section is abandoned. It is the consensus that replacement of the cord is not the ideal treatment. Rhodes[16] in particular condemns replacement of the cord on the ground that the cord circulation may be diminished or actually occluded, and refers to the experimental work of Barcroft[17] who showed that in full-term sheep the umbilical vessels reacted to any kind of stimulation by contracting. It has also been shown that the vessels of the cord are sensitive to temperature and to irritation from handling. Rhodes has emphasized that in allowing a prolapsed cord to cool, or by excessive handling, spasm may be initiated and may result in occlusion of the circulation. It is recommended then that when the cord prolapses outside the vagina it be gently

replaced but that no further manipulation be carried out.

When the prolapse is discovered at full dilatation, management is clear-cut except when other complications such as disproportion are present. It is the case in which prolapse of the cord is discovered when the patient is just short of full dilatation that may perhaps tax the obstetrician's judgment most heavily. In the anxiety to deliver the baby, such management as Dührssen's incisions, forcible delivery with forceps, etc., may be tempting, but on the whole such measures are inadvisable, in the interests of both the fetus and the mother. These cases must be judged individually by the conditions that obtain, but generally speaking, and particularly in primiparas, where there is any question of delay in delivery, Cesarean section is the method of choice.

The management may be summarized as follows:

1. All cases of premature rupture of the membranes should be admitted to hospital, and vaginal examination should be carried out on admission.

2. The fetal heart tones should be checked.

3. Pelvic examination should be performed in all cases where (a) the membranes rupture before engagement, (b) there is malpresentation whether engaged or not, (c) labour is premature, or (d) the patient is a multipara.

If the cord prolapse is discovered, while the operating room is being prepared, oxygen should be administered to the mother and pressure on the cord should be relieved by pushing up the presenting part by means of a hand in the vagina and appropriate positioning of the patient. A Cesarean section should be performed unless the fetus is deliverable from below without harm to the mother or infant.

SUMMARY AND CONCLUSIONS

An analysis of 55 cases of prolapse of the cord occurring at the Vancouver General Hospital over a 10-year period is presented. The incidence of cord prolapse in this series was 0.1% of all deliveries. There were 16 perinatal deaths, giving a gross fetal mortality of 29% and a corrected fetal mortality of 23%.

Some of the predisposing factors and their significance in relation to incidence and fetal mortality are discussed. The importance of early diagnosis is stressed, since the prognosis is much worse for the fetus where there is delay between diagnosis and delivery. Methods of management are discussed and Cesarean section is recommended as the method of choice if the fetus is not immediately desirable. An outline for a program of management is submitted.

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PAGES OUT OF THE PAST: FROM THE JOURNAL OF FIFTY YEARS AGO

THE PRESENT STATUS OF CONSERVATIVE GYNAECOLOGY

It is undoubtedly a fact that the present tendencies in the treatment of diseases of the internal genital organs of women are markedly towards conservatism, and the time has passed when a woman with a backache, or a persistent pain in her groin, is hurried to the operating table and subjected to the removal of organs which are of the utmost importance not only to herself but the race, without an attempt being made to save her from such a loss and mutilation by the employment of the local and constitutional measures that are at our command.

One of the first to sound a note of warning against the indiscriminate removal of important organs from a woman's pelvis was Dr. William M. Polk, of New York, who, in an able paper in 1886, said: "In the interest of conservatism, let us hope that this will not always mean extirpation of the tubes and ovaries, for who can say that the abdominal surgeon may not devise means by which those organs may be so treated as to secure health without robbing of the possibility of maternity. The operator who fails to note the distinction between acute and chronic salpingitis, and loses sight of the fact that the first, and even the second, may be cured by simple methods, sacrifices many tubes and ovaries which might better be left in place.

I am of the opinion that gynaecological conservatism should, in the first place, imply the avoidance of operative interference whenever it is possible, and that, when surgical intervention becomes imperative, the preservation of an organ which may be free from disease and able to functionate, and whose integrity is so important to the woman, should be looked upon as the height of gynaecologic skill. One does not need to be very old to remember the time, only a comparatively few years ago, after it had been demonstrated that the peritoneal cavity, which hitherto had been considered inviolate, could be entered with comparative safety, if only ordinary methods of cleanliness were observed, when a woman with a persistent, or even an occasional, pain located in her pelvis, rarely, if ever, escaped the loss of some of her internal genital organs, unless she herself had the temerity flatly to refuse operative interference.—W. Travis Gibb: *Canadian Medical Association Journal*, 1: 485, June 1911.