



Setting standards to improve women's health

UMBILICAL CORD PROLAPSE

This is the first edition of this guideline.

1. Purpose and scope

The purpose of this guideline is to describe modalities to prevent, diagnose and manage cord prolapse. It addresses those pregnant women at high risk of or with a diagnosis of cord prolapse in hospital and community settings. Pregnancies complicated by fetal malformation or with cord prolapse before 22 completed weeks of gestation will not be covered by this guideline. All later gestations are included.

2. Background and introduction

Cord prolapse has been defined as the descent of the umbilical cord through the cervix alongside (occult) or past the presenting part (overt) in the presence of ruptured membranes.^{1,2} Cord presentation is the presence of the umbilical cord between the fetal presenting part and the cervix, with or without membrane rupture. The overall incidence of cord prolapse ranges from 0.1% to 0.6%.^{1,3-11} In the case of breech presentation, the incidence is slightly higher than 1%.¹² It has been reported that male fetuses appear to be predisposed to cord prolapse.^{7,9,13} The incidence is influenced by population characteristics and is higher where there is a large percentage of multiple gestations.¹⁴

Cases of cord prolapse appear consistently in perinatal mortality enquiries,¹⁵⁻¹⁸ and one large study found a perinatal mortality rate of 91/1000.¹ Prematurity and congenital malformations account for the majority of adverse outcomes associated with cord prolapse in hospital settings¹ but birth asphyxia is also associated with cord prolapse.^{1,9} Perinatal death has been described with normally formed term babies, particularly with planned home birth.^{1,16,19,20} Delay in transfer to hospital appears to be an important contributing factor.¹

Asphyxia may also result in hypoxic-ischaemic encephalopathy and cerebral palsy.²¹ The principal causes of asphyxia in this context are thought to be cord compression and umbilical arterial vasospasm preventing venous and arterial blood flow to and from the fetus. There is a paucity of long-term follow-up data of babies born alive after cord prolapse in both hospital and community settings.

The management of prolapsed cord is one of the labour ward guidelines mandated by the Clinical Negligence Scheme for Trusts (CNST),²² Welsh Pool Risk²³ and Clinical Negligence and Other Risks Scheme (CNORIS)²⁴ maternity standards in England, Wales and Scotland, respectively.

3. Identification and assessment of evidence

This RCOG guideline was developed in accordance with standard methodology for producing RCOG Green-top Guidelines. Medline, Embase, the Cochrane Database of Systematic Reviews, the Cochrane Control Register of Controlled Trials (CENTRAL), the Database of Abstracts of Reviews and Effects (DARE) the ACP

Journal Club, and Ovid database, including in-process and other non-indexed citations, were searched using the terms ‘umbilical cord’, ‘prolapse’ and ‘funic (cord)’. Selection of articles for analysis and review was then made based on relevance to the objectives. Further documents were obtained by the use of freetext terms and hand searches.

The levels of evidence and the grade of recommendations used in this guideline originate from the guidance by the Scottish Intercollegiate Guidelines Network Grading Review Group that incorporates formal assessment of the methodological quality, quantity, consistency and applicability of the evidence base.²⁵

Because of the emergent nature and rare incidence of the condition, there are no randomised controlled trials comparing interventions. There are large numbers of case reports, case-control studies and case series. Some studies have simply used the general population as control group. Other studies have controlled for known confounding variables.

4. Clinical issues

4.1 What are the risk factors for cord prolapse?

Clinicians need to be aware of the risk factors associated with umbilical cord prolapse.



Several risk factors are associated with cord prolapse (Table 1):^{1,5,7,9,10,26}

Table 1. Risk factors for cord prolapse	
General	Procedure related
Multiparity	Artificial rupture of membranes
Low birth weight, less than 2.5 kg	Vaginal manipulation of the fetus with ruptured membranes
Prematurity less than 37 weeks	External cephalic version (during procedure)
Fetal congenital anomalies	Internal podalic version
Breech presentation	Stabilising induction of labour
Transverse, oblique and unstable lie (when the longitudinal axis of the fetus is changing repeatedly)	Insertion of uterine pressure transducer
Second twin	
Polyhydramnios	
Unengaged presenting part	
Low-lying placenta, other abnormal placentation	

In general, these factors predispose to cord prolapse by preventing close application of the presenting part to the lower part of the uterus and/or pelvic brim. Rupture of membranes in such circumstances compounds the risk of prolapse.

Evidence level 2++

Some authorities have also speculated that cord abnormalities (such as true knots or low content of Wharton’s jelly) and fetal hypoxia-acidosis may alter the turgidity of the cord and predispose to prolapse.⁷⁻²⁹

Evidence level 4

Interventions can result in cord prolapse with about 50% of cases being preceded by obstetric manipulation.³⁰ The manipulation of the fetus with or without prior membrane rupture (external cephalic version, internal podalic version of the second twin, manual rotation, placement of intrauterine pressure catheters)^{30,31} and planned artificial rupture of membranes,^{11,30} particularly with an unengaged presenting part, are the interventions that most frequently precede cord prolapse.

Evidence level 3

Induction of labour with prostaglandins is not associated with cord prolapse.¹

Evidence level 2++

4.2 *Can cord presentation be detected antenatally?*

Routine ultrasound examination is not sufficiently sensitive or specific for identification of cord presentation antenatally and should not be performed to predict increased probability of cord prolapse, unless in the context of a research setting.

B

In two Canadian studies, cord prolapse was preceded by the identification of cord presentation at routine ultrasound (real time with colour mapping) in only 12.5% of cases. Just one of 13 cases of suspected cord presentation developed cord prolapse.³²

Evidence level 3

4.3 *Can cord prolapse or its effects be avoided?*

With transverse, oblique or unstable lie, elective admission to hospital after 37+6 weeks of gestation should be discussed and women should be advised to present quickly if there are signs of labour or suspicion of membrane rupture.

D

Women with noncephalic presentations and preterm prelabour rupture of the membranes should be offered admission.

C

Artificial membrane rupture should be avoided whenever possible if the presenting part is mobile. If it becomes necessary to rupture the membranes, this should be performed with arrangements in place for immediate caesarean delivery.

B

Vaginal examination and obstetric intervention in the context of ruptured membranes and a high presenting part carry the risk of upward displacement and cord prolapse. Upward pressure on the presenting part should be kept to a minimum in such women.

✓

Rupture of membranes should be avoided if, on vaginal examination, the cord is felt below the presenting part. When cord presentation is diagnosed in established labour, caesarean section is usually indicated.

✓

One study evaluated outcomes in 29 women with transverse or unstable lie after 37 weeks of gestation. When managed expectantly as outpatients, five (17%) eventually presented in labour with a persistent transverse lie. Major complications included two prolapsed cords and one neonatal death.³³

Evidence level 3

Inpatient care minimises delays in diagnosis and management of cord prolapse. Labour or ruptured membranes in the context of an abnormal lie is an indication for caesarean section.³³ Women with preterm prelabour rupture of membranes with noncephalic presentations appear to have a significantly higher risk of cord prolapse when compared with their cephalic counterparts.³⁴

Evidence level 2++

4.4 *When should cord prolapse be suspected?*

Cord presentation and prolapse may occur without outward physical signs and with a normal fetal heart rate pattern. The cord should be examined for at every vaginal examination in labour and after spontaneous rupture of membranes if risk factors are present or if cardiotocographic abnormalities commence soon thereafter.

✓

With spontaneous rupture of membranes in the presence of a normal fetal heart rate patterns and the absence of risk factors for cord prolapse, routine vaginal examination is not indicated if the liquor is clear.



Cord prolapse should be suspected where there is an abnormal fetal heart rate pattern (bradycardia, variable decelerations etc), particularly if such changes commence soon after membrane rupture, spontaneously or with amniotomy.



Speculum and/or digital vaginal examination should be performed at preterm gestations when cord prolapse is suspected.



Bradycardia or variable fetal heart rate decelerations have been associated with cord prolapse and their presence should prompt vaginal examination.³⁵ In one series of 89 cases of cord prolapse in women being monitored electronically, each one had trace abnormalities; 66% had variable decelerations and 34% had a prolonged deceleration of more than 1 minute or persistent bradycardia.³⁶

Evidence level 2++

Mismanagement of abnormal fetal heart rate patterns is the most common feature of substandard care identified in perinatal death associated with cord prolapse.¹⁶

Prompt vaginal examination is the most important aspect of diagnosis. The Confidential Enquiries into Maternal and Child Health 27/28 project¹⁷ highlighted the importance of avoiding digital vaginal examinations in women with preterm labour but suspicion of cord prolapse was regarded as an exception to that rule.

Evidence level 3

4.5 *What is the optimal initial management of cord prolapse in hospital settings?*

When cord prolapse is diagnosed before full dilatation, assistance should be immediately called and preparations made for immediate delivery in theatre.



There are insufficient data to evaluate manual replacement of the prolapsed cord above the presenting part to allow continuation of labour. This practice is not recommended.



To prevent vasospasm, there should be minimal handling of loops of cord lying outside the vagina.



To prevent cord compression, it is recommended that the presenting part be elevated either manually or by filling the urinary bladder.



Cord compression can be further reduced by the mother adopting the knee–chest position or head-down tilt (preferably in left-lateral position).



Tocolysis can be considered while preparing for caesarean section if there are persistent fetal heart rate abnormalities after attempts to prevent compression mechanically and when the delivery is likely to be delayed.



Although the measures described above are potentially useful during preparation for delivery, they must not result in unnecessary delay.



Umbilical cord replacement by digital elevation has been advocated for managing cord prolapse to allow labour to continue. In a series of eight cases of cord prolapse, the procedure was not possible in one woman and vaginal delivery was imminent in another two. The prolapsed cord was successfully replaced in the five other women. The prolapsed segment was described as short in all

Evidence level 3

five cases. Continuous fetal monitoring was used before, during and after the replacement. Typically, there was a prolonged deceleration of 4 minutes during the reduction. Two fetuses (40%) had persistent cardiotocographic abnormalities after the reduction and, in both, the umbilical artery blood gas pH was less than 7.25 after delivery. There were no neonatal deaths or Apgar scores of less than seven at 5 minutes but other short- or long-term outcome measures of neonatal morbidity were not reported.³⁷ These data are insufficient to support cord replacement and this should not be used outside a clinical trial. In this study, in all five women where replacement was successful a vaginal delivery was achieved. There have been no studies in which cord replacement has been used as a temporary measure while preparing for caesarean section.

Evidence
level 3

There are concerns that manipulation of the cord or exposure to air may cause reactive vasoconstriction and fetal hypoxia-acidosis.^{2,38,39} Some authorities advise that swabs soaked in warm saline are wrapped around the cord but this is of unproven benefit.^{38,39}

Elevation of the presenting part is thought to reduce pressure on the umbilical cord and prevent vascular occlusion. There have been no randomised controlled trials but its use has been associated with a high chance of good outcome.

Evidence
level 4

Manual elevation is achieved by inserting a gloved hand or two fingers in the vagina and pushing the presenting part upwards. A variation is to remove the hand from the vagina once the presenting part is above the pelvic brim and apply continuous suprapubic pressure upwards.⁴⁰ Excessive displacement may encourage more cord to prolapse.

Simple manual displacement was assessed in 132 cases in a large Oxford study.¹ After excluding death due to extreme prematurity and lethal anomaly, there was only one death from asphyxia in the remaining 121 cases. This outcome was associated with delayed transfer from home.

Evidence
level 2++

If the decision-to-delivery interval is likely to be prolonged, particularly if it involves ambulance transfer, elevation through bladder filling may be more practical. Bladder filling can be achieved quickly by inserting the end of a blood giving set into a Foley's catheter. The catheter should be clamped once 500–750 ml has been instilled. It is essential to empty the bladder again just before any delivery attempt, be it vaginal or caesarean section.

In original description by Vago,⁴¹ the procedure was performed in a moderate Trendelenburg position. There was one neonatal death in 28 cases, with a decision-to-delivery interval of 25–115 minutes. In a second study,⁴² 88 cases of cord prolapse in the first stage were treated with bladder instillation before caesarean section. There were no fetal deaths, despite a diagnosis–delivery interval of more than 30 minutes for 48 women. Chetty et al.⁴³ recorded no perinatal deaths in 24 cases similarly managed with an average diagnosis–delivery interval of 65 minutes.

Evidence
level 3

The knee–chest and head-down positions have not been evaluated for the management of cord prolapse independently of other interventions.

Tocolysis has been used to reduce contractions and abolish bradycardia, including women with cord prolapse.^{44–46} The suggested tocolytic regimen is terbutaline 0.25 mg subcutaneously.^{38,39,47,48}

Evidence
level 2
(extrapolated)

4.6 *What is the optimal mode of delivery with cord prolapse?*

A caesarean section is the recommended mode of delivery in cases of cord prolapse when vaginal delivery is not imminent, to prevent hypoxia–acidosis.

B

A category 1 caesarean section should be performed with the aim of delivering within 30 minutes or less if there is cord prolapse associated with a suspicious or pathological fetal heart rate pattern but without unduly risking maternal safety.

B

Verbal consent is satisfactory.



Category 2 caesarean section is appropriate for women in whom the fetal heart rate pattern is normal. Regional anaesthesia may be considered in consultation with an experienced anaesthetist.

C

Caesarean section is associated with a lower perinatal mortality and reduced risk of Apgar score less than three at 5 minutes compared with spontaneous vaginal delivery in cases of cord prolapse when delivery is not imminent.⁹ However, when vaginal birth is imminent, outcomes are similar or better when compared with caesarean section.^{1,8}

There is poor correlation between the decision-to-delivery interval and umbilical cord pH.⁴⁹⁻⁵² The 30-minute decision-to-delivery interval is the acknowledged target for category 1 caesarean section.^{22,53} The average interval between decision and childbirth for fetal concern in maternity units in the UK ranges between 30 and 40 minutes⁴⁸ but, in the National Sentinel Caesarean Section Audit,⁵⁴ for cases with cord prolapse the median interval was 17 minutes and 75% of deliveries were performed within less than 26 minutes (interquartile range 12-26). It is acknowledged that patient safety and attention to the individual woman is more important than fixation on time targets.

Evidence level 2++

For women at term with a grossly pathological fetal heart rate pattern on transfer from home (severe bradycardia), category 1 caesarean section should be advised, as dictated by national guidelines.⁵⁵ For women with a grossly pathological pattern at extremely preterm gestation (less than 24 weeks), a discussion of the chance of (healthy) survival should take place.

With modern techniques, the complications of general anaesthesia are rare but still higher than for regional anaesthesia.⁵⁶ The use of temporary measures, as described above, can reduce cord compression, making regional anaesthesia the technique of choice.⁵⁷ Repeated attempts at regional anaesthesia should be avoided.

Evidence level 4

The outcome for emergency caesarean section is not worse for deliveries occurring up to 60 minutes from decision,⁵⁴ provided that the situation is not immediately life-threatening for the fetus, but care must be taken to avoid unnecessary delay during preparation.

Evidence level 2++ (extrapolated)

Vaginal birth, in most cases operative, can be attempted at full dilatation if it is anticipated that delivery would be accomplished quickly and safely.

D

Breech extraction can be performed under some circumstances, such as after internal podalic version for the second twin.

C

In a study in which 39 women with cord prolapse in the second stage of labour were allowed to deliver vaginally, the percentage of babies with 5-minute Apgar scores of less than seven was 5% for a decision-to-delivery interval less than 10 minutes, 30% for 10-20 minutes and 71% for 20-30 minutes. There were no cases with decision-to-delivery interval of 30 minutes or over.⁴²

Evidence level 3

One large retrospective study demonstrated that a mean decision-to-delivery interval of 15 minutes (SD 9.5 minutes) is achievable in operative vaginal deliveries in a labour room (with 30 minutes for delivery in an operating room) for urgent indications ('fetal distress').⁵⁸ However, another study showed that assisted vaginal birth for urgent indications took 27 minutes on average (SD 14

Evidence level 2+ (extrapolated)

minutes). Further analysis showed that only 41/110 (37%) were delivered within 20 minutes and 57/110 (52%) within 30 minutes.⁵⁹

Evidence
level 2+
(extrapolated)

It is important that clinicians only attempt vaginal birth for those women with very favourable characteristics. It should also be remembered that any delays could be compounded by the possible need to then undertake a caesarean birth.

In the Oxford study,¹ the only case of birth asphyxia was associated with an emergency caesarean section after planned home birth. There were 21 attempted forceps deliveries for viable fetuses with cord prolapse, all of which were successful. Of live fetuses delivered vaginally, none had 5-minute Apgar score of less than seven or an arterial cord pH of less than 7.1. The decision-to-delivery interval was less than 20 minutes in 31 of 32 vaginal deliveries and less than 30 minutes in the remaining case.

Evidence
level 2++

The operator should choose the instrument most appropriate to the clinical circumstances and their level of skill. Forceps and vacuum deliveries have different benefit and risk profiles.⁶¹ A recent study showed no difference in neonatal outcomes for fetal distress⁵⁸ but the two instruments have not been compared directly in the context of cord prolapse.

Evidence
level 3

A practitioner competent in the resuscitation of the newborn should attend all deliveries with cord prolapse. Paired cord blood samples should be taken for pH and base excess measurement.

D

Neonates born live after cord prolapse are highly likely to require resuscitation, as evidenced by a high rate of low Apgar scores; 21% at 1 minute and 7% at 5 minutes.¹

The strong predictive value of a normal paired cord blood gas for the exclusion of intrapartum-related hypoxic-ischemic brain damage justifies the use of paired cord gas analysis in cord prolapse.⁴⁸

Evidence
level 3

4.7 *What is the optimal management in community settings?*

Women should be advised, over the telephone if necessary, to assume the knee-chest face-down position while waiting for hospital transfer. During emergency ambulance transfer, the knee-chest is potentially unsafe and the left-lateral position should be used.

✓

All women with cord prolapse should be advised to be transferred to the nearest consultant-led unit for delivery, unless an immediate vaginal examination by a competent professional reveals that a spontaneous vaginal delivery is imminent. Preparations for transfer should still be made.

B

The presenting part should be elevated during transfer by either manual or bladder filling methods. It is recommended that community midwives carry a Foley catheter for this purpose and equipment for fluid infusion.

D

To prevent vasospasm, there should be minimal handling of loops of cord lying outside the vagina.

✓

Perinatal mortality is increased by more than ten-fold when cord prolapse occurs outside hospital compared with prolapse occurring inside the hospital.³⁶ Neonatal morbidity is also increased in this circumstance.¹

Elevation of the presenting part during transfer can probably prevent cord compression.^{62,63}

Evidence
level 3

4.8 What is the optimal management of cord prolapse before viability?

Expectant management should be discussed for cord prolapse complicating pregnancies with gestational age at the limits of viability.

D

Uterine cord replacement may be attempted.

✓

Women should be counselled on both continuation and termination of pregnancy following cord prolapse at the threshold of viability.

✓

At extreme preterm gestational age (before 24 weeks), temporary measures have been recorded for periods up to 3 weeks.^{2,64-66} Prolongation of pregnancy at such gestational ages creates a chance of survival but morbidity from prematurity remains a frequent serious problem.⁶⁷

Evidence level 3

Some women may prefer to choose termination of pregnancy, perhaps after a short period of observation to see if labour commences spontaneously. Late termination of pregnancy requires specialist expertise and should only be performed in context of recommendations of the RCOG.⁶⁸ There should be a clear distinction between augmentation of labour with the intention of achieving a live baby and termination of the pregnancy where the intention is that the baby is not born alive and, if over 21 completed weeks, feticide needs to be considered.

There is one reported case of cord replacement at extreme preterm gestational age (23 completed weeks of gestation). The woman was in labour and vaginal delivery occurred after 8 hours.³⁷ There have been no reports of cases in which uterine replacement of the cord was used to assist expectant management of cord prolapse at extreme preterm gestation.

Evidence level 3

There are no data to guide decisions about the timing of delivery. Delivery should be considered if there are signs of severe fetal compromise once viability has been reached or a gestational age associated with a reasonable neonatal outcome is achieved. Some women might prefer to run a high risk of fetal death to achieve a gestational age associated with a better chance of healthy neonatal survival.

5. Clinical governance

5.1 Debriefing

Postnatal debriefing should be offered to every woman with cord prolapse.

D

After severe obstetric emergencies, women might be psychologically affected with postnatal depression, post-traumatic stress disorder or fear of further childbirth. Women with cord prolapse who undergo urgent transfer to hospital might be particularly vulnerable to emotional problems.⁶² Debriefing is an important part of maternity care and should be offered by a professional competent in counselling.⁶⁹⁻⁷¹

Evidence qualitative

5.2 Training

All staff involved in maternity care should receive at least annual training in the management of obstetric emergencies including the management of cord prolapse.

✓

Updates on the management of obstetric emergencies (including the interpretation of fetal heart rate patterns) are a proactive approach to risk management. CNST,²² CNORIS²⁴ and Welsh Pool Risk²³ standards mandate that all staff involved in maternity care should attend annual multidisciplinary rehearsals (skill drills) including the management of cord prolapse. Such rehearsals allow staff, especially new and junior members, to familiarise themselves with their specific role in emergencies.

One study of training did not demonstrate any benefit for the management of cord prolapse⁷² but a recent large study (SaFE) showed that practical, multiprofessional, obstetric emergency training increased midwives' and doctors' knowledge of obstetric emergency management⁷³ and improved the management of simulated shoulder dystocia⁷⁴ and eclampsia. Overall, training resulted in a sustained improvement in performance.⁷⁵

Annual training seems adequate for those already proficient but more frequent rehearsal is advisable for those initially lacking competency until skill acquisition is achieved.⁷⁵ Further work is required to specifically evaluate the role of training in preventing cord prolapse related morbidity.

Evidence
level 1++
(extrapolated)

5.3 Clinical incident reporting

Clinical incident forms should be submitted for all cases of cord prolapse.



6. Auditable standards

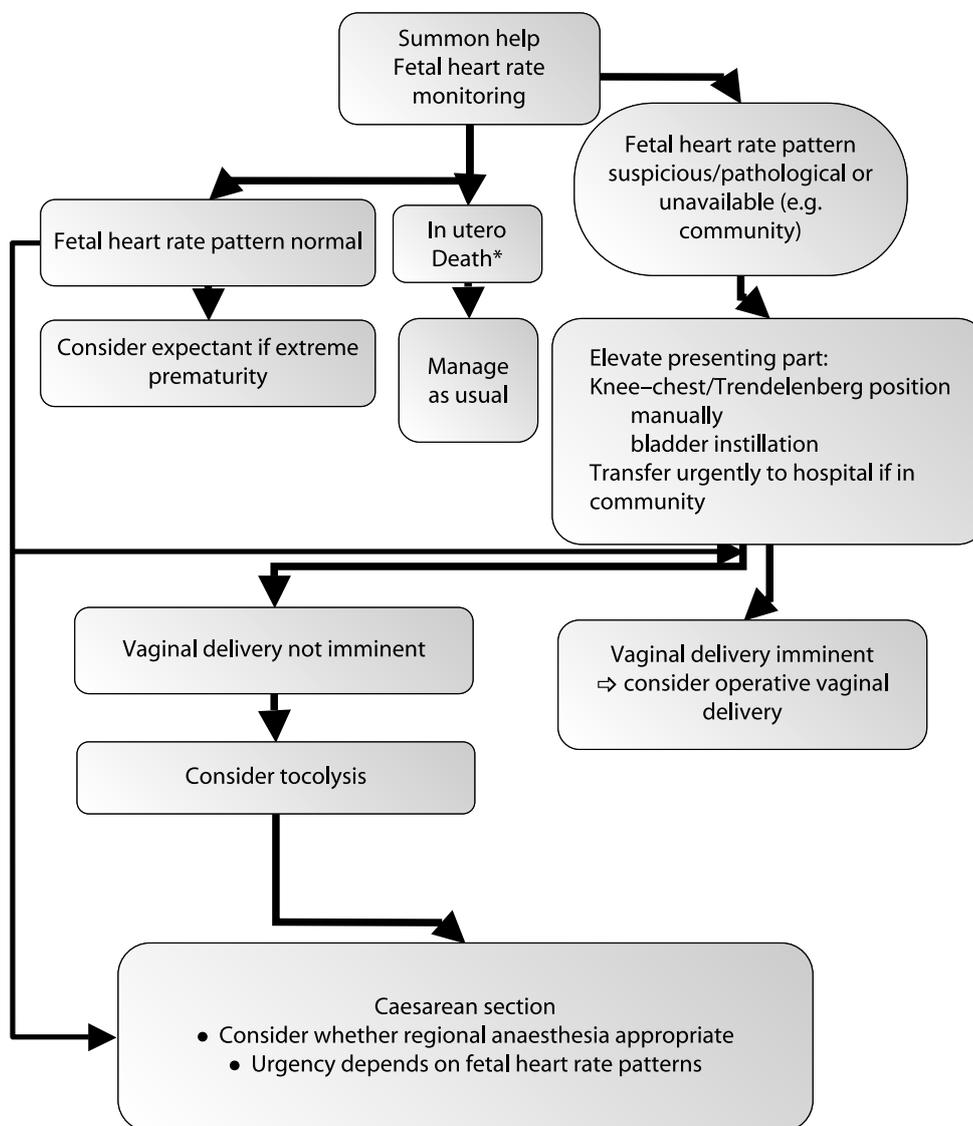
1. Proportion of staff receiving annual training in cord prolapse.
2. Audit of the management of cord prolapse in hospital settings.
3. Audit of the management of cord prolapse in community settings.
4. Diagnosis-delivery interval for spontaneous and assisted vaginal deliveries and caesarean sections in cases of cord prolapse.
5. Critical analysis of adverse outcomes (compliance with guidance).

References

1. Murphy DJ, MacKenzie IZ. The mortality and morbidity associated with umbilical cord prolapse. *Br J Obstet Gynaecol* 1995;102:826-30.
2. Lin MG. Umbilical cord prolapse. *Obstet Gynecol Surv* 2006; 61:269-77.
3. Myles TJ. Prolapse of the umbilical cord. *J Obstet Gynaecol Br Emp* 1959;66:301-10.
4. Cope E. Presentation and prolapse of umbilical cord; an analysis of 350 cases. *J Obstet Gynaecol Br Emp* 1951;58:259-71.
5. Dilbaz B, Ozturkoglu E, Dilbaz S, Ozturk N, Sivaslioglu AA, Haberal A. Risk factors and perinatal outcomes associated with umbilical cord prolapse. *Arch Gynecol Obstet* 2006;274:104-7.
6. Boyle JJ, Katz VL. Umbilical cord prolapse in current obstetric practice. *J Reprod Med* 2005;50:303-6.
7. Kahana B, Sheiner E, Levy A, Lazer S, Mazor M. Umbilical cord prolapse and perinatal outcomes. *Int J Gynaecol Obstet* 2004; 84:127-32.
8. Dare FO, Owolabi AT, Fasubaa OB, Ezechi OC. Umbilical cord prolapse: a clinical study of 60 cases seen at Obafemi Awolowo University Teaching Hospital, Ile-Ife. *East Afr Med J* 1998;75:308-10.
9. Critchlow CW, Leet TL, Benedetti TJ, Daling JR. Risk factors and infant outcomes associated with umbilical cord prolapse: a population-based case-control study among births in Washington State. *Am J Obstet Gynecol* 1994;170:613-18.
10. Yla-Outinen A, Heinonen PK, Tuimala R. Predisposing and risk factors of umbilical cord prolapse. *Acta Obstet Gynecol Scand* 1985;64:567-70.
11. Woo JS, Ngan YS, Ma HK. Prolapse and presentation of the umbilical cord. *Aust N Z J Obstet Gynaecol* 1983;23:142-5.
12. Panter KR, Hannah ME. Umbilical cord prolapse: so far so good? *Lancet* 1996;347(8994):74.
13. Sheiner E, Levy A, Katz M, HersHKovitz R, Leron E, Mazor M. Gender does matter in perinatal medicine. *Fetal Diagn Ther* 2004;19:366-9.
14. Faiz SA, Habib FA, Sporrang BG, Khalil NA. Results of delivery in umbilical cord prolapse. *Saudi Med J* 2003;24:754-7.
15. Study of antepartum term stillbirths. In: Confidential Enquiry into Stillbirths and Deaths in Infancy. *5th Annual Report*. London: Maternal and Child Health Consortium; 1998. p. 41-50.
16. Focus Group: Breech presentation at onset of labour. In: Confidential Enquiry into Stillbirths and Deaths in Infancy. *7th Annual Report*. London: Maternal and Child Health Consortium; 2000. p. 25-39.
17. Confidential Enquiries into Stillbirths and Deaths in Infancy. Project 27/28. An enquiry into quality of care and its effect on survival of babies born at 27-28 weeks. London: The Stationery Office; 2003 [www.cemach.org.uk/getattachment/e6ffafcfacbd-4f22-ad8c-4975b6cbee82/Project-27-28.aspx]
18. The '4kg and over' enquiries 1997. In: Confidential Enquiries into Stillbirths and Deaths in Infancy. *6th Annual Report*. London: Maternal and Child Health Consortium; 1999. p. 35-47.
19. Beard RJ, Johnson DA. Fetal distress due to cord prolapse through a fenestration in a lower segment uterine scar. *J Obstet Gynaecol Br Commonw* 1972;79:763.
20. Johnson KC, Daviss BA. Outcomes of planned home births with certified professional midwives: large prospective study in North America. *BMJ* 2005;330:1416-22.
21. Alastair MacLennan for the International Cerebral Palsy Task Force. A template for defining a causal relation between acute intrapartum events and cerebral palsy: international consensus statement. *BMJ* 1999;1054-9.
22. NHS Litigation Authority. Clinical Negligence Scheme for Trusts: Maternity Standards. Criterion 4.1.1; 2006.
23. Welsh Pool Risk. Standard 15, Maternity, Version 3, January 2005.
24. Clinical Negligence and Other Risks Scheme. Scottish Executive, Health Department Directorate of Finance; 1999.
25. Harbour R, Miller J. A new system for grading recommendations in evidence based guidelines. *BMJ* 2001;323:334-6.
26. Uygur D, Kis S, Tuncer R, Ozcan FS, Erkaya S. Risk factors and infant outcomes associated with umbilical cord prolapse. *Int J Gynaecol Obstet* 2002;78:127-30.

27. McDaniels HR, Umezaki H, Harer WB, Valenzuela GJ. Is umbilical cord prolapse secondary to fetal acidemia? *Prenatal and Neonatal Medicine* 2001;6:129-32.
28. Clark DO, Copeland W, Ullery JC. Prolapse of the umbilical cord. A study of 117 cases. *Am J Obstet Gynecol* 1968;101:84-90.
29. Hershkovitz R, Silberstein T, Sheiner E, Shoham-Vardi I, Holcberg G, Katz M, et al. Risk factors associated with true knots of the umbilical cord. *Eur J Obstet Gynecol Reprod Biol* 2001;98:36-9.
30. Usta IM, Mercer BM, Sibai BM. Current obstetrical practice and umbilical cord prolapse. *Am J Perinatol* 1999;16:479-84.
31. Skupski DW, Harrison-Restelli C, Dupont RB. External cephalic version: an approach with few complications. *Gynecol Obstet Invest* 2003;56:83-8.
32. Ezra Y, Strasberg SR, Farine D. Does cord presentation on ultrasound predict cord prolapse? *Gynecol Obstet Invest* 2003;56:6-9.
33. Phelan J, Boucher M, Mueller E, McCart D, Horenstein J, Clark S. The nonlaboring transverse lie. A management dilemma. *J Reprod Med* 1986;31:184-6.
34. Lewis DF, Robichaux AG, Jaekle RK, Salas A, Canzoneri BJ, Horton K, et al. Expectant management of preterm premature rupture of membranes and nonvertex presentation: what are the risks? *Am J Obstet Gynecol* 2007;196:566e1-6.
35. Tejani S, Tejani N, Weiss RR, Nathanson H. Vasa previa. Diagnosis and management. *NY State J Med* 1979;79:772-3.
36. Koonings PP, Paul RH, Campbell K. Umbilical cord prolapse. A contemporary look. *J Reprod Med* 1990;35:690-2.
37. Barrett JM. Funic reduction for the management of umbilical cord prolapse. *Am J Obstet Gynecol* 1991;165:654-7.
38. American Academy of Family Physicians. *Advanced Life Support in Obstetrics (ALSO) Provider Manual*. 4th ed: Newcastle upon Tyne: ALSO UK; 2000.
39. Goswami K. Umbilical cord prolapse. In: Grady K, Howell C, Cox C, editors. *Managing Obstetric Emergencies and Trauma. The MOET course manual*. 2nd ed. London: RCOG Press; 2007. p. 233-7.
40. Prolapsed cord. In: World Health Organization, UNFPA, UNICEF, World Bank. *Managing Complications in Pregnancy and Childbirth. A guide for midwives and doctors*. Geneva: WHO; 2003. p. S97-8. [www.who.int/reproductive-health/impac/index.html].
41. Vago T. Prolapse of the umbilical cord: a method of management. *Am J Obstet Gynecol* 1970;107:967-9.
42. Caspi E, Lotan Y, Schreyer P. Prolapse of the cord: reduction of perinatal mortality by bladder instillation and cesarean section. *Isr J Med Sci* 1983;19:541-5.
43. Chetty RM, Moodley J. Umbilical cord prolapse. *S Afr Med J* 1980;57:128-9.
44. Ingemarsson I, Arulkumaran S, Ratnam S. Single injection of terbutaline in term labor. I. Effect on fetal pH in cases with prolonged bradycardia. *Am J Obstet Gynecol* 1985;153:859-65.
45. Katz Z, Shoham Z, Lancet M, Blickstein I, Mogilner BM, Zalel Y. Management of labor with umbilical cord prolapse: a 5-year study. *Obstet Gynecol* 1988;72:278-81.
46. Katz Z, Lancet M, Borenstein R. Management of labor with umbilical cord prolapse. *Am J Obstet Gynecol* 1982;142:239-41.
47. Module 8. Cord prolapse. In: Draycott T, Winter C, Crofts J, Barnfield S, editors. *PROMPT: Practical Obstetric Multi-Professional Training Course Manual*. London: RCOG Press; 2008. p. 117-24.
48. National Collaborating Centre for Women's and Children's Health. *Intrapartum Care: Care of Healthy Women and Their Babies During Childbirth*. Clinical Guideline. London: RCOG Press; 2007.
49. Tan WC, Tan LK, Tan HK, Tan AS. Audit of 'crash' emergency caesarean sections due to cord prolapse in terms of response time and perinatal outcome. *Ann Acad Med Singapore* 2003;32:638-41.
50. Bloom SL, Leveno KJ, Spong CY, Gilbert S, Hauth JC, Landon MB, et al. Decision-to-incision times and maternal and infant outcomes. *Obstet Gynecol* 2006;108:6-11.
51. Thomas J, Paranjothy S, James J. National cross sectional survey to determine whether the decision to delivery interval is critical in emergency caesarean section. *BMJ* 2004;328:665-7.
52. MacKenzie IZ, Cooke I. What is a reasonable time from decision-to-delivery by caesarean section? Evidence from 415 deliveries. *BJOG* 2002;109:498-504.
53. National Collaborating Centre for Women's and Children's Health. *Caesarean Section*. Clinical Guideline. London: RCOG Press; 2004.
54. Royal College of Obstetricians and Gynaecologists Clinical Effectiveness Support Unit. *The National Sentinel Caesarean Section Audit Report*. London: RCOG Press; 2001.
55. Royal College of Obstetricians and Gynaecologists Clinical Effectiveness Support Unit. *The Use of Electronic Fetal Monitoring. The use and interpretation of cardiotocography in intrapartum fetal surveillance*. Evidence-based Clinical Guideline No. 8. London: RCOG Press; 2001.
56. Afolabi BB, Lesi FE, Mera NA. Regional versus general anaesthesia for caesarean section. *Cochrane Database Syst Rev* 2006;(4):CD004350.
57. Scrutton M. Cord prolapse demands general anaesthesia: Cons. *Int J Obstet Anesth* 2003;12:290-2.
58. Murphy DJ, Koh DK. Cohort study of the decision to delivery interval and neonatal outcome for emergency operative vaginal delivery. *Am J Obstet Gynecol* 2007;196:145e1-7.
59. Okunwobi-Smith Y, Cooke I, MacKenzie IZ. Decision to delivery intervals for assisted vaginal vertex delivery. *BJOG* 2000;107:467-71.
60. Royal College of Obstetricians and Gynaecologists. *Operative Vaginal Delivery: Green-top Guideline No. 26*. London: RCOG; 2005 [www.rcog.org.uk/index.asp?PageID=523].
61. Altaras M, Potashnik G, Ben-Adereth N, Leventhal H. The use of vacuum extraction in cases of cord prolapse during labor. *Am J Obstet Gynecol* 1974;118:824-30.
62. Weston R. When birth goes wrong. *Pract Midwife* 2001;4(8):10-12.
63. Patterson C. Managing cord prolapse at a home birth. *Pract Midwife* 2005;8:34-5.
64. Leong A, Rao J, Opie G, Dobson P. Fetal survival after conservative management of cord prolapse for three weeks. *BJOG* 2004;111:1476-7.
65. Nizard J, Cromi A, Molendijk H, Arabin B. Neonatal outcome following prolonged umbilical cord prolapse in preterm premature rupture of membranes. *BJOG* 2005;112:833-6.
66. Poetker DM, Rijhsinghani A. Fetal survival after umbilical cord prolapse for more than three days. A case report. *J Reprod Med* 2001;46:776-8.
67. Draycott T, Sibanda T, Owen L, Akande V, Winter C, Reading S, et al. Does training in obstetric emergencies improve neonatal outcome? *BJOG* 2006;113:177-82.
68. Royal College of Obstetricians and Gynaecologists. *The Care of Women Requesting Induced Abortion*. Evidence-based Clinical Guideline No. 7. London: RCOG Press; 2006.
69. Murphy DJ, Pope C, Frost J, Liebling RE. Women's views on the impact of operative delivery in the second stage of labour: qualitative interview study. *BMJ* 2003;327(7424):1132.
70. Mapp T, Hudson K. Feelings and fears during obstetric emergencies 1. *Br J Midwifery* 2005;13:30-5.
71. Mapp T. Feelings and fears post obstetric emergencies 2. *Br J Midwifery* 2005;13:36-40.
72. Johanson R, Menon V, Burns E, Kargramanya E, Osipov V, Israelyan M, et al. Managing Obstetric Emergencies and Trauma (MOET) structured skills training in Armenia, utilising models and reality based scenarios. *BMC Med Educ* 2002;2:5.
73. Crofts JF, Ellis D, Draycott TJ, Winter C, Hunt LP, Akande VA. Change in knowledge of midwives and obstetricians following obstetric emergency training: a randomised controlled trial of local hospital, simulation centre and teamwork training. *BJOG* 2007;114:1534-41.
74. Crofts JF, Bartlett C, Ellis D, Hunt LP, Fox R, Draycott TJ. Training for shoulder dystocia: a trial of simulation using low-fidelity and high-fidelity mannequins. *Obstet Gynecol* 2006;108:1477-85.
75. Crofts JF, Bartlett C, Ellis D, Hunt LP, Fox R, Draycott TJ. Management of shoulder dystocia: skill retention 6 and 12 months after training. *Obstet Gynecol* 2007;110:1069-74.
76. Royal College of Obstetricians and Gynaecologists. *Development of RCOG Green-top guidelines*. Clinical Governance Advice No. 1a-c. London: RCOG; 2006 [www.rcog.org.uk/index.asp?PageID=1776].

APPENDIX I: Algorithm for the management of cord prolapse



* confirmed by ultrasound

APPENDIX II

Clinical guidelines are: 'systematically developed statements which assist clinicians and patients in making decisions about appropriate treatment for specific conditions'. Each guideline is systematically developed using a standardised methodology. Exact details of this process can be found in Clinical Governance Advice No. 1: *Development of RCOG Green-top Guidelines* (available on the RCOG website at www.rcog.org.uk/index.asp?PageID=75). These recommendations are not intended to dictate an exclusive course of management or treatment. They must be evaluated with reference to individual patient needs, resources and limitations unique to the institution and variations in local populations. It is hoped that this process of local ownership will help to incorporate these guidelines into routine practice. Attention is drawn to areas of clinical uncertainty where further research may be indicated.

The evidence used in this guideline was graded using the scheme below and the recommendations formulated in a similar fashion with a standardised grading scheme.

Classification of evidence levels	Grades of recommendations
1++ High-quality meta-analyses, systematic reviews of randomised controlled trials or randomised controlled trials with a very low risk of bias	A At least one meta-analysis, systematic reviews or randomised controlled trial rated as 1++ and directly applicable to the target population; or A systematic review of randomised controlled trials or a body of evidence consisting principally of studies rated as 1+, directly applicable to the target population and demonstrating overall consistency of results
1+ Well-conducted meta-analyses, systematic reviews of randomised controlled trials or randomised controlled trials with a low risk of bias	B A body of evidence including studies rated as 2++ directly applicable to the target population and demonstrating overall consistency of results; or Extrapolated evidence from studies rated as 1++ or 1+
1- Meta-analyses, systematic reviews of randomised controlled trials or randomised controlled trials with a high risk of bias	C A body of evidence including studies rated as 2+ directly applicable to the target population and demonstrating overall consistency of results; or Extrapolated evidence from studies rated as 2++
2++ High-quality systematic reviews of case-control or cohort studies or high-quality case-control or cohort studies with a very low risk of confounding, bias or chance and a high probability that the relationship is causal	D Evidence level 3 or 4; or Extrapolated evidence from studies rated as 2+
2+ Well-conducted case-control or cohort studies with a low risk of confounding, bias or chance and a moderate probability that the relationship is causal	Good practice point
2- Case-control or cohort studies with a high risk of confounding, bias or chance and a significant risk that the relationship is not causal	<input checked="" type="checkbox"/> Recommended best practice based on the clinical experience of the guideline development group
3 Non-analytical studies; e.g. case reports, case series	
4 Expert opinion	

The Guidelines review process will commence in April 2011 unless otherwise indicated

This Guideline was produced on behalf of the Guidelines and Audit Committee of the Royal College of Obstetricians and Gynaecologists by:

Dr D Siassakos MRCOG, Bristol; Dr Robert Fox MRCOG, Taunton; Mr TJ Draycott MRCOG, Bristol.

and peer reviewed by:

British Maternal and Fetal Medicine Society; Dr DI Fraser MRCOG, Norwich; Mr HKS Hinshaw FRCOG, MOET, Sunderland; Miss SA Irani MRCOG, Birmingham Dr SIMF Ismail MRCOG, Yeovil; Dr TA Johnston MRCOG, Birmingham; Mr IZ MacKenzie FRCOG, Oxford; Obstetric Anaesthetists' Association; Professor C O'Herlihy FRCOG, Dublin, Ireland; RCOG Consumers' Forum; Ms M Shilton, Registered Midwife, Ipswich Hospital NHS Trust; Dr EA Thornberry FRCA, Royal College of Anaesthetists; Mr DJ Tuffnell FRCOG, Bradford.

The Guidelines and Audit Committee lead peer reviewers were:

Dr P Owen MRCOG, Glasgow, Professor FM McAuliffe MRCOG, Dublin, Ireland, and Professor DJ Murphy MRCOG, Dublin, Ireland.

The final version is the responsibility of the Guidelines and Audit Committee of the RCOG

DISCLAIMER

The Royal College of Obstetricians and Gynaecologists produces guidelines as an educational aid to good clinical practice. They present recognised methods and techniques of clinical practice, based on published evidence, for consideration by obstetricians and gynaecologists and other relevant health professionals. The ultimate judgement regarding a particular clinical procedure or treatment plan must be made by the doctor or other attendant in the light of clinical data presented by the patient and the diagnostic and treatment options available.

This means that RCOG Guidelines are unlike protocols or guidelines issued by employers, as they are not intended to be prescriptive directions defining a single course of management. Departure from the local prescriptive protocols or guidelines should be fully documented in the patient's case notes at the time the relevant decision is taken.