Recent Advances in Obstetrics & Gynaecology



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Contents

Preface		v
Chapter 1	Fetal therapy and surgery *Gulati N, Kilby MD*	1
Chapter 2	The impacted head at caesarean section *Annette Briley, Andrew Shennan, Graham Tydeman*	13
Chapter 3	Midwifery-led care for women at all levels of risk *Sally K Tracy*	21
Chapter 4	The role of urodynamics in female lower urinary tract symptoms *Verghese TS, Latthe P*	33
Chapter 5	Medical management of urinary incontinence in the premenopausal woman *Dina El-Hamamsy, Douglas G Tincello*	45
Chapter 6	Caesarean scar ectopic pregnancy *Venetia Goodhart*	57
Chapter 7	Ambulatory interventions in the management of acute gynaecology and early pregnancy complications *Kim Lawson, Cecilia Bottomley*	67
Chapter 8	Hereditary cancer in gynaecology: What clinicians should know about genetic-testing, screening and risk reduction *Faiza Maryam Gaba, Ranjit Manchanda*	81
Chapter 9	Vulval cancer in elderly women *Madeleine Macdonald, John Tidy*	99

Chapter 2

The impacted head at caesarean section

Annette Briley, Andrew Shennan, Graham Tydeman

JAYPEE BROTHERS

THE SIZE OF THE PROBLEM

Caesarean section (CS) rates in the UK vary from 26% in Wales to 31.1% in Scotland (England 27.1%; Northern Ireland 29.9%) [1].

With total births in 2015 reaching 760,845 it can be estimated that 228,250 babies were born by CS. Elective operations occur in 14–15% of all births [1]. Therefore, more than 105,000 occurred as emergencies, some of which were undertaken late in the first or second stage of labour, when the fetal head has descended low in the maternal pelvis.

The proportion of CS undertaken in the second stage of labour is projected to increase for several reasons. These include: a decline in the use of rotational and midcavity forceps deliveries; an overall decline in assisted vaginal births; a move towards vacuum births, known to have a higher failure rate and increased use of regional analgesia with concomitant prolongation of the second stage. These factors, combined with increasing prevalence of maternal obesity and fetal macrosomia, are likely to further contribute to a rising incidence of impacted fetal head [2].

During CS in late labour the surgeon has to reach deep into the woman's pelvis and gain access below the fetal head in order to lift it out and deliver the baby. In late labour, the fetal head can become impacted between the maternal bony pelvis and soft tissues, causing difficulty in obtaining access below the head. Even when access is achieved, there may be further difficulty in overcoming the partial vacuum that forms beneath the baby's head. Despite second stage CS becoming more common [3] the incidence of difficulty in delivering the fetal head is largely unknown, although Loudon and colleagues reported 30% of emergency CS undertaken in late labour recorded difficulty in delivering the fetal head [4]. Data currently in press from one maternity provider in Scotland reported some degree of difficulty in delivering the fetal head in 18% of all emergency CS (81/440). This was most common when cervical dilatation was ≥8 cm (124/440; 48%), but was also seen at lower dilatations (21/440; 6.5%) [5]. It is reasonable

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to state that impaction of the fetal head is a recognised complication encountered by most labour ward clinicians.

IMPLICATIONS

Impaction of the fetal head at CS has been associated with maternal and neonatal morbidities [3]. Neonatal morbidities most commonly reported are localised bruising and lacerations to the face and head. These may be considered relatively minor, but have implications for increased risk of jaundice requiring phototherapy, and irritability, leading to prolongation of hospital stay, difficulty in establishing breastfeeding, and inherent longer term bonding issues. More serious but less common neonatal complications include neonatal hypoxia, skull fractures, haematomas, brachial plexus injuries, seizures and increased incidence of neonatal unit admissions [6–8]; all of which could have longer term health implications for the child.

Difficulty in delivering the impacted fetal head has been associated with a 36% increase in measured maternal blood loss and is also associated with bladder trauma; wound infection; uterine tears; haematoma and longer hospital stays [9,10]. There is a paucity of data regarding longer-term outcomes but the Birth Trauma Association (BTA) report multiple morbidities including incontinence, prolapse, dyspareunia, fistula, anal sphincter injury and post-traumatic stress disorder.

This clinical emergency also impacts on staff. Due to the unpredictability of the situation, many junior doctors will encounter difficulty in delivering an impacted fetal head out of hours when senior assistance may be unavailable. Midwives and other allied health professionals are often asked to assist and many feel uncertain about the pressure to apply and uncomfortable about undertaking this during surgery.

CURRENT GUIDELINES

There are currently no national guidelines recommending a single technique to deal with this situation, and a range of techniques are employed. The National Institute for Health and Clinical Excellence (NICE) states that techniques used are associated with maternal and neonatal trauma and there is currently inadequate evidence available to recommend inserting a balloon device to disimpact the deeply engaged fetal head at CS [11].

The Cochrane review, undertaken in 2016 [7], concluded that reverse breech extraction may be associated with less neonatal morbidity than the push method, which involves elevation through pressure applied to the fetal head via the vagina. This may have been due to the impact of studies from low and middle resource settings. Certainly, a survey of trainees in the UK and an audit in one NHS provider found that the push method was universally used [5,9]. Both concluded that more work in the area is required.

TECHNIQUES DESCRIBED IN THE LITERATURE TO FACILITATE DELIVERY OF THE IMPACTED FETAL HEAD

Patwardhan's technique

First described in 1957 [12] it is still advocated by some.

It is only relevant when the deeply engaged fetal head is either occipito-transverse (OT) or occipito-anterior (OA).

JAYPEE BROTHERS

In these cases, an incision is made in the lower uterine segment, at the level of the anterior shoulder, which is delivered first.

Using gentle traction on the shoulder, the posterior shoulder is delivered.

The surgeon then hooks his fingers through both axillae and using gentle traction, aided by an assistant providing fundal pressure, the body of the fetus is brought out of the uterus.

Only the baby's head remains in the uterus and this is gently lifted out of the pelvis.

Evaluation of this technique has been undertaken in one retrospective case review study ($n = 79$) and another prospective cohort ($n = 50$) in developing countries and reported less incidence of maternal and neonatal morbidities than either the push or the pull method [13,14]. Additionally, impaction of the head would need to be anticipated for this technique to be used, and whilst this may be more predictable in developing countries, where many women transfer for delivery following many hours laboring elsewhere, in the UK situation prediction of difficulty in delivering the fetal head remains challenging.

Shazly's step

Described in 2013 in a case series of eight patients, this technique involves abdominal disimpaction with lower segment support as a novel technique to minimise moridities [15]. The edge of the lower uterine segment is grasped with forceps applied approximately 2 cm apart along the lower edge of the incision, until it is completely supported. These forceps are handled by an assistant and gentle upward traction, perpendicular to the uterine surface, is applied. There is now adequate space for the surgeon's hand to undertake manipulation without applying pressure on the lower segment, and the fetal head can be delivered. The authors describe it as a promising technique to minimise complications during CS for obstructed labour. However no further investigations have been undertaken, although a research protocol has been registered (ClinicalTrials.gov ID: NCT02934516) to compare this technique with the 'classic' push method. Ethics review is pending and recruitment is anticipated to commence late 2017/early 2018 [16].

Push method

The push method of cephalic replacement has been the favoured technique in the UK and USA since the 1980s.

The woman is placed into a frog-legged position with knees flexed and thighs abducted. Using an aseptic technique an assistant inserts a hand into the vagina and using cupped fingers gently pushes the fetal head superiorly into the pelvis. At the same time, the surgeon applies traction to the fetal shoulders or attempts to flex and elevate the fetal head [17].

Some clinicians practice a bimanual push method whereby the surgeon elevates the fetal head with a hand from below whilst simultaneously elevating the head with the other hand in the uterus [18].

Reverse breech extraction (The "pull' method)

This is more widely used in developing countries but many UK based clinicians who have not worked overseas, have not seen this technique.

With this method the surgeon reaches upwards the upper uterine segment and holds one or both fetal legs. Gentle traction is applied until the second leg is apparent. Both fetal legs are delivered by gentle traction (similar to a footling breech technique). During this

JAYPEE BROTHERS

procedure a low transverse incision may require extension into an inverse T or J-shaped wound to maximise space [19].

EVIDENCE COMPARING TECHNIQUES

A Cochrane review investigating techniques for assisting with delivery of the impacted fetal head included four trials (357 women) compared the push method versus the pull method. In three studies (239 women), the primary outcome was birth trauma for the infant and there was no difference with either technique for this relatively rare outcome (risk ratio 1.55 95% CI 0.42 to 5.73), although the small sample size may not show clinically important effects. There were also no differences for many secondary outcomes (blood loss > 500 mL, blood transfusion, wound infection, mean hospital stay, Apgar scores). Heterogeneity between trials confounded comparison but the duration of operation was significantly shorter for reverse breech extraction, which may contribute to fewer adverse maternal outcomes in this group [7].

The authors concluded that whilst there is limited evidence that reverse breech may improve maternal and fetal outcomes there was no difference in infant birth trauma and further randomised trials are needed to investigate this further [7].

The use of tocolytics to relax the uterus and therefore make it easier to deliver the infant where difficulty is anticipated was also reviewed. However, the authors concluded that the single randomised trial (97 women) in the literature did not provide sufficient evidence to support or refute this practice [7].

An earlier meta-analysis included 11 studies (1028 women), prospective and retrospective, and incorporating a variety of delivery techniques, reported increased rates of wound extensions, greater blood loss and transfusion and longer operating time in the push group. However there were three long bone fractures in the infant in the pull group compared to none in the push group. All included studies were undertaken in non-Western and non-European settings so the generalisability of the findings is limited [20].

DEVICES DEVELOPED TO ASSIST WITH DELIVERY OF THE IMPACTED FETAL HEAD

Murless head extractor

Developed in South Africa in the 1940s this single blade device was first used in the UK in the 1950s [21]. Initial evaluation in the US used the device on 40 unselected women undergoing. The authors found the device expedited delivery in all cases but was particularly useful when the head was deeply engaged in the pelvis [22]. Further evaluation occurred in 1992 when it was similarly deemed useful and not associated with increased maternal or neonatal morbidities [23].

Although still available, there is no evidence in the literature of recent use of this device.

C-Snorkel

This is a sterile, molded polymer tube with an internal diameter of approximately 1 cm. Inserted vaginally and placed close to the fetal head, this tube facilitates the passage of air around the head, thus overcoming the partial vacuum that has formed making it easier for the surgeon to place a hand beneath the head and deliver it. In a small study ($n = 23$), the

JAYPEE BROTHERS

device was compared with 49 retrospectively selected cases, where it was not used. The effectiveness of the device was dependent on the station of the fetal head during surgery with fewer hysterotomy extensions at mid-cavity ($n = 0/17$ versus $n = 14/41$, 34%, $P < 0.01$) and fewer push-ups required ($n = 0/17$ versus $n = 11/41$, 27% $P = 0.02$). These differences were not seen when the presenting part was at a low station (+2, +3) and indeed confirmation of this significant difference requires confirmation in a robust randomised controlled trial (RCT). The device was positively reviewed by junior staff but there was little consensus amongst senior colleagues regarding its utility [24].

Fetal Pillow

Safe Obstetric Systems have developed the Fetal Pillow. This device is formed of a foldable baseplate with an attached silicone balloon and a thin tube, with a two-way connector. The baseplate and balloon are inserted vaginally and once in place between the perineal muscles and the fetal head, inflated with 180 mL saline. The aim of the device is to elevate the fetal head to facilitate easier delivery with minimal manipulation. The device is deflated postoperatively via the two way connector and removed by gently pulling the tubing. An initial prospective observational study with historical controls reported an average 4 cm elevation of the fetal head was achieved in all cases ($n = 50$). Additionally, compared with the control group, there were fewer uterine extensions in the fetal pillow group ($P = 0.03$), incision to delivery interval was shorter ($P < 0.001$) as were hospital stay ($P \leq 0.001$). There was no statistical difference between groups for blood loss >1,000 mL, blood transfusions, maternal deaths or admission to ITU [25]. Subsequently, the same authors undertook a RCT to further evaluate the device. This larger study ($n = 240$) devised a grading system for uterine extensions and used major, defined as grades 2–3 as the primary endpoint for the study, which were less common in the fetal pillow group. Other outcomes included less blood loss >1,000 mL fewer transfusions. For the neonate there was a reduction in both admissions to NICU and stays >24 hours, but these failed to reach statistical significance [26].

Both these studies were wholly [25] or partially [26] commercially sponsored, and independent verification of these promising results is required given the cost of the device.

Tydeman tube

The Tydeman tube has been developed to overcome both the partially formed vacuum as well as assist elevation of the impacted fetal head, following established principles of the push technique but using a device designed to reduce trauma and ease the procedure. It is made of silicone and consists of two parts; the cup which is soft and is inserted into the vagina to lie against the fetal head. It is attached to a slightly curved, semi rigid wide-bore tube, which allows air to enter from below. Should a push up be required this can be done from outside the mother's body with the cup applying the force to the baby's head over a larger area than is possible with manual elevation. Tests on a simulator, have shown that greater elevation is achieved with the Tydeman tube compared with digital elevation (mean difference +9.1 mm $P < 0.001$), and that although greater force was applied to achieve this (mean difference +0.42 Kgf, $P < 0.001$) the force was spread over 6.97 cm^2 versus 2.0 cm^2 and therefore is may be less likely to cause fetal damage [27]. These authors also reported a case series of the first 10 Tydeman Tubes used in clinical practice. All devices were used in nulliparous women with cervical dilatation 9 cm or 10 cm. All Apgar scores were >8 at 1 and

JAYPEE BROTHERS

5 minutes. In one case, the Tydeman tube was only used as elevation could not be achieved with a digital technique.

The mean score for all operators was 7.7/10 suggesting that clinicians found the device easy to use.

Further evaluation of the device in clinical trials is planned.

CONCLUSION

Difficulty in delivering the fetal head at CS in late labour is not uncommon. In some situations, it can be predicted but often it is unexpected. Although various techniques and devices are available, there are currently no guidelines as to how best to deal with this obstetric emergency, with most clinicians relying on advice and experience of those around them. Given current strategies to prevent primary CS, and changes in maternal demography and staff training, the incidence of impaction of the fetal head is likely to increase.

The lack of evidence around best practice to deal with this is well reported and the need for further research outlined [7,10].

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JAYPEE BROTHERS

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JAYPEE BROTHERS

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