Quick Hits in Obstetric Anesthesia

Roshan Fernando
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Sioned Phillips
Editors

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To my mother and father who asked me to take up a career in medicine all those years ago. To Anelia and Nia for being in my life during the time it has taken to write and publish the book and for all the fun and encouragement along the way.

Roshan Fernando

I dedicate this book to my father Dr. Mohammad Sultan and my mother Maleka Sultan. Thank you for teaching me dedication, hard work, self-belief and perseverance. I also dedicate this book to the 3 special girls in my life. My wife, Ellile, who has provided me with limitless encouragement, strength and support. And finally, to my 2 daughters, Sofia and Aarya. Thank you for every moment of joy, I cherish every second we spend together.

Pervez Sultan

I would like to thank Toc for his support and advice whilst completing this project.
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Sioned Phillips

Foreword

The demand on obstetric anaesthetists is ever increasing, with the majority of women being cared for within hospital delivery areas, requiring their services. Caring for obstetric patients is very different compared to caring for patients in other surgical settings. Obstetric anaesthetists will frequently administer neuraxial anaesthesia for surgical procedures while women are awake for their operation. They must also take into consideration the effects of anaesthesia on the fetus. The types of obstetric surgical interventions are distinct compared to the routine case-load encountered by junior anaesthetists in the main operating areas of hospital facilities. As well as these differences, the majority of surgery that occurs within the delivery area is emergent in nature and requires prompt anaesthetic input. All of these factors can lead to uncertainty for novice obstetric anaesthetists, and covering delivery wards can be a daunting prospect for many anaesthetic trainees.

Quick Hits in Obstetric Anesthesia is not only aimed at novice obstetric anaesthetists but is also intended for use as a quick reference guide by all grades of anaesthetist. Information is clearly presented and summarises the management of emergency situations and common problems which are encountered while working with pregnant patients. Different anaesthetic 'recipes' and management strategies are presented for common obstetric procedures in addition to trouble-shooting chapters and 'what to do lists' for frequently encountered dilemmas. Quick Hits in Obstetric Anaesthesia includes chapters which are written by leading international experts in the field of obstetric anaesthesia, covering a spectrum of antenatal and postpartum situations when the input of obstetric anaesthetists to multidisciplinary team working is key to ensuring excellent patient outcomes.

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Spinal Anaesthesia for Caesarean Delivery

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Sioned Phillips and Adrienne Stewart

Spinal anaesthesia is the gold standard for providing surgical anaesthesia for caesarean delivery (CD). It allows the mother and her partner to experience the birth of their baby and provides excellent operating conditions for the surgeon. The main concern surrounding the use of spinal anaesthesia is the incidence of spinal induced maternal hypotension, which can occur in up to 80% of parturients if untreated. Another disadvantage of spinal anaesthesia, compared with alternative neuraxial anaesthetic techniques for caesarean delivery, such as epidural or combined spinal epidural (CSE) anaesthesia, is that a fixed dose of local anaesthetic is administered and there is no capacity to administer additional local anaesthetic and extend the time of the effective block. Therefore, if it is anticipated that surgery may be prolonged, an alternative technique such as a CSE technique should be considered.

Contra-indications

- Patient refusal
- Allergy to amide local anaesthetics
- Uncorrected hypovolaemia
- Coagulopathy INR > 1.4, platelets < 70×10^9/L
- Localised sepsis around the insertion site
- Raised intracranial pressure (ICP)

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Consent

The parturient should be seen before elective or emergency caesarean delivery. A history should be taken including any relevant medical and obstetric history, drug history and allergies. A fasting history should be taken and the airway assessed in case of any complication. A brief description of the procedure should follow, including potential risks and complications of the procedure, as well as a careful explanation that they may experience sensations of pressure at times during the surgery and that this is to be expected.

Potential Risks and Side Effects

- Failure to achieve a satisfactory block and the need to convert to general anaesthesia
- Headache (1 in every 100)
- Permanent nerve injury (1 in 23,500–50,500) or paraplegia (1 in 54,500–141,500)
- Common side effects, such as nausea/vomiting, itching, shivering and hypotension

Needles

Atraumatic or Pencil point needles (e.g. Whitacre and Sprotte) are preferred over "cutting" needles (Quincke) as they are less likely to cause a post-dural puncture headache (PDPH), as they separate the dural fibres as opposed to cutting through them. PDPH is said to be due to the development of a leak of CSF through the dural hole. The larger the needle, the bigger the hole in the dura (and the greater the CSF leak) and therefore, the higher the risk of developing PDPH. Although 27G Pencilpoint needles are available and suitable for use, 25G and 26G needles are most commonly used. The incidence of a PDPH with a 25G Whitacre needle has been documented as being as high as 2.5–3% [1, 2], compared with 0–0.5% with a 27G Whitacre [1], therefore, smaller gauge needles such as a 26G Whitacre [3] or 27G Whitacre are recommended for use.

Position

It is often technically easier to insert a spinal with a patient sitting. However, in emergency cases, particularly when there is fetal distress, the lateral position may be more favourable for a number of reasons: it is easier to perform CTG

monitoring; there is improved maternal cardiac output; block height ascends more quickly, reducing the time to surgical anaesthesia; and in cases where there is fetal distress, an anaesthesia assistant can start pre-oxygenating the mother in the lateral position, saving time if there is a need to abandon spinal anaesthesia in favour of general anaesthesia.

A modified lateral position, called the Oxford position, can be used with the aim of preventing excessive cephalad spread of local anaesthetic. Here a pillow is inserted under the shoulders, to limit cephalad spread of local anaesthetic in the lateral position. This position is rarely used, but an understanding of patient position to manipulate spread of local anaesthetic is important.

Intrathecal Drugs and Doses

Local anaesthetic drugs

The gravid uterus results in an increase in intra-abdominal pressure, which is transmitted to the epidural venous plexus. This leads to a decrease in CSF volume, and therefore pregnant patients require a reduction of 25% in the dose of local anaesthetic, to achieve the same block height as a non-pregnant patient. Other factors, such as gestational age will also affect the final height of the block, such that pre-term patients will require more local anaesthetic, as there is less increase in intra-abdominal pressure and subsequent effect on CSF volume.

- Hyperbaric and plain (hypobaric) bupivacaine are the only licenced local anaesthetic drugs for spinal anaesthesia in the UK.
- Hyperbaric bupivacaine 0.5 and 0.75% are the most commonly used local anaesthetics as they have a fast onset of action and produce a reliable, adequate sensory block height. Both preparations contain glucose to increase the density of the spinal solution.
- The **ED95 of intrathecal hyperbaric bupivacaine is 11.2 mg** (when co-administered with an opioid) [4], however doses used to provide surgical anaesthesia for caesarean delivery, documented in the literature, **range from between 8 to 15 mg**. There is a risk of an inadequate block when lower doses are used, and of a high block with higher doses.
- The height of block is dependent on the mass of the drug given as opposed to the drug volume.

Opioid drugs

The addition of opioid drugs to the local anaesthetic will improve both the quality and duration of surgical anaesthesia.

- fentanyl 10–25 mcg—is fast and easy to prepare, therefore good in the emergency situation, however its effect is short acting (1–2 h of postoperative analgesia) and does not provide an adequate period of post-operative analgesia.
- morphine 100–200 mcg—has a slow onset but provides effective long-lasting post-operative analgesia for up to 24hours. Any preparation of morphine used via the intrathecal route must be preservative free. Intrathecal preservative free morphine is less commonly used (compared to intrathecal diamorphine) in the UK compared to many other countries. Intrathecal fentanyl should be co-administered with intrathecal morphine due to, morphines slower onset of action.
- diamorphine 300–400 mcg—is available as a crystalline formulation, requiring dilution for preparation, and so can be time consuming to prepare in an emergency. Its use is recommended in the UK by NICE (National Institute of Health and Care Excellence) as it provides good post-operative analgesia after caesarean delivery [5].

Block Assessment

- A sensory block height to cold sensation to T4, and light touch to T5 is widely regarded as acceptable for caesarean delivery.
- It is also important to test that the sacral roots are blocked prior to surgery, as well as ensuring a dense bilateral motor block in the lower limbs. A lack of motor block usually indicates a poorly functioning spinal.
- Block height and lower limb motor block assessment achieved before surgery should be carefully documented and recorded in the notes.

Common Problems Encountered

- Inadequate block—before surgery: depending on the urgency of surgery, consider a repeat spinal anaesthetic, adjusting and reducing the dose according to the initial block height achieved. May need to convert to general anaesthesia if insufficient time to repeat the block.
- Inadequate block—during surgery: depending on the stage of surgery, consider IV adjuncts such as IV fentanyl, however conversion to general anaesthesia may be required (See Chaps. 56, 9).
- Spinal-induced hypotension—leading to nausea and vomiting: the prophylactic use of a vasopressor infusion such as phenylephrine together with crystalloid co-loading, in addition to reactive phenylephrine bolus doses can be used to facilitate blood pressure control (See Chap. 10).

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Combined Spinal-Epidural Anaesthesia for Caesarean Delivery

7

Marc Van de Velde

Most caesarean deliveries are performed under neuraxial anaesthesia. In the vast majority of cases this is a Single Shot Spinal (SSS) technique (see Chap. 6). Unplanned operative deliveries in women who were initially planning to deliver vaginally and with a labour epidural catheter in place, usually have the epidural topped-up for surgery (see Chap. 8). However, in many institutions or for a variety of indications, combined spinal-epidural anaesthesia (CSE) is performed for caesarean delivery. In this chapter the CSE technique for operative delivery is discussed as well as potential advantages and disadvantages regarding its use.

The CSE Technique

A single interspace, (spinal) needle through (epidural) needle technique is commonly used when performing a CSE [1]. For a description of the technique see Chap. 2 on 'combined spinal-epidural analgesia for labour'.

CSEs can be performed in either the sitting or left lateral positions. Testing of the level and degree of motor and sensory blockade after CSE placement, is performed in a similar manner to block testing after a SSS (see Chap. 56).

Indications

Although a SSS is the preferred technique for most operative deliveries, CSE may have a role to play in certain situations:

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- Prolonged surgery—the availability of an epidural catheter to extend anaesthesia duration in case of prolonged surgery (e.g. obesity, complicated surgery, repeat caesarean delivery, placenta accreta spectrum). A single shot spinal injection produces a good quality block, but of a limited duration (75–120 min). A CSE should be considered for any procedure, which could potentially last beyond this duration.
- History of previous failed or inadequate spinal block.
- Anatomical abnormality (e.g. severe scoliosis), increasing the possibility of an inadequate block with the initial spinal injection.
- Following the removal of an inadequately functioning labour epidural catheter before urgent caesarean delivery. Occasionally a previously sited epidural catheter used to provide labour analgesia is used to provide anaesthesia for surgery using high concentration local anaesthetic drugs, but fails to provide an inadequate level of anaesthesia before surgery starts. In such cases, a low dose (spinal) CSE (followed by an epidural top-up) may be preferable to avoid a potentially high spinal block, which is sometimes associated with a full dose spinal (following an epidural top-up). Naturally, the clinical urgency of proceeding with an emergency caesarean delivery, will dictate which mode of anaesthesia is the most appropriate to be used.
- Hemodynamically compromised parturients—a single shot spinal technique, in which rapid vasodilation could cause haemodynamic compromise, is contraindicated in the presence of certain cardiac comorbidities (e.g. aortic stenosis). A low dose CSE (spinal) followed by an epidural top-up may provide improved cardiovascular stability in these situations compared to a SSS technique.
- Low dose spinal anesthesia can be used to avoid profound hypotension, maternal nausea and vomiting as well as reducing the use of high dose vasopressors such as phenylephrine. Whenever a lower spinal dose is used, a backup epidural catheter is advised to manage or prevent breakthrough pain in cases of prolonged surgery (>45 min). For dosing regimens see below.
- Postoperative analgesia—the epidural catheter can be used for postoperative analgesia if necessary, using a patient controlled epidural analgesia (PCEA) technique with low dose epidural mixtures of local anaesthetic and opioid.

CSE Spinal Doses

Usually, intrathecal hyperbaric/heavy bupivacaine is administered in the intrathecal component of a CSE. A standard dose of heavy bupivacaine used in a SSS (11–15 mg) is administered, although some experienced anesthesiologists may choose to use a lower dose. It is important to note that the duration of anaesthesia is significantly reduced as a result of spinal dose reductions. Clinicians that use a low dose CSE technique typically administer 6–9 mg of heavy bupivacaine, which may result in good anaesthetic conditions for only 40–50 min depending on patient factors such as weight, height and size of the gravid uterus. Therefore, when

surgery is prolonged an epidural top-up should be considered after approximately 40 min (prophylactically) if surgery is ongoing in order to prevent/manage breakthrough sensations or pain. A meta-analysis found that spinal doses of bupivacaine below 8 mg compromised anaesthetic efficacy (requiring increased anaesthesia supplementation via the epidural catheter) despite the benefit of lower side-effects such as nausea/vomiting and hypotension [2].

When the epidural catheter is used to extend the height of the spinal block (qv), prolong the duration or enhance the quality of the anaesthesia block, titrated doses of high concentration local anaesthetic can be administered (such as lidocaine 2% with 1 in 200,000 epinephrine, ropivacaine 0.75%, bupivacaine 0.5%, levobupivacaine 0.5% or chloroprocaine 3%).

A Practical Approach to Using A Low-dose CSE Technique

- Single space, needle-through-needle, CSE performed in the sitting position at the L3-L4 or L4-L5 interspace.
- Loss of Resistance (LOR) to saline.
- Injection of 6.0–7.5 mg heavy bupivacaine with 2.5 mcg sufentanil or 15 mcg fentanyl (with or without intrathecal preservative-free morphine 150 mcg or diamorphine 300 mcg).
- Insertion of an epidural catheter 3–5 cm within the epidural space.
- Supine position with a left lateral tilt, head down position until the anaesthesia block level reaches the T4 dermatome (absence of cold sensation is usually tested, since touch sensation is usually preserved during low dose spinal anesthesia).
- Once the block reaches a level to include the T4 dermatome (to cold sensation), the head down position is no longer needed, and surgery can start.
- If the sensory block does not reach the T4 dermatome, an incremental epidural top-up is given until a T4 level is reached. A suitable epidural top-up could include 5–10 ml of 0.5% levobupivacaine or the same volume of 0.75% ropivacaine.
- If the uterus is not closed within 40 min of the spinal injection, a prophylactic titrated dose of high concentration epidural top-up is administered.
- Some anesthesiologists use an Epidural Volume Extension (EVE) technique when using a low dose spinal as part of a CSE. EVE is a technique which is said to extend a spinal block whereby saline (5–10 mL) is administered via the epidural catheter (or directly through the epidural needle) after the administration of intrathecal local anaesthetic. The aim is to extend the cephalad spread of the sensory block, by a volume effect. However, the effect of EVE has been shown to be equivocal [3].

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Epidural Top-Up for Caesarean Delivery

8

Ryan Howle and Tauqeer Husain

An epidural that has been sited for labour analgesia can be converted to anaesthesia for operative delivery by "topping up" with higher concentrations of local anaesthetic. This is distinct from a de novo epidural, which takes longer to provide adequate anaesthesia when inserted at the time of surgery, and therefore may be impractical for most clinical situations.

Indications

- Operative intervention—e.g. caesarean delivery, perineal repair, manual removal of placenta, examination under anaesthesia
- Trial of instrumental delivery—e.g. forceps, ventouse, Kiwi delivery

Contra-indications

- Inadequate epidural labour analgesia—e.g. missed segments, unilateral block, need for multiple clinician epidural boluses in labour
- Surgical urgency doesn't allow for time to top-up
- Known or suspected accidental dural puncture
- Change in maternal condition that would make epidural top-up unsafe—e.g. major obstetric haemorrhage

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Factors Affecting Decision to Top-up an Existing Epidural Catheter

- Quality of epidural
  - Adequate labour analgesia is usually associated with adequate operative anaesthesia.
  - If the analgesic block has receded, the top-up may take longer to provide surgical anaesthesia.
  - Where epidural analgesia has not been established in labour, an epidural top-up can produce unpredictable operative anaesthesia.
  - If an epidural has been difficult to insert during labour, it should be utilised for operative anaesthesia where possible, as alternative neuraxial procedures are also likely to be difficult to perform.
- Time to delivery/surgical readiness
  - Epidural anaesthesia often takes longer than spinal anaesthesia to establish a clinically appropriate block level. This is also dependent on the top-up regimen used (see below).
  - When planning for time-critical emergency delivery, 10–20 min should be allowed for an epidural top up to provide adequate anaesthesia.
- Maternal well-being
  - The slower onset of action of epidural top-ups, compared to spinal anaesthesia, is often associated with less haemodynamic disturbance in cases of maternal cardiac disease, pre-eclampsia or mild blood loss. However, as the volume of blood loss increases, neuraxial anaesthesia and analgesia becomes increasingly poorly tolerated regardless of whether the spinal or epidural route of administration is used.
  - If there is increased maternal risk from general anaesthesia (e.g. predicted difficult airway), establishment and optimisation of neuraxial anaesthesia should occur as a priority during labour. This will facilitate successful epidural top up for caesarean delivery, if required.

Epidural Top-up Regimens

- Various mixtures are in use [2] and depend on institutional protocols (Table 8.1).
- The addition of fentanyl to the top-up mixture (50–75mcg) can reduce the onset time by up to 2 min.
- 'Fast-mix' solution (local anaesthetic + epinephrine + bicarbonate) can produce surgical anaesthesia within 7 min. However, this needs to be offset with the time

Table 8.1 Methods of epidural top-up (Hillyard et al. 2011) [1]

Epidural top-up mixture (15–20 ml solution)	Block onset time (min)	Intra-operative supplementation (%)
Levobupivacaine 0.5% or Bupivacaine 0.5%	10–18	15–29
Bupivacaine 0.5% (10 ml) + Lidocaine 2% (50:50 mixture)	12	34
Ropivacaine 0.75%	10	13
Lidocaine 2% + epinephrine 1:200,000 (100 mcg)	9–14	8–21

required to prepare the solution (up to 4 min) and the extra risk of drug error during preparation of the solution [3].

- These regimens utilise alkalisation, by the addition of 8.4% sodium bicarbonate, to raise the injectate pH, which in turn increases the amount of lipophilic, unionised local anaesthetic that can diffuse through the nerve cell membrane to block the nerve impulse. This translates clinically to a significantly quicker onset of action, improved pain threshold and density of motor block [4].
- Alkalinisation should be performed using preservative-free sodium bicarbonate, as alternative preparations contain Ethylenediaminetetraacetic acid (EDTA), which may be associated with neurological injury. In the UK, a lack of availability of preservative-free sodium bicarbonate recently has led to the many units using only 2% lidocaine with 1:200,000 epinephrine (or 100mcg).
- This adjusted 'fast-mix' solution is prepared as: 20 ml 2% lidocaine with 0.1 ml 1:1,000 epinephrine (100mcg) added immediately before administration.

How to Top-up

- Test dose—3–5 ml, wait two to three minutes
  - Observe for signs and symptoms of intrathecal or intravascular spread (e.g. rapid onset high block, hypotension, tachycardia, dyspnoea, lip tingling, light-headedness, seizures, arrhythmias).
- Total dose—15–20 ml
  - Delivering a large volume bolus (e.g. 10 ml) at high pressure will encourage rapid dermatomal spread [5]. However, large bolus administration in an untested epidural catheter exposes the patient to the risk of high/total spinal or intravenous spread and local anaesthetic toxicity.
  - Optimal administration would be to deliver 15–20 ml in divided doses after an adequate test dose.

Where to Top-up

- Deciding where to initiate testing and topping up of an epidural catheter requires a balance between the time required to achieve surgical anaesthesia, patient safety and the ability to identify erroneous spread.
- However, once the top-up has commenced, an anaesthetist must remain with the patient until the end of surgery.
- Top-up in the labour room—usually unmonitored and difficult to identify complications. If performed, only administer the test dose and accompany the patient to theatre and attach monitoring at the earliest opportunity.
- Top-up in the operating theatre—extended onset time but improved patient safety.

Block Assessment

The block should be assessed before or immediately after the epidural top-up to identify a baseline, then at regular intervals to determine if the patient has adequate anaesthesia appropriate for surgery. In the presence of an effective analgesic block, a multi-modal approach to block assessment is necessary to assess progression [4, 6].

- Temperature sensation can be assessed with ice or an ethyl chloride spray.
- Light touch can be assessed by the initial "blowing" or "air jet" sensation of the ethyl chloride spray or with cotton wool or tissue paper.
- Motor (Bromage score)—often preserved with an analgesic block (e.g. for labour analgesia) and can remain incomplete after an effective epidural top-up.
- Pain/pinprick—e.g. Neurotip ® (rarely used clinically), skin pinching provides a crude assessment.
- Care should be taken to differentiate completely anaesthetised levels (e.g. absolutely no appreciation of cold) from transition zones where there is some blunting of sensation (e.g. some appreciation of cold) and non-anaesthetised areas (e.g. where there is a complete appreciation/sensation of cold).
- In the anaesthetic literature, adequacy of neuraxial anaesthesia for caesarean delivery has been quoted as a block to light touch up to T5 bilaterally. However, surveys of obstetric anaesthetists in the UK suggest that in practice most favour a block to cold up to T4 bilaterally. The latter approach does not seem to be associated with greater rates of inadequate anaesthesia [7].
- Good clinical practice will be influenced by local guidelines and personal clinical experience. However, it should include assessment and documentation of the upper levels and ideally lower levels (sacral blockade) to both light touch and cold, although in practice (especially in emergency situations) this is rarely documented.

Failed Epidural Top-up

This should not be declared until at least 15 min have elapsed giving sufficient time for the block to establish. Management will depend on clinical urgency, maternal health and projected block progression (time to develop surgical anaesthesia).

- Inadequate block height but good progression—additional boluses of epidural mixture may assist in achieving the required level of anaesthesia. However, care should be taken when the total administered local anaesthetic is approaching the maximal toxic dose (e.g. in a 90 kg woman, local anaesthetic toxic dose limit will be achieved after 27 ml of 2% lidocaine with epinephrine). Administering local anaesthetic slowly when it is certain that the epidural catheter is not in a blood vessel may mitigate some of the risks of local anaesthetic toxicity and allow further small boluses to be administered.
- Poor progression or patchy/incomplete block—consider an epidural bolus or the addition of fentanyl but be prepared to abandon the top-up and to use an alternative technique.

Abandoned Top-up

In situations where an epidural top-up has been abandoned due to a lack of effectiveness, an alternate form of anaesthesia must be identified and initiated.

- Where time critical delivery or maternal health precludes further neuraxial attempts, or when maternal consent for further neuraxial procedures is not obtained, general anaesthesia should be planned for delivery.
- In any other situation, further spinal or Combined Spinal-Epidural (CSE) anaesthesia should be performed, once the epidural catheter has been removed.
- There is some debate about the role of spinal anaesthesia following a failed epidural top-up, with some case reports of unpredictable spread of spinal anaesthesia leading to a high spinal block and the need for emergency intubation. This has led to some suggestions that spinal anaesthesia should be avoided in this situation or the total spinal dose reduced.
- However, the use of spinal anaesthesia, administered in either a full or reduced dose, is routine practice in many institutions following failed epidural top-up. Advocates of reduced doses (typically 20–30% less) argue the risk of high spinal block is due to volume expansion of the epidural space from previous epidural drug administration, which results in a higher dermatomal block level. However, this is not supported by prospective, randomised evidence. Additionally, a reduced dose spinal anaesthetic may expose the patient to another inadequate block, the risks of a second procedure and the need for subsequent general anaesthesia [4].

- A reasonable approach may be to administer a "normal" spinal dose, but take proactive steps to minimise the effects of a high block with careful positioning, intravenous fluids and vasopressors. Alternatively, if a reduced spinal dose is to be administered, it should be as part of a CSE procedure to reduce the risk of further suboptimal anaesthesia.

End of Surgery

Decisions about epidural management after surgery are also required.

- Post-operative analgesia can be provided by administration of a long-acting opioid (e.g. 3 mg diamorphine or 2–3 mg morphine) via the epidural catheter before the end of surgery.
- Most epidurals catheters are removed at the end of surgery, but caution must be employed if there is risk of coagulopathy (e.g. blood loss greater than 1500 ml, Haemolysis Elevated Liver enzymes and Low Platelets (HELLP) variant of pre-eclampsia or pre-delivery coagulopathy) or imminent return to theatre (e.g. on-going bleeding or removal of vaginal packs).
- If an epidural catheter is kept in situ; meticulous monitoring, handover, documentation and follow-up is required.

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General Anaesthesia for Caesarean Delivery

9

Atif Chaudhary and Robin Russell

Indications

- Extreme urgency (maternal or fetal compromise)
- Contraindication to neuraxial block: coagulopathy, sepsis, hypovolaemia, lack of consent
- Patient request
- Inadequate neuraxial block
- Maternal co-morbidities: significant cardiac or neurological disease, abnormal placentation

Contraindications

- Patient refusal
- Predicted difficult airway
- Allergy to general anaesthetic drugs

Pre-Assessment

The degree of pre-assessment depends on urgency of delivery. The follow issues should be addressed:

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- Past medical and anaesthetic history
- Pregnancy-related conditions
- Current medications
- Allergies
- Last food and drink intake
- Airway assessment
- Full blood count & cross-match (where indicated)
- Placental location
- Antacids: intravenous ranitidine 50 mg (unless previously given) OR intravenous omeprazole 40 mg and oral sodium citrate 30 mL
- Consent: include information on difficult intubation, aspiration of stomach contents, accidental awareness, sore throat, nausea and vomiting and postoperative analgesia

Induction of Anaesthesia

Before induction of anaesthesia:

- Patient positioned supine with left uterine displacement. A ramped position or head elevation pillow (Fig. 9.1) may be required for optimal airway management due to an increase in chest diameter and breast tissue
- Trained, dedicated anaesthetic assistant in attendance
- Large-bore intravenous access with fluids running
- Patient monitoring (ECG, non-invasive BP, oxygen saturation, end-tidal gas monitoring)
- Airway equipment checked including available difficult airway trolley. Video laryngoscopes are increasingly used for difficult intubation (Fig. 9.2). Suction readily available

Fig. 9.1 The Oxford HELP (Head Elevation Pillow) Pillow which is used to improve the view at laryngospcopy during endotracheal intubation. Published with permission from Alma Medical, UK

Fig. 9.2 The C-MAC videolaryngoscope which is used to facilitate the view at laryngoscopy during endotracheal intubation. Published with the permission of Karl Storz, Germany

- Pre-oxygenation
- Insertion of urinary catheter
- Surgeons scrubbed and the patient's abdomen cleaned and draped
- WHO checklist performed
- Prophylactic broad-spectrum antibiotics

Traditionally, pre-oxygenation has been performed with a tight-fitting facemask and oxygen flow rates >10 L/min for three minutes. Oxygen at 5 L/min may also be given via nasal cannulae to maintain bulk flow of oxygen during attempts at intubation [1]. Before induction, end-tidal oxygen levels should be >90%. There has been recent interest in the use of trans-nasal humidified rapid-insufflation ventilator exchange (THRIVE) [2]. More research is needed to establish its role in obstetric general anaesthesia.

Rapid-sequence induction is preferred to minimise the risk of aspiration of stomach contents. Cricoid pressure of 10 N force is applied by the anaesthetic assistant as the patient starts to lose consciousness and increased to 30 N when the patient is anaesthetised. If applied incorrectly, cricoid pressure can lead to difficulty with intubation. It may need to be reduced or removed where difficulty occurs although this may increase the risk of aspiration [1].

Drugs for Rapid Sequence Induction

- Thiopental (5–7 mg/kg) OR Propofol (2–2.5 mg/kg)

Thiopental has been used for many years but due to its decreasing popularity in other areas of anaesthesia, many younger anaesthetists are less familiar with its use. High-quality evidence supporting the use of one particular agent in terms of

maternal awareness and neonatal depression is lacking. There may be an increased risk of drug errors with thiopental. The use of either agent is acceptable. Etomidate and ketamine are now rarely used.

- Succinylcholine (1.5 mg/kg) OR Rocuronium (1–1.2 mg/kg)

Succinylcholine has a rapid onset, short duration and muscle fasciculation (not always seen in pregnancy) indicates its effect. However its side effects (myalgia, potassium rise, arrhythmias, trigger for malignant hyperpyrexia, raised intracranial pressure and prolonged duration in cholinesterase deficiency) have resulted in an increasing popularity in rocuronium. There are concerns about rocuronium's longer duration of action if intubation and oxygenation are not possible. Its effects may be reversed with sugammadex. If required within three minutes of administration of rocuronium 1.2 mg/kg, a dose of 16 mg/kg of sugammadex is recommended for reversal of neuromuscular blockade. Rocuronium's side effect profile is favourable when compared to succinylcholine, although cases of anaphylaxis have been reported. As an alternative to rocuronium, atracurium 0.4–0.5 mg/kg can be used although its onset of action is slower.

Obtunding the Hypertensive Response to Laryngoscopy

Laryngoscopy and intubation stimulate a profound hypertensive response which is undesirable especially in women with hypertensive, cardiac or neurological disease. This may be obtunded by:

- Opioids: remifentanil (1–1.5 μg/kg); alfentanil (10–15 μg/kg); fentanyl (1–1.5 μg/kg)
- Labetalol (5–10 mg boluses to effect)
- Esmolol (0.5–2 mg/kg)
- Magnesium (40 μg/kg): caution in patients already receiving magnesium therapy
- Lidocaine (1.5 mg/kg)

The neonatal team should be informed of maternal drug administration at induction of general anaesthesia.

Maintenance of Anaesthesia

Anaesthesia is usually maintained with a volatile agent (sevoflurane or isoflurane) with or without nitrous oxide. Overpressure techniques, in which high concentrations of volatile agents with high fresh gas flows are given initially, are

recommended to reduce the risk of awareness. A minimum alveolar concentration (MAC) value of 1.0–1.5 should be maintained until delivery. Higher inspired oxygen concentrations improve umbilical cord gas values but have not been demonstrated to improve clinical outcome. It is usual to administer 50% oxygen and to ventilate to normocapnia of pregnancy (4.0–4.5 kPa) pre delivery. Intravenous anaesthesia can be used and may be helpful in the presence of uterine atony; however, in the majority of cases no obvious advantage has been demonstrated over volatile-based techniques.

Following delivery, it is usual to administer an oxytocin bolus (3–5 IU slowly) and infusion (10 IU/h). Opioids are usually given after delivery and the concentration of volatile agent reduced. Intravenous fluids are given to replace preoperative deficit and intraoperative losses. Local anaesthetic blocks may be administered by the surgeon during wound closure or by the anaesthetist at the end of surgery. On completion of surgery, anaesthetic agents are discontinued and the patient awoken in either the left-lateral or sitting position. Extubation should occur only when the patient is awake.

Postoperative Management

All patients should receive the same standard of recovery as other surgical patients and should include:

- Supplemental oxygen
- Regular observations: heart rate, blood pressure, respiratory rate and oxygen saturation
- Multimodal analgesia: regular paracetamol, non-steroidal anti-inflammatory drugs (if not contraindicated), and opioids (intravenous patient-controlled analgesia)
- Thromboprophylaxis
- Postnatal anaesthetic review

Problems Specific to General Anaesthesia for Caesarean Delivery

- Failed intubation (see Chap. 64) at caesarean delivery occurs in approximately 1 in 400 cases in the UK [3]
- Volatile anaesthetic agents reduce uterine tone potentially increasing haemorrhage, although this effect can be minimised with oxytocin.
- Accidental awareness (see Chap. 61) is more common in the obstetric population (1 in 600 cases) [4]

- Placental transfer of anaesthetic drugs may have effects on the baby. Opioids are increasingly used at induction to blunt the stress response to laryngoscopy and to reduce the risk of accidental awareness [5]. The neonatal team should be informed of their use.

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Hypotension During Spinal Anaesthesia for Caesarean Delivery

10

Sarah Ciechanowicz and Adrienne Stewart

Background

Hypotension following spinal anaesthesia (SA) for caesarean delivery (CD) causes adverse effects in both mother and fetus [1, 2]. In the neonate, depressed Apgar scores and umbilical acidosis are correlated to the duration and severity of hypotension. In the mother, it causes nausea and vomiting, dizziness and decreased levels of consciousness. Maternal hypotension has been historically defined as a systolic arterial blood pressure (SBP) <80% of baseline, or 90–100 mmHg [3]. The incidence of hypotension following SA is high; therefore prevention and treatment should be principle aims for management, and are discussed in detail in an international consensus [4].

Haemodynamic Changes

SA primarily causes a decrease in systemic vascular resistance (SVR) due to arteriole vasodilation and moderate venodilation from sympathetic blockade. This leads to a compensatory baroreceptor-mediated reflex tachycardia and increase in stroke volume, causing an early rise in cardiac output (the product of stroke volume and heart rate: CO = SV x HR).

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Standards for Monitoring

An accurate baseline blood pressure should be recorded, usually non-invasively using an automatic oscillometric device. Repeated measures should be performed if in active labour, or if a higher value is obtained than expected.

- Repeat measurements every 1–2 min from the induction of SA [5].
- Uteroplacental perfusion relies on both maternal blood pressure and cardiac output. Maternal heart rate (HR) is a surrogate for cardiac output, and so bradycardia should be avoided.
- Continuous blood pressure monitoring with an intra-arterial device or non-invasive pulse contour devices such as the Clearsight® device, may be beneficial in high-risk cases especially in women with cardiac disease.

Vasopressors

The goal of management is to restore the SVR, therefore α adrenergic agonists are recommended as first-line for prevention and treatment of SA-induced hypotension. Phenylephrine, an almost pure α receptor agonist, is currently the agent of choice, with causes less neonatal acidosis and provides superior blood pressure control when compared to ephedrine, which was previously favoured in obstetric anaesthesia to treat SA-induced hypotension [6]. Vasopressors with some β agonist activity may have an even better profile (norepinephrine, metaraminol), but evidence is currently limited [7].

Administration

Prophylactic infusion is superior to reactive bolus administration in clinical practice, as boluses are likely to be delayed and result in more hypotension compared to infusion treatment [8]. A phenylephrine variable rate prophylactic infusion should be started at 25–50 $\mu g.min^{-1}$ immediately after induction of SA and titrated to maintain SBP and HR. Excessive use should be avoided to prevent dose-dependent reductions in both maternal HR and cardiac output [9].

- SBP should be maintained at $\geq 90\%$ of baseline with frequent monitoring.
- Episodes of SBP <80% should be treated promptly with additional boluses of phenylephrine 50–100 μg. Increasing the rate of infusion alone will not work as rapidly as administering a bolus.
- If SBP <90% baseline with a low HR, low dose ephedrine boluses (6 mg) may be used.
- For hypotension <80% baseline, with bradycardia, an anticholinergic (glycopyrronium, atropine) may be needed, but evidence for the routine use of glycopyrronium is lacking [10].

- Persistent hypotension should prompt a search for other causes of hypotension e.g. hypovolaemia, cardiac failure.
- After delivery of the neonate, the phenylephrine infusion may be reduced.

Computer-controlled 'smart pumps'

- More recently, closed loop automated vasopressor delivery systems have been studied that utilise computer controlled feedback algorithms [11].
- For on–off algorithms, the infusion is turned on when SBP is below the threshold.
- In future, these systems may provide better haemodynamic control than clinician-controlled pumps.

Mechanical Strategies

- Avoidance of aortocaval compression should be achieved when supine with left lateral uterine displacement ideally by using a uterine wedge or a 15° operating table tilt. Manual uterine displacement may be more effective, but is difficult to achieve during CD.
- Leg compression with bandages, inflatable boots or anti-thromboembolic stockings may be effective, but results show heterogeneity between methods. Venous compression is likely less effective than more intensive arteriolar compression [12].
- Leg elevation to 30° after SA may reduce the incidence of hypotension, but this is impractical for surgery.

Fluid Strategies

Intravenous fluid-loading techniques can improve cardiovascular stability after SA, but should be used in conjunction with vasopressor prophylaxis [13].

- Crystalloid preloading has limited efficacy in preventing SA-induced hypotension and so is not recommended.
- Crystalloid co-loading (administering a fluid bolus at the time of the spinal) may provide some additional benefit to vasopressor prophylaxis, if infused under pressure early on during the onset of SA [5]. However in routine clinical practice many anaesthetists run the fluid co-load without a pressurised system.
- Colloid preloading (e.g. with hydroxyl-ethyl starch) may be effective but confers no advantage over crystalloid co-loading. 500 ml preload of colloid appears to have a similar benefit to 1000 ml of crystalloid co-load, and so either can be utilised to facilitate the prevention of hypotension with a phenylephrine infusion [14] (Fig. 10.1).

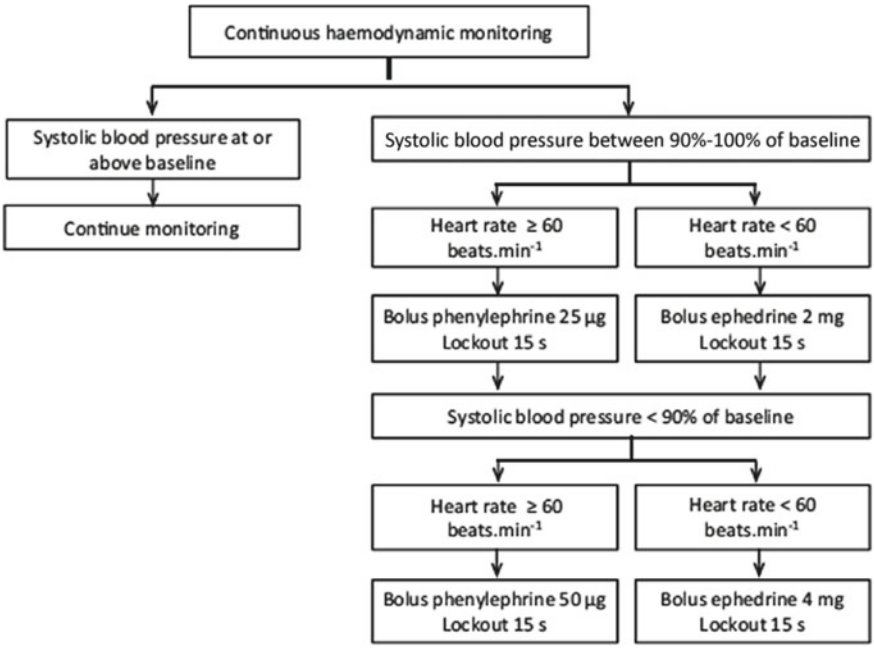

Fig. 10.1 Schematic diagram of the algorithm used in a double-intravenous vasopressor automated system for treatment of hypotension following SA for CD. Reproduced with permission from John Wiley and Sons Publications [15]

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Pain Relief After Caesarean Delivery

11

Amber Naz and Mitko Kocarev

Introduction

Caesarean delivery is associated with moderate to severe postoperative pain, comparable to the pain after abdominal hysterectomy [1]. Post caesarean pain affects the mother's functional capacity during recovery from surgery and taking care of her newborn. It is the most important concern of expectant mothers undergoing caesarean delivery and therefore effective post-operative pain management should aim for visual analogue pain (VAPS) scores of below 3 (on a scale of 0–10) both at rest and on movement [2].

High acute pain scores on VAPS are independent predictors of developing chronic post caesarean pain, which is reported in more than 18% of patients up to 3 months and 6% of patients for up to 12 months after surgery [3].

There appears to be considerable variability amongst patients regarding their pain experience, opioid use, and functional recovery after caesarean delivery [4]; therefore, a systematic approach, beginning with a targeted preoperative assessment tailored to the individual patient's need is necessary for optimum results.

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Multimodal Analgesia

Multimodal analgesia involves the use of a variety of analgesic medication and techniques that target different mechanisms of action in the peripheral and/or central nervous system, with the aim to improve analgesia using their synergistic and additive effects. Post-caesarean pain control strategy is based on various components of the multimodal approach.

Neuraxial Opioids

Neuraxial anesthesia is used as the preferential technique for the majority of caesarean deliveries and neuraxial opioids currently represent the "gold standard" for providing effective and prolonged post-caesarean analgesia. Both the epidural and intrathecal routes have been shown to produce similar pain relief.

- Morphine (preservative free formulation)
  - Hydrophilic opioid, slower onset, prolonged duration of analgesia up to 27 h after a single dose [5]
  - Recommended for postoperative analgesia.
  - Dosing regimen: 0.1–0.2 mg Intrathecal (IT) and 3 mg epidural.

- Diamorphine (a crystalline powder which needs to be reconstituted)
  - Lipophilic opioid; fast onset, a single dose may be effective up to 14 h [6]
  - Recommended for both intraoperative and postoperative analgesia.
  - Dosing regimen: 0.25–0.4 mg IT and 3 mg epidural.

- Fentanyl
  - Lipophilic with a linear molecular structure; very rapid onset; short-lived action of 2–4 h.
  - Excellent intraoperative analgesia however limited postoperative analgesia.
  - Dosing regimen: 10–25 mcg IT. 50–100 mcg epidural.

- Extended-release epidural morphine (EREM) is a unique multivesicular liposome-based delivery system (DepoFoam®), which contains aqueous morphine sulfate. This slow release formulation extends the analgesic period for up to 48 h and reduces the need for supplemental analgesics in comparison with conventional epidural morphine [7]. The recommended EREM dose is 6–8 mg after the umbilical cord is clamped.

Side Effects of Neuraxial Opioids

- Maternal
  - Respiratory depression
  - Nausea and vomiting
  - Pruritus
  - Sedation
  - Urinary retention
  - Reactivation of the oral herpes simplex virus
- Neonatal
  - Respiratory depression

Pruritus; a common side effect, especially with epidural opioids can be managed with opioid antagonists such as naloxone, at a risk of some reversal of analgesia. Prophylactic 5HT3 inhibitors, such as ondansetron, can be used for prevention of nausea, vomiting as well as pruritus [8].

Systemic Opioids

They are the mainstay of treatment in patients who have not received neuraxial opioids and can be used for rescue analgesia in those that have:

- Intravenous patient controlled analgesia (IV PCA)
  - Preferred over other parenteral routes for acute postoperative pain as it provides better analgesia, early ambulation, less sedation and better patient satisfaction [9]. The most commonly used opioids are morphine and fentanyl.
- Oral opioids

These can be included initially as part of a multimodal approach or as a "step down" oral alternative after initial IV PCA. They are an integral part of patient controlled oral analgesia (PCOA) treatments that enable patients to manage their own pain medication [10]. A Cochrane review in 2015 concluded that an ideal oral analgesic regimen has not yet been proven [11]. Some recommended drugs regimens are shown in Table 11.1.

Table 11.1 Recommended oral opioid analgesic regimens

Opioid oral analgesic	Recommended dose/interval	Side effects	Comments
Morphine immediate release tablets/oral solution	10–20 mg PO q4 h	Mu agonist class side effects[a]	Can stimulate histamine release, hypotension, bronchospasm
Codeine	30–60 mg PO q6 h	Mu agonist class side effects[a] light headedness, dizziness, shortness of breath	Active metabolite is morphine. Some individuals may metabolize codeine to morphine more rapidly. Prolonged exposure may cause higher than expected levels of morphine in breast milk leading to severe adverse events in infants [12]. Should not be used by breastfeeding mothers
Oxycodone immediate release tablets	5–10 mg PO q4–q6 h	Mu agonist class side effects[a]	Oral oxycodone-based post-operative oral regimen has been found equi-analgesic to intrathecal morphine after caesarean delivery [13]
Oxycodone extended release tablets	10–20 mg PO q12 h		
Tramadol 50 mg PO q8 h	50 mg PO q8 h	Dizziness, nausea, constipation, headache, sedation, dry mouth	Mixed mu agonist opioid and noradrenaline and serotonin (5-HT) reuptake inhibitor. Increased risk of seizures with high doses (>400 mg/day) or history of seizure disorder

[a]Common side effects of mu agonists include respiratory depression, sedation, nausea, vomiting, constipation, pruritus; less commonly euphoria and dysphoria

Non-Steroidal Anti-Inflammatory Drugs (NSAIDS)

These have been found to be very effective in post caesarean pain and decrease opioid requirements by 30–50% [14]. There are not many comparative studies between various NSAIDS and their use is directed by availability and institutional preferences.

- Diclofenac 50 mg PO q8hrly.
- Ketorolac 30–60 mg IV/IM q8hrly

- Celecoxib a selective cyclooxygenase-2 (COX-2) inhibitor, 200 mg or 400 mg PO single dose [15, 16], can be considered in patients at risk of gastrointestinal and renal side effects of other non-selective NSAIDs.

Paracetamol has additive and synergistic effects with NSAIDS and reduces opioid requirements by 10–20% [17].

- A common dosing regimen is 1 gm PO or IV Q6 h.

Adjuvants

- **Anticonvulsants**: Gabapentin and pregabalin, when used as part of a multimodal regime, have been found to increase the quality of postoperative analgesia and reduce opioid consumption [18, 19]. However, the evidence in the setting of caesarean delivery is inconclusive [20, 21]. Side effects including sedation, visual disturbances and a high maternal to fetal transfer ratio limit the routine use of these drugs, especially preemptively. Currently, there is insufficient evidence to support the use of gabapentin in standard analgesic practice, but it may still be considered for patients at higher risk of experiencing severe post-caesarean pain.
- **Ketamine**: Sub-anaesthetic intravenous doses of ketamine 0.15–0.5 mg/kg have been found to have benefit in the setting of caesarean delivery under general anaesthesia (GA) but not under spinal where neuraxial opioids have already been used [22]. This drug may again have a role as a preemptive analgesic in patients in whom pain is difficult to manage.
- **Clonidine**: This has been used as an adjunct with intrathecal local anaesthetics and shown to increase the duration and quality of post-operative analgesia. However, the side effects of sedation and maternal hypotension may limit its routine use for post caesarean delivery pain. It can be considered for persistent post caesarean pain as it may reduce the pain sensitization and perceived increase in pain intensity over time ("wind-up") [23].

Patient Controlled Epidural Analgesia (PCEA)

Although not recommended for routine use because of undesirable side effects such as delayed ambulation, increased nursing workload, cost and epidural catheter related complications, PCEA, may still be worthwhile in certain situations:

- Opioid-tolerant patient (history of chronic pain, substance abuse disorder)
- Non-availability or contraindication to opioids
- Contraindications to NSAIDS.
- Rescue analgesia where multimodal regimens are inadequate.

Transverse Abdominis Plane Block (TAP)

Evidence suggests that TAP blocks are effective in providing pain relief after caesarean delivery under general anaesthesia (GA) [24] and spinal anaesthesia without long acting opioids such as morphine [25]. Additionally, intrathecal morphine is found to be associated with superior analgesia compared with TAP block alone [25]. The spread of local anaesthetic within the fascial plane provides effective analgesia to the abdominal wall, but the visceral pain arising from the abdominal cavity remains untreated. However, it appears that more posterior block approaches may increase the duration and quality of analgesia [26] possibly by producing some degree of block along the thoracolumbar sympathetic chain.

TAP blocks can be effectively used:

- When GA has been used for caesarean delivery.
- When long acting neuraxial opioids have not been used.
- Rescue analgesics if pain is predominantly from the incision site and not visceral.

TAP blocks can be used with bilateral continuous infusion catheters and with additives such as clonidine along with local anesthetics.

Quadratus Lumborum Block (QLB)

QLB is a relatively novel fascial plane block. It has been shown to provide effective pain relief after caesarean delivery [27]. Compared to the TAP block, QLB is associated with extended spread of local anesthetic providing superior quality of analgesia with longer duration and reduced morphine consumption [28]. A recent study on cadavers showed that the injected contrast can spread cranially to the thoracic paravertebral space and intercostal spaces reaching the somatic nerves and the thoracic sympathetic trunk [29]. However, the level of sensory block achieved with QLB varies with the location of injection. Currently, anterior, posterior, lateral and intramuscular approaches have been described. The optimal approach for caesarean delivery has yet to be determined.

Summary

Post caesarean pain remains an inadequately managed entity with significant inter-patient variability that warrants identification of patients at high risk, and their management with the use of analgesic regimens tailored to individual needs (Fig. 11.1). The initial strategy includes targeted preoperative assessment followed by utilization of intraoperative interventions such as intrathecal/epidural morphine

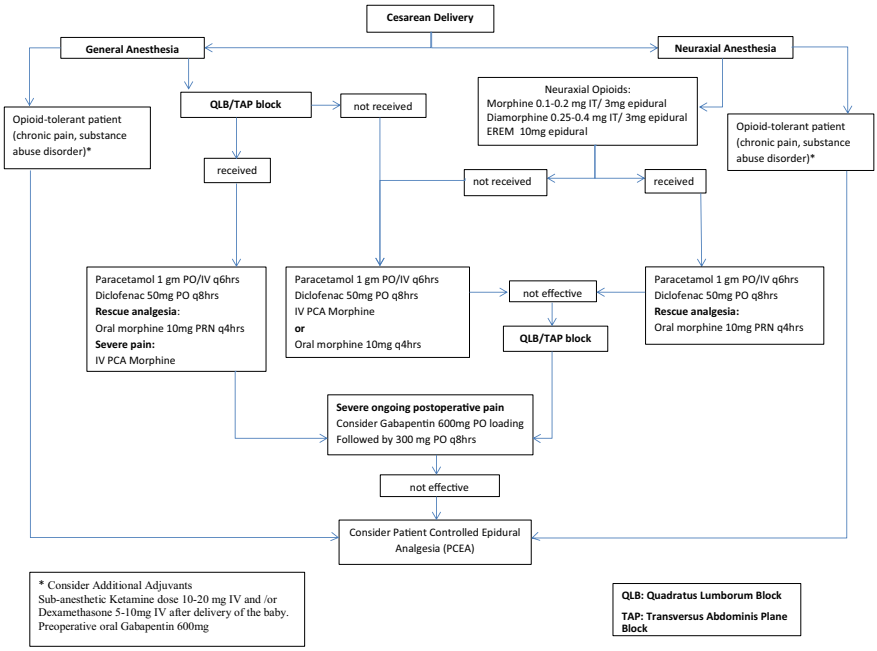

Fig. 11.1 Cesarean delivery postoperative pain management algorithm

if neuraxial anesthesia has been used, or TAP/QLB block for caesarean delivery under general anaesthesia. Subsequently, multimodal analgesia is essential in providing adequate post-operative pain control. This approach should ensure improved maternal functional capacity and facilitate her recovery after caesarean delivery.

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Manual Removal of Placenta

12

Rebecca Brinkler and John Dick

Indication

Retained placenta.

Incidence

Incidence of retained placenta is 2% of all deliveries worldwide.

Definition of Retained Placenta

- Retained placenta is defined as failure to deliver the placenta within 30 minutes of birth with active management and within 60 minutes of birth with physiological management [1].
- In an actively managed 3rd stage 98% of placentas are delivered within 30 minutes while in a conservatively managed 3rd stage it can take up to 60 minutes for 98% of placentas to deliver.

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Pathophysiology of Third Stage of Labour

- Normal expulsion of the placenta occurs due to contraction of the retroplacental myometrium leading to shear stress on the maternal surface of the placenta, which causes it to detach. Myometrial contractions then expel the placenta from the uterus.
- The placenta can be retained due to failure to detach from the myometrium (placenta adherens) or a failure to be expelled from the uterus as a result of a closing cervix (trapped placenta).
- Active management consists of administering a uterotonic, uterine massage and traction on the cord as well as emptying the bladder.
- If the placenta has not been delivered within 1 hour of active management or there is significant ongoing bleeding, manual removal of the placenta needs to be performed, usually under anaesthesia.

Risks Factors Associated with Retained Placenta

- Previous retained placenta
- Previous injury to uterus
- Abnormal placental implantation
- Preterm delivery
- Induced labour
- Multiparity
- Stillbirth
- Maternal age >30 years.

Complications of Retained Placenta

(1) Postpartum haemorrhage (PPH)
    - Primary PPH. The bleeding risk begins to increase 20–30 minutes after delivery of the neonate.
    - Secondary PPH. This may occur with unrecognised retained placental tissue.
(2) Postpartum endometritis
(3) Uterine inversion
(4) Cervical shock.
    - The placenta separates, but lies above the cervix without it being expelled as normal. Marked bradycardia and hypotension can occur due to increased vagal tone.

Anaesthetic Management of a Patient Undergoing Manual Removal of Placenta

- Either neuraxial or general anaesthesia
- When planning the anaesthetic technique, it is important to consider whether there has been significant blood loss leading to haemodynamic compromise or coagulopathy. In either case a neuraxial block would not be appropriate.
- Clinical assessment of the patient's haemodynamic state should take place in addition to measuring visible blood loss
- Always consider the possibility of concealed blood loss.
- Delays in going to the operating theatre due to scheduling of more urgent cases can result in ongoing bleeding and hypovolaemia.
- The patient may need resuscitation prior to induction of anaesthesia.

Surgical Procedure (Fig. 12.1) [2]

1. Full aseptic precautions are implemented, with the operator often wearing arm length gloves to insert one hand into the uterine cavity (Fig. 12.1).
2. The placental edge is identified and is steadily detached with the fingers until separated.
3. The other hand is placed on the abdomen and maintains fundal pressure, pushing downwards towards the opposite hand, which is within the uterine cavity.
4. Ultrasound guidance is often used to ensure complete removal of any retained products.
5. There is a risk of uterine perforation and inversion.
6. Occasionally a placenta remains adherent and this requires senior obstetric input for further management.

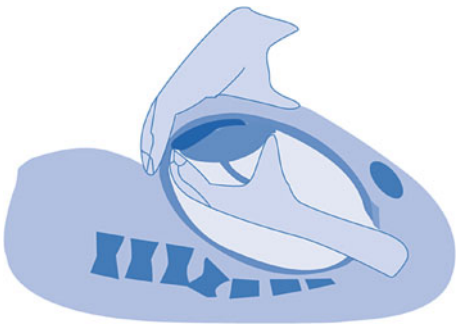

Fig. 12.1 Manual removal of the placenta (manoeuvre of Credé). Figure reproduced from: Obstetric management of labour, delivery and vaginal birth after caesarean delivery. Devlieger R, Smet M-E. In Oxford Textbook of Obstetric Anaesthesia. Eds. Clark V, Van de Velde M, Fernando R. Oxford University Press 2016. Published with permission from Oxford University Press through PLSclear

General Anaesthesia

- Airway risk in a postpartum patient must be assessed and managed in the same way as any pregnant patient.
- Antacid prophylaxis should be administered before a standard rapid sequence or modified rapid sequence induction including pre-oxygenation.
- Maintenance of anaesthesia is usually with a volatile agent such as sevoflurane.
- Volatile agents relax the uterus and may allow easier removal of the placenta; however they may also lead to increased bleeding as a result of reduced uterine tone. Therefore, a minimum alveolar concentration (MAC) of ≤ 1 is usually administered.

Neuraxial Anaesthesia

- This is the preferred method of anaesthesia.
- There are no guidelines regarding ideal block height.
  - A block to T10 was previously thought to be adequate as this covers the innervation of the uterus. However, the bimanual technique of placenta removal requires palpation of the uterus through the abdomen, which causes abdominal discomfort. It has been shown that there is significant reduction in discomfort when the spinal block height is at a T6 dermatome level or above, compared to a block height to a T9–T10 dermatome level. An increased block level has not been shown to increase the incidence of intraoperative hypotension [3].
- For spinal anaesthesia we would recommend using a dose of hyperbaric bupivacaine (e.g. 10–14 mg) adequate to achieve a sensory block level height to T4 or above. Intrathecal opioids such as fentanyl 15 mcg may improve the quality of the block.
- If there is a pre-existing labour epidural analgesia catheter in place, then this can be used to provide surgical anaesthesia using high concentration local anaesthetics such as: 2% lidocaine with epinephrine, 0.5% levobupivacaine or 0.75% ropivacaine; using a volume between 10 and 15 ml. Epidural opioids such as fentanyl 50-100 mcg added to the local anaesthetic may improve the quality of the block.

Pharmacological considerations

- Oxytocin—A bolus (5 units) may be given to assist separation followed by an infusion after removal to assist uterine contraction (e.g. 40 units in 500 mls 0.9% saline at 125 mls/h i.e. @10 units/h).
- Carboprost—250 mcg IM, maximum dose 2 mg. May also help control bleeding in addition to oxytocin.

- The use of ergometrine (500 mg intramuscularly) is controversial since it may constrict the cervix making placental removal more difficult.
- Glyceryl trinitrate (GTN)—If the cause of placental retention is due to obstruction behind a contracted cervix, GTN (2 sublingual sprays—2 × 200 mcg metered doses) will relax the uterus/cervix. Alternatively, an intravenous bolus of 50–250 mcg can be given. Hypotension and bleeding (due to uterine relaxation) are possible complications.
- Antibiotics—Manual removal of the placenta is associated with an increased risk of endometritis, therefore the World Health Organisation (WHO) recommend prophylactic intravenous antibiotics prior to commencing this procedure.

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Cervical Cerclage (Insertion and Removal)

13

David Monks, Pervez Sultan, and Methodius Tuuli

Definition

The term cervical cerclage describes the placement of a circumferential suture at various anatomical sites along the length of the cervix. The types of cervical cerclage are summarized in Table 13.1.

Indications

Cervical cerclage is performed, in women with presumed or evident cervical insufficiency, to prevent loss of the pregnancy. This is due to either an inherent or acquired (previous trauma/surgery) weakness of the cervix and cerclage provides structural support to maintain the fetal membranes within the uterus and may also prevent ascending infection through maintenance of cervical length and

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Table 13.1 Types of cervical cerclage

Procedure	Description	Typical duration of procedure (min)
Transvaginal cerclage (McDonald)	Purse-string suture placed at the *cervico-vaginal junction* (no bladder mobilzation)	20–40
High transvaginal cerclage (Shirodkar)	Purse-string suture placed *above the level of the cardinal (uterine) ligaments* following bladder mobilization	30–60
Transabdominal cerclage (TAC)	Placed at the *cervico-isthmic junction* via a laparotomy (often Pfannensteil incision) or laparoscopy	60–90
Occlusion cerclage (OC)	An attempt to retain the endocervical mucus plug by a continuous non-absorbable suture at the *external cervical os*	20–40

Table 13.2 Indications for cervical cerclage

Indication	Description
History-indicated cerclage (HIC)	The insertion of a *prophylactic cerclage* in women with a gynaecological or obstetric history that suggests that they are at higher risk of spontaneous second-trimester loss or pre-term delivery. A HIC is normally inserted at 12–14 weeks of gestation
Ultrasound-indicated cerclage (UIC)	This is performed as a *therapeutic measure* on asymptomatic women when cervical shortening is observed on transvaginal ultrasound, often between 14 and 24 weeks of gestation
Exam-indicated cerclage	This is a *salvage procedure* when premature dilatation of the cervix leads to herniation of fetal membranes into the vagina

preservation of the endocervical mucus plug. Indications for cervical cerclage are summarized in Table 13.2 [1, 2].

Contraindications

Contraindications include multiple pregnancy, chorioamnionitis, ongoing vaginal bleeding, pre-term premature rupture of membranes (PPROM) and active labor.

Anesthestic Management

Cervical cerclage is routinely performed as a day case procedure. The anesthetic used to facilitate this varies widely across the UK and globally. The most common anesthetic techniques utilized are spinal or general anesthesia (GA) and, less

commonly, epidural, combined spinal-epidural (CSE) anesthesia or pudendal nerve block. The choice is influenced by the specific procedure, indication, maternal choice and risk/benefit for mother and fetus. One large retrospective study assessed the anesthetic technique for cervical cerclage and found no differences in obstetric outcomes and only marginal differences in recovery times (shorter after GA) and post-procedural analgesic requirements (greater after GA) [3].

Regardless of anesthetic technique chosen, the following should be considered in all cases:

- Prophylaxis to avoid aspiration—fasting according to national/institutional guidelines. Consideration also should be given to the use of ranitidine and metoclopramide prior to surgery in order to reduce acidity and volume of gastric secretions.
- Precautions to avoid hypotension and placental insufficiency.
- Position using left uterine displacement when gestational age >18–20 weeks.
- Fetal heart rate monitoring (depending on institutional policy and whether pre-viable gestational age).
- Possible need for uterine relaxation.

Spinal Anesthesia with Hyperbaric Local Anesthetic

This technique works very well for *prophylactic sutures (HIC and UIC)* as it provides quick and reliable anesthesia of the vagina and perineum (S2–4) and cervix (T10–L1). Decisions regarding local anesthetic, dose and supplemental opioids are made with the usual considerations required for ambulatory care. A commonly-used regimen is hyperbaric bupivacaine (7.5–12.5 mg) ± fentanyl (10–20 mcg) but shorter acting agents such as prilocaine or chloroprocaine are used, routinely, in some centres. A block to the level of the T10 dermatome is usually desirable prior to commencing the procedure. Since the operator may request a Trendelenburg position in certain circumstances, some anesthesiologists may choose to keep the patient seated for 2–3 min following intrathecal injection in order to produce a "saddle block," and to minimize cephalad spread upon positioning.

The use of minimally effective doses, short-acting opioids, judicious intraoperative fluid therapy and emptying of the bladder at the end of the procedure, can obviate the need for urinary catheterization although vigilance for post-operative urinary retention is essential.

General Anesthesia

There are certain scenarios where GA may be preferred to a neuraxial technique. This decision should be made after consideration of the risks in individual patients and discussion with the operating team, particularly regarding the surgical technique and risk of rupture of membranes.

Disadvantages of General Anesthesia

- *Risks to the fetus of in-utero exposure to GA:* animal studies have demonstrated the neurotoxicity of most anesthestic agents as evidenced by neuronal apoptosis and long-term behavioural deficits [4]. There is some data from humans suggesting an association between exposure to GA agents during cesarean delivery and autism [5]. These findings are however limited by their observational nature and further studies are required.
- *Risk of failed intubation:* although the risk of failed intubation in parturients is known to be higher than in the non-pregnant population, the physiological changes and clinical circumstances that confer this increased risk are arguably more relevant during the latter stages of pregnancy than the early second trimester. Routine airway assessment and planning for GA however, should remain routine practice prior to cervical cerclage.
- *Risk of pulmonary aspiration:* the incidence of aspiration in fasted patients undergoing elective cervical cerclage in the second trimester is uncertain, although a large retrospective cohort of women having deep sedation in the second trimester to facilitate dilation and evacuation of products of conception demonstrated a low incidence of pulmonary aspiration (0.08%, 95% CI 0.01–0.29%) [6]. Should assessment of aspiration risk be low, second-generation supraglottic devices are considered safe by many anesthesiologists.

Advantages of General Anesthesia

- *Improved surgical access*: some operators prefer the surgical conditions provided by GA when performing abdominal cerclage.
- *Reduced risk of ruptured membranes*: in rescue cerclage, it is proposed that GA can minimize rises in intrauterine pressure by: avoiding positioning the patient

for neuraxial anesthesia; employing the tocolytic effects of inhalational agents; and facilitating the steep Trendelenburg position. These theoretical advantages, however, are not supported by conclusive evidence.

Potential Risks Associated with Cervical Cerclage

- Rupture of fetal membranes
- Pre-term labour and associated neonatal morbidity and mortality
- Bleeding
- Infection
- Cervical lacerations
- Cervical stenosis (delayed onset)
- Uterine rupture (onset of labor prior to cerclage removal)

Removal of Transvaginal Cerclage

This is often performed without anesthaesia at 37–38 weeks but transabdominal cerclages are most commonly removed at the time of cesarean delivery or may be maintained for future pregnancies.

Discharge Criteria

Standard discharge criteria for day case/ambulatory care procedures apply.

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External Cephalic Version

14

Ruth Shaylor and Carolyn F. Weiniger

Background and Indications

Breech presentation occurs in 3–4% of pregnancies [1]. Vaginal delivery for breech presentation is associated with increased neonatal morbidity and mortality [2]. There is also epidemiological evidence that children born via vaginal breech delivery do not perform as well at school in terms of exams results later in life compared to children presenting with breech presentation born by caesarean delivery or vertex presentation born by vaginal delivery [3]. Consequently, breech presentation is associated with a high incidence of caesarean delivery [4], despite caesarean delivery being a high contributing factor to maternal morbidity and mortality.

External cephalic version (ECV) is a procedure that can turn the fetus from breech to cephalic presentation whilst in-utero and allow the mother to attempt vaginal delivery. ECV should be offered to all women who are at least 37/40 weeks gestational age with a fetal breech presentation and without contraindications to the procedure or vaginal delivery [5]. It has an overall success rate of approximately 60% [4].

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Contraindications

Absolute contraindications:

- Any contraindication to vaginal delivery
- Multiple gestation (although the second twin may undergo ECV after delivery of the first)
- Placenta accreta or praevia
- Non-reassuring baseline fetal heart rate
- Patient refusal.

Relative contraindications:

- History of placental abruption
- Uterine anomalies
- Suspicion of ruptured membranes
- HELLP syndrome (hemolysis; elevated liver enzymes; low platelet count)
- Pre-eclampsia or severe pregnancy-induced hypertension
- Fetus with congenital abnormalities
- Fetal growth restriction (estimated fetal weight [EFW] <5th percentile).

Performing ECV

(1) Ultrasound to confirm fetal breech position,
(2) Obtain full informed consent,
(3) Perform baseline cardiotocography (CTG) to assess fetal wellbeing and to identify underlying uterine contractions.
(4) Consider administering a tocolytic. Protocols vary among institutions. Commonly administered agents include either terbutaline subcutaneously or nifedipine orally. Side-effects of tocolysis can include maternal tachycardia.
(5) ECV should be performed under fetal monitoring (ultrasound can be used to identify the fetal heart rate) and operating facilities should be readily available.
(6) When the uterus is relaxed the obstetrician lifts the fetal feet out of the pelvis and then places one hand on the fetal head and one on the fetal buttocks and attempts to turn the fetus in a forward roll motion.
(7) If that is unsuccessful then a backward roll may be attempted. Up to three attempts should be allowed per procedure with full assessment of fetal well being between attempts.
(8) After the procedure, fetal monitoring should continue until the trace is reassuring and has returned to baseline.

(9) If the ECV is unsuccessful then a second attempt may be offered at a later date.
(10) After ECV, the parturient may be discharged with the aim for vaginal or caesarean delivery at a later date depending on the outcome of the procedure.

Pain Management

- ECV may be uncomfortable for the parturient and abdominal guarding decreases the success rate. Neuraxial block may provide maternal comfort and abdominal wall relaxation.
- Several studies have reported that a block to neuraxial *anesthesia* density is associated with improved ECV success rates [6, 7].
- Neuraxial block to *analgesic* density is not associated with increased ECV success.
- It is important that the obstetric anesthetist working within the delivery suite is aware of such patients in case any complications occur (see below).
- In many countries/institutions (such as the within the UK), neuraxial analgesia or anaesthesia are not routinely offered for this procedure (Fig. 14.1).

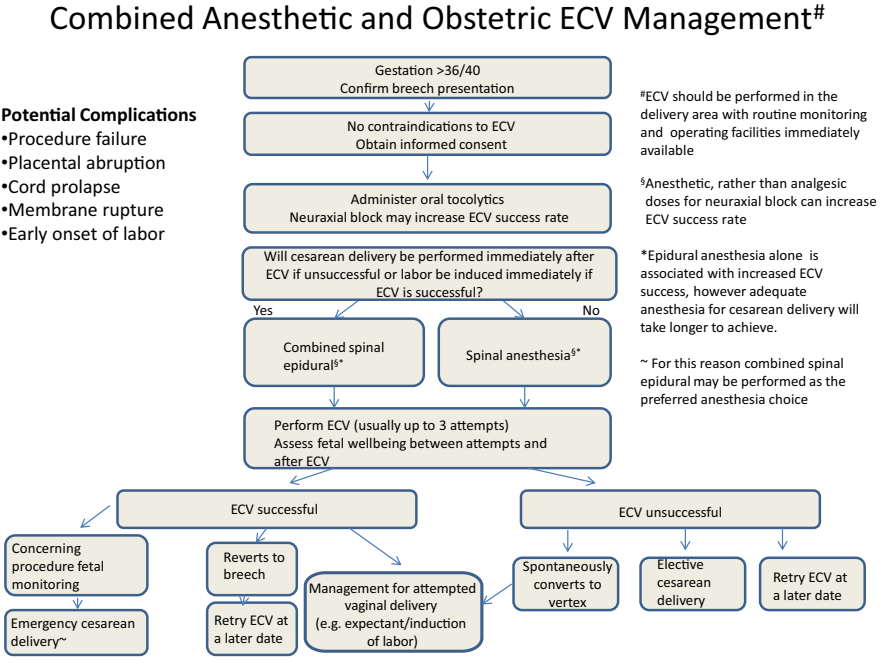

Fig. 14.1 Combined anesthetic and obstetric management of external cephalic version

Anaesthesia for ECV

- A specific anesthesia assessment and consent should be obtained for neuraxial anesthesia (see Chaps. 6 and 8).
- The patient should be fasted and receive antacid prophylaxis.
- The procedure should be performed in the operating room to facilitate speedy conversion to caesarean delivery if required. If this is not practical then it should be performed in an area with full anesthetic monitoring and an obstetric team with full operating facilities readily available if there is a need for urgent operative delivery.

Spinal versus CSE anaesthesia technique?

- If the likelihood for requirement of emergency caesarean delivery is deemed to be low and there are no plans to perform an elective caesarean delivery if the procedure is successful, then spinal anesthesia alone can be suitable, however a combined-spinal epidural (CSE) technique enables more flexibility in the decision process.
- If planned conversion to elective cesarean delivery in the event of unsuccessful ECV is likely, a CSE technique should be considered with a suitable local anesthetic dose.
- Consider administering a short-acting intrathecal opioid such as fentanyl in addition to the local anesthetic dose (for recommended doses see below), and a long-acting opioid via the epidural catheter if cesarean delivery is performed.
- Following the ECV, maternal monitoring is required in an appropriate setting such as the recovery room or a monitored labor ward bed until the return of motor and sensory function.

Spinal and CSE dosing strategies

Practice varies widely among institutions regarding neuraxial block technique, drug and doses, sensory and motor block target of the drug administered. Local ECV logistics such as the setting where ECV is performed also vary.

- Aim for a sensory dermatome block height to T6
- A typical spinal regimen for an ECV can consist of 7.5–10 mg hyperbaric bupivacaine with 15 mcg fentanyl.
- There may be a role for shorter acting agents such as intrathecal prilocaine providing quicker recovery and hospital discharge following ECV procedure.
- The epidural catheter can be used to achieve the desired block height with lower intrathecal bupivacaine doses.
- The epidural catheter can also be used to:

(1) provide analgesia for labour
(2) to provide anaesthesia for caesarean delivery
(3) administer epidural long-acting opioids such as morphine for postoperative analgesia if a caesarean delivery is performed.

Complications [4]

- Procedure failure
- Placental abruption
- Cord prolapse
- Membrane rupture
- Early onset of labor

Changes in fetal heart rate are not uncommon during ECV but usually settle after the procedure is completed. If the ECV is performed under single shot spinal anesthesia, the duration of anaesthesia may be inadequate to cover emergency caesarean delivery. The conversion rate to emergency caesarean delivery is 0.45–1.6% at the time of ECV procedure in experienced centers [8]. ECV at term is safe, decreasing the rate of cesarean delivery from 95% without ECV to 20% with ECV, reducing the likelihood of maternal morbidity [9], and is associated with a decreased likelihood of cesarean delivery in subsequent pregnancies [10].

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Artificial Rupture of the Membranes

15

Priyanka Sara and Pat O'Brien

Artificial rupture of the membranes (ARM), also known as amniotomy, is a procedure in which the membranes containing the amniotic fluid (liquor) around the fetus are accessed through the cervix and broken or ruptured deliberately. In order to perform ARM, the membranes must be physically accessible through the cervix, i.e. the cervix needs to be at least 1 cm dilated.

Indications

- To initiate labour (induction of labour/IOL)—not used alone, usually followed by oxytocin augmentation [1, 2]. (see Chap. 32 Augmentation of Labour)
- To augment/accelerate the process of labour
- To allow application of a fetal scalp electrode or fetal scalp blood sampling (for measurement of pH/lactate).

Contraindications

- Placenta praevia
- Vasa praevia
- Umbilical cord presentation
- Malpresentation—breech/transverse lie

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- High fetal head within the pelvis (relative contraindication—see below)
- Preterm labour (relative contraindication, normally allowed to progress spontaneously)
- Caesarean delivery required for another reason
- Previous classical caesarean delivery/>2 caesarean deliveries
- Maternal/fetal anatomical abnormality that contraindicates vaginal birth
- Active primary genital herpes/maternal HIV with a high viral load.

Procedure

See Fig. 15.1.

Setting and Preparation

- Preferably performed within the delivery area or birth centre and not on the antenatal ward, as ARM can sometimes lead to unexpected complications such as umbilical cord prolapse or placental abruption.
- Confirm that the fetal presenting part is cephalic and engaging/entering the pelvis.
- There is a significant risk of umbilical cord prolapse if:
  - The head is "floating" free above the pelvis
  - There is an unstable lie of the fetus
  - Polyhydramnios (large amniotic fluid volume) is diagnosed.
- If the risk of cord prolapse is considered to be high, ARM may be performed in the operating theatre in case emergency caesarean delivery is required.
- In rare situations during induction of labour following the initial first step of administering prostaglandins, if the cervix has not adequately opened and

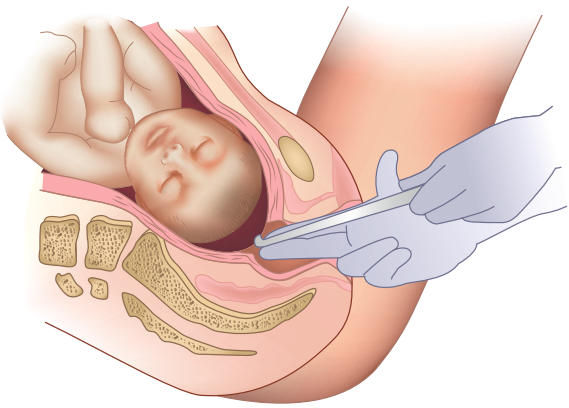

Fig. 15.1 Rupture of the membranes using an amnihook

ripened (<1 cm and long), vaginal examinations and ARM can be uncomfortable and painful due to both prostaglandin effects and technical difficulties of performing an ARM. In such instances, epidural analgesia should be considered prior to an ARM attempt.

- If ARM is not possible, this can be described as "failed IOL" and can be converted to a category 2 emergency caesarean delivery.
  - In high risk cases performed in the operating theatre (high risk for cord prolapse and difficult ARM), women should be adequately fasted and antacid prophylaxis administered since there is a possibility that caesarean delivery will be required.
  - In situations where the presenting fetal head is high and not within the pelvis, a 'controlled' ARM should be performed, allowing the amniotic fluid to drain slowly, perhaps with some pressure on the fundus of the uterus to push the fetal head further into the pelvis.

Procedure (for a Right-Handed Examiner)

- Counsel and explain the procedure to the woman as it can cause discomfort; ask her to empty her bladder and position her for an ARM.
- 2-finger vaginal examination with the right hand to assess the cervix and feel the membranes. The left hand holds and guides the amnihook to break the membranes as shown in the figure.
- Check the colour of liquor (meconium/blood tinged/clear) and amount (no/minimal/copious).
- Check the fetal heart rate, as transient fetal heart decelerations can occasionally be triggered by umbilical cord compression after ARM.

Anaesthetic Considerations

Pain Management

ARM can usually be performed with no analgesia or simple analgesia such as paracetamol/intramuscular opioids such as morphine/diamorphine, or inhaled Entonox®. However, in a minority of cases when the woman finds it too painful (for example, when the cervix is very posterior in the vagina and only 1 cm dilated), there is a role for epidural analgesia using analgesic doses (similar to initiation of labour epidural rather than anaesthetic doses for caesarean delivery) to facilitate the ARM procedure. ARM alone may be enough to trigger labour; if not, further augmentation with oxytocin may be required.

Managing the Risks

Complications after ARM are uncommon, but umbilical cord prolapse, revelation of frank blood-stained liquor and fetal bradycardia with placental abruption have been reported. Even though ARM in certain cases carries a risk of cord prolapse [3, 4], a Cochrane review of amniotomy for augmenting spontaneous labour demonstrated no difference between ARM versus no ARM, in the incidence of cord prolapse (RR 1.00, 95% CI 0.14–7.10). This would suggest that artificial membrane rupture carries a low risk of cord prolapse provided clinical judgement is made as to its safety in individual women [5]. Depending on the maternal and fetal condition, emergency caesarean delivery may occasionally be necessary. This would most likely necessitate a general anaesthetic if neuraxial anaesthesia had not already been administered.

- The obstetric anaesthetist within the delivery area should be aware of any woman at high risk of cord prolapse after a proposed ARM, who does not have an epidural in situ.
- This would allow an assessment regarding any potential difficulties in administering a GA in an emergency (for example obesity or difficult airway) and a management plan between the obstetrician and anaesthetist to be made prior to the procedure.

Efficacy

Although amniotomy appears to be effective for inducing labour when the cervix is favourable, when compared with vaginal prostaglandins, it is associated with more frequent need for oxytocin augmentation. The UK National Institute for Health and Care Excellence (NICE) guidance advises that amniotomy alone should not be used as a primary method of induction of labour unless there are specific clinical reasons for avoiding vaginal prostaglandins (PGE_2), in particular the risk of uterine hyperstimulation [1]. This makes ARM the preferred mode of induction in multiparous women with an open cervix. It is an inexpensive intervention and is a good method for women who wish to minimise drug intervention. However, women should be aware of the need for augmentation with an oxytocin infusion if contractions do not start 2–4 hours after ARM or there is insufficient progress of labour.

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Consent

16

Kate McCombe

Adult patients with capacity have absolute autonomy over their bodies and so we must seek valid consent before any medical intervention. Failing to gain consent risks criminal prosecution for battery (harmful or offensive contact with another person), a civil claim in medical negligence for financial compensation, and disciplinary action from the professional regulators e.g. the General Medical Council (GMC) in the UK.

Seeking consent is a process, not an event, and the process should facilitate an exchange of information to allow a mutually acceptable management plan to be reached. Consent must not be reduced to simply, 'getting the patient to sign a form' to protect us from litigation.

Capacity

To give **consent** a patient must have **capacity**. A capable patient can:

1. **Understand** information about the treatment.
2. **Retain** this information for long enough to
3. **Weigh** it in the balance and come to a decision.
4. **Communicate** this decision (this does not have to be verbally).

The legal age of majority is the age where minors cease to be considered children and are assumed to have legal control over their decisions and actions. It varies between countries, for example, in the UK patients over the age of 16 are assumed to have capacity unless serious doubt exists to the contrary [1], whilst in the USA

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and Australia the age of majority is 18. In the eyes of the law, pregnant or laboring women retain their capacity except in the rarest of circumstances [2]. The Association of Anaestheists which publishes nationally accepted guidance for the profession across many areas of clinical practice, confirms in their guidance pertaining to obstetric consent, "*Drugs, fatigue, pain or anxiety may compromise the capacity of the adult parturient, but do not necessarily lead to incapacity unless the degree of compromise is severe.*" [3].

Standards of Information Disclosure

For consent to be valid, the patient must be informed of all **material risks** inherent in the procedure, no matter how unlikely they are to occur. A risk is material if, "*a reasonable person in the patient's position would be likely to attach significance to the risk.*" [4].

Consent for neuraxial anaesthesia should include [5]:

Risk	Epidural	Spinal
Significant drop in blood pressure	1: 50 (occasional)	1: 8 (common)
Pruritus	1: 3–10 (dose dependent) (common)	1: 5 (dose dependent) (common)
Ineffective block necessitating additional pain relief in labour or delivery	1: 8 (common)	1: 20 (occasional)
Failure to provide surgical anaesthesia necessitating general anaesthesia	1: 20 (occasional)	1: 50 (occasional)
Post dural puncture headache (PDPH)	1: 100 (uncommon)	1: 500 (uncommon)
Nerve damage (numb patch on a leg or foot or weakness)	1: 1000 temporary (quite rare) 1: 13,000 duration >6 months (rare)	1: 1000 temporary (quite rare) 1: 13,000 duration >6 months (rare)
Paralysis	1: 250,000 (extremely rare)	1: 250,000 (extremely rare)
Infection	1: 50,000 epidural abscess (very rare) 1: 100,000 meningitis (very rare)	1: 50,000 epidural abscess (very rare) 1: 100,000 meningitis (very rare)
Accidental loss of consciousness ('high spinal')	1: 100,000 (very rare)	1: 100,000 (very rare)

Types of Consent

The law in the UK and USA does not require separate **written** consent for anaesthesia. The Association of Anaestheists guidance states, "*a signed form does nothing to validate or invalidate the consent. The anaesthetic can be considered a component of another treatment or part of a larger and interrelated process (e.g. epidural pain relief for childbirth), rather than a treatment in itself.*" [3]. The GMC advises that we take written consent for any intervention which is *'complex or high risk'*, or has *'significant consequences for the patient's employment, social or personal life'* [6]. Although, *written* consent is not a legal requirement prior to insertion of neuraxial anaesthesia, the patient must still be informed of the risks and benefits of the intervention and give their consent and this conversation must be documented in the medical notes. Regardless of the law, many hospitals insist on written consent before any anaesthetic intervention is undertaken and doctors should follow local protocols and guidance.

In reality, it can be very difficult to have a meaningful discussion of risk with a woman in advanced labour and women may retain little of the information given at this time. Therefore, early provision of information about pain relief is essential, ideally in the antenatal period, but certainly early in labour so that women have the opportunity for due consideration of their options. Most delivery areas within the UK use the UK Obstetric Anaesthetists' Association (OAA) Epidural Information Card to aid this process during labour [5].

If a woman requests an epidural but is too distressed to engage in the consent process, then it is reasonable to proceed and to document that the epidural was performed with the patient's implied consent (i.e. she allowed the procedure to be performed) and in her best interests to relieve her pain.

Birth Plans

A woman who has expressed a wish not to have an epidural on her antenatal birth plan retains the capacity, and the right, to change her mind during labour and the anaesthetist should proceed in the usual manner without fear of reprimand. In the rare case of loss of capacity during labour, the Association of Anaestheists advises that the birth plan be respected as a documented refusal of therapy [3].

Emergency Delivery

The consent process must be tailored to facilitate urgent delivery of the baby when necessary. Extremely rarely, a woman might refuse caesarean delivery even if this might lead to the death of her baby. In the UK, if the woman has capacity, this remains her right as here, the fetus has no legal rights until birth and so its interests