

Regional anaesthesia for caesarean section and what to do if it fails

Sophie A Kimber Craig

Abstract

Regional anaesthetic techniques are the most frequently used type of anaesthetic used for caesarean deliveries. They have a better safety profile than general anaesthesia in the pregnant woman. The choice of whether to use a spinal, epidural or combined spinal–epidural technique will depend on patient and surgical factors. Particular care is required in those receiving therapeutic anticoagulation or with clotting abnormalities. Women should be provided with information regarding the risks and intended benefits of the different techniques to make an informed choice regarding mode of anaesthesia. All women having caesarean deliveries must have vital sign monitoring, antacid prophylaxis and intraoperative venous thromboembolic prophylaxis. A left lateral tilt must be maintained until delivery of the baby to reduce the effects of aortocaval compression. Adequate anaesthesia must be confirmed prior to commencing surgery and strategies for managing failed spinal anaesthesia should be considered. Breakthrough pain during caesarean delivery is a distressing complication and must be addressed. General anaesthesia should be offered and, if declined, the woman's pain must be adequately managed with alternative analgesic methods. These include nitrous oxide, opioids and local anaesthetic infiltration.

Keywords Anaesthesia for caesarean; breakthrough pain; combined-spinal-epidural anaesthesia; epidural top-up; failed regional; spinal anaesthesia

Royal College of Anaesthetists CPD Matrix: 1D02, 1F01, 2B03, 2B04, 2G01 2G02, 2G04.

Choice of regional anaesthetic technique for caesarean delivery

Following national reports into maternal mortality related directly to complications from airway management during general anaesthesia (GA), regional anaesthesia (RA) is the most commonly used technique for caesarean section (CS). The benefits of RA are listed here, but discuss all options with the woman to ensure informed consent:

- avoiding intubation – which reduces the risk of aspiration, failed/oesophageal intubation and avoids the pressor effect
- reduced blood loss¹
- reduced risk of venous thromboembolism

Sophie A Kimber Craig MBChB FRCA is a Consultant Anaesthetist and Clinical Lead for Obstetric Anaesthesia at Bolton NHS Foundation Trust, Bolton, UK. Conflicts of interest: none declared.

Learning objectives

After reading this article, you should be able to:

- determine which regional anaesthetic technique is the best in different clinical situations
- identify women at risk of problems associated with the use of a regional technique and list the potential complications of the technique
- explain the appropriate management of a woman who has pain during caesarean delivery under regional anaesthesia

- better pain relief postoperatively
- reduced potential for transfer of drugs to the baby
- the woman is awake during birth of her baby
- the birth partner can be present.

Spinal anaesthesia is the most commonly used form of RA, but epidural (either de novo or conversion of a labour epidural) or combined spinal–epidural (CSE) techniques are also employed. The choice of which technique to use will depend on patient and surgical factors and the urgency of the surgery. [Table 1](#) shows a comparison of the intended benefits and potential disadvantages of these techniques.

Contraindications to regional anaesthesia

[Box 1](#) outlines the absolute and relative contraindications to RA.

Always confirm whether a woman is receiving therapeutic anticoagulation. Allow sufficient time between the last dose and the block (or removal of an epidural catheter). Comprehensive guidance on this has been published.² Uncertainty regarding a woman's clotting function should be discussed with a consultant haematologist.

Risks of regional anaesthesia

The risks of RA and their incidences are shown in [Box 2](#). Note that, although extremely rare, anaesthetic complications are the most common cause of maternal cardiac arrest; epidural top-ups and spinal anaesthesia have caused cardiovascular collapse and total spinal anaesthesia leading to arrest.^{3,4}

Preoperative preparation

Identify any risk factors for prolonged/difficult surgery, contraindications to RA and assess the woman's airway. Provide information about the anaesthetic and obtain verbal consent for anaesthesia. Prior to CS, women should have:

- a full blood count
- a group and save (if she has any risk factors complicating the pregnancy)
- antacid prophylaxis (e.g. ranitidine 150 mg orally in elective cases or 50 mg intravenously, depending on the urgency of surgery).

Intraoperative conduct

When performing RA for CS:

- a trained assistant must be present

Benefits and potential disadvantages

	Spinal	Epidural	Combined spinal–epidural
Benefits of technique	<ul style="list-style-type: none"> Rapid onset — can be used in emergency cases Better quality of block than epidural Reduced incidence of breakthrough pain compared with epidural Reduced risk of post-dural puncture headache (PDPH) Low rates of failure 	<ul style="list-style-type: none"> Avoids repeat RA attempt if labour epidural already in-situ Block can be extended for prolonged procedures Block can be augmented if woman experiences breakthrough pain Additional opioids can be administered 	<ul style="list-style-type: none"> Useful for maintaining cardiac stability as block can be brought on slowly, avoiding sudden changes in BP Allows extension of anaesthesia for longer timeframe Additional opioids can be administered
Potential disadvantages	<ul style="list-style-type: none"> Hypotension can be more pronounced due to speed of onset Exaggerated cephalad spread may occur if used immediately after labour epidural 	<ul style="list-style-type: none"> Dysfunctional labour epidurals are associated with failure of CS block Increased risk of PDPH Currently commercial available kit does not have non-Luer lock connections (as for CSE) 	<ul style="list-style-type: none"> Time taken for insertion Test dose impossible if inserted solely for surgery Potential of subarachnoid spread of drug administered into epidural space Higher complication rates than spinal and epidural alone
Example cases	<ul style="list-style-type: none"> Elective caesarean delivery Emergency CS for fetal distress 	<ul style="list-style-type: none"> Urgent CS in woman with functional labour epidural in-situ Morbidly obese women for elective CS (surgery may be prolonged) 	<ul style="list-style-type: none"> Cases requiring more than one procedure (e.g. placenta accreta where intrailiac balloons may be inserted prior to CS) For women with cardiac disease

Table 1

Absolute and relative contraindications to RA

Absolute contraindications

- Patient refusal
- Allergy to any of the drugs for injection
- Significant coagulopathy or thrombocytopenia (platelet count $<75 \times 10^9.L^{-1}$)
- Infection at insertion site
- Clinically significant or untreated systemic septicaemia
- Raised intracranial pressure
- Uncorrected hypovolaemic or cardiogenic shock

Relative contraindications

- Existing or acute neurological deficits/disease — thoroughly assess the extent of any pre-existing deficit and record the findings (to ensure that any deficit is not erroneously attributed to the RA postoperatively)
- Previous spinal surgery (with significant scarring or metal-work) or gross spinal deformity
- Disorders of coagulation (e.g. recent low molecular weight heparin administration or a falling platelet count in the presence of pre-eclampsia)

Box 1

- gain/confirm intravenous access (ideally at least 16G) and commence fluids (unless the woman is pre-eclamptic, when she may be fluid restricted)
- apply monitoring (ECG, BP and oxygen saturations) — ensure the BP measurement is cycling prior to induction of anaesthesia
- maintain a 15° left tilt until the baby is delivered
- insert a urinary catheter
- supplemental oxygen is not necessary unless saturations fall below 94%
- undertake venous thromboembolism (VTE) prophylaxis (either in the form of graduated compression stockings or calf compression devices)
- give antibiotic prophylaxis prior to knife-to-skin.⁵

Regional techniques

Spinal anaesthesia

Spinal anaesthesia can be performed in the sitting, lateral or Oxford position. Strict asepsis is essential during insertion. Clean the woman's skin using a solution containing 0.5% chlorhexidine and allow it to dry to ensure its efficacy.⁶ Using a sterile technique (i.e. hat, gown, gloves, mask, drapes), anaesthetize the skin and then perform an intrathecal injection using a 24G–27G pencil point needle (this reduces the risk of post-dural puncture headache). Give 2.2–2.7 ml of hyperbaric local anaesthetic (LA), usually bupivacaine, with an opioid (300–400 µg of diamorphine is a standard dose in the UK) intrathecally. The LA dose can be adjusted (by 0.1–0.2 ml) to take into account:

- extreme prematurity or very small for gestational age babies (increase dose)

Side effects and complications of regional anaesthesia

Common	Quite rare
Hypotension	Temporary neuropraxia
Nausea and vomiting	High spinal block (particularly with epidural)
Itching	
Shivering	Rare
	Permanent neuropraxia
Occasional	Very rare
Breakthrough pain (requiring analgesia or conversion to GA)	Infection (meningitis/spinal or epidural abscess)
Uncommon	Spinal/epidural haematoma
Postdural puncture headache	Local anaesthetic toxicity (epidural/CSE only)
	Extremely rare
	Paralysis
	Death

Box 2

- predicted very large babies or the presence of polyhydramnios (decrease dose)
- a labour epidural previously in-situ for many hours or needing multiple top-up boluses (be prepared for exaggerated cephalad spread)
- very tall or short women (adjust dose or [reverse] Trendelenburg positioning to establish block height or prevent further cephalad spread).

Epidural anaesthesia

If the woman has a well-functioning labour epidural and time allows, this can be converted for anaesthesia. Note whether she has required top-ups to maintain analgesia in labour, the presence of a 'window' to pain or a unilateral block, as these increase the risk of the epidural not being successfully converted for CS. Aspirate the catheter to detect intravascular and intrathecal placement; subdural migration will not necessarily be revealed. Epidurals can also be used de novo in patients where a slower onset of block is desired (e.g. in cardiac disease).

Many LAs and additive mixtures have been given with varying effects (Table 2). Additives are not stable in solution together, therefore they must be prepared at the time of administration. Time taken to mix drugs may offset any benefit in speed of onset and adds the risk of potential drug errors. Whether giving (levo-) bupivacaine 0.5%, ropivacaine 0.75% or lidocaine 2%, the maximum safe dose must not be exceeded. Giving the dose in 5–10 ml aliquots will help prevent profound hypotension and high blocks. A volume of 15–20 ml (or more) is usually required. A slight head down position and further 5 ml bolus may be required to anaesthetize the higher thoracic dermatomes. Opioids (fentanyl 100 mcg or diamorphine 2.5–5 mg) will improve the quality of analgesia. Further LA boluses can be given during surgery to augment anaesthesia if required.

The catheter can be left in at the end of surgery to provide postoperative analgesia or it can be removed, provided there is no contraindication.

Local anaesthetics and additive drugs

Drug	Expected effect
Local anaesthetics:	
• Speed of onset (although some studies demonstrate no significant differences)	Lidocaine > bupivacaine
• Duration of action	Bupivacaine > Ropivacaine > Lidocaine
Sodium bicarbonate	Possible increased speed of onset (due to increased pH in relation to drug pKa)
Opioids	<ul style="list-style-type: none"> • Enhance quality of block • Postoperative analgesia (with diamorphine)
Epinephrine	Lengthen duration of block (by reducing absorption from epidural space)

Table 2

Combined spinal–epidural

CSEs can either be a needle-through-needle technique or performed at two levels. The spinal dose can be as for a normal spinal or it can be reduced and then augmented using the epidural component (as above).

Confirming adequate anaesthesia and block height

There is considerable variation in modalities (pinprick, cold and light touch) used by anaesthetists to assess block height. A block to T5 to light touch is considered a reliable way of confirming anaesthesia that is adequate for surgery to proceed. Despite this, cold sensation, which normally indicates a higher level of block than light touch, is frequently used. This may result in a higher incidence of breakthrough pain.⁷ Sacral root and motor block should also be confirmed (although this provides crude information only as it is difficult to discern at precisely what level power is lost).

Record block height assessment in the anaesthetic record; include timing and modality used.

Prevention and management of hypotension following RA

Hypotension following RA is common, more so with spinal than epidural techniques and it may compromise placental blood flow. Symptoms (nausea, vomiting and/or light headedness) can precede reduced BP readings. The aim is to maintain systolic blood pressure at around pre-spinal levels.⁸ Prevent and manage hypotension by:

- avoiding aortocaval compression – either with left lateral tilt of the operating table or with uterine displacement
- giving intravenous fluids (either by colloid preloading or crystalloid coload)
- administering intravenous vasopressors (a variable rate phenylephrine infusion is recommended) ± ephedrine boluses
- giving ondansetron 4 mg intravenously (as this may help reduce hypotension and will reduce the associated nausea and vomiting).

Failure of RA

Why do regional anaesthetics fail and what can I do if it occurs?

With good practice, less than 1% of spinal anaesthetics are ineffective. There are a multitude of possible causes for failed spinal anaesthesia, including erroneous drug leakage outside the intrathecal space, inadequate LA spread or failure of drug action. Always allow adequate time for the block to work and use a Trendelenburg position with the patient's knees bent to augment drug distribution.⁹ Where it still fails to provide adequate anaesthesia for surgery, the options are:

- give further intrathecal local anaesthesia – this requires a second dural puncture (with its concomitant risks) and carries the risk of inadvertent high block
- convert to GA prior to commencing surgery.

When an initial epidural top-up has not provided adequate anaesthesia, further local anaesthesia (usually in 5 ml boluses) can be given via the catheter up to the relevant maximum dosage for the specific local anaesthetic used, provided there is time to do so. If still not effective, perform GA, as attempts at spinal anaesthesia after epidural drug administration are very likely to result in significant cephalad spread of anaesthesia with the associated problems this might cause.

Breakthrough pain during CS

Sensations of pulling, tugging and pressure during CS are normal. If a woman complains of pain, however, this must be taken seriously; it is a common cause for complaint and litigation.

Do the following if the woman complains of pain:

- stop the surgery
- establish the nature of the discomfort – whether this is a painful sensation or the usual awareness of pressure or tugging
- if she confirms pain, offer her a general anaesthetic
- if she declines general anaesthesia, treat her pain.

Options for analgesia include:

- inhaled nitrous oxide
- rapid onset systemic opioids, such as alfentanil (which can be given intravenously in 100–250 µg boluses), until the pain is adequately managed
- alternative analgesics, such as ketamine (given in boluses of 10–20 mg to achieve analgesia).
- IA infiltration of the skin at the site of incision (if this is the cause for discomfort)

If these are ineffective, strongly encourage her to accept GA.

Document all discussions about the discomfort and any interventions you make to address the pain and whether these were successful. Provide explanations to the woman at the time and debrief her postoperatively.

Postoperative pain management

Using a multimodal approach is appropriate. Unless contraindicated, give women paracetamol (maximum 4 g per day in divided doses) and a non-steroidal anti-inflammatory drug regularly. Intrathecal opiates are the mainstay for the initial postoperative period and additional opioids can be prescribed orally (occasionally intravenous patient-controlled analgesia may

be required). Codeine should not be given to breastfeeding women; dihydrocodeine is an alternative.

Postoperative review

All women who have received RA should be reviewed post-operatively. Address any pain or side effects and identify any complications. If any are found:

- assess and examine the woman thoroughly
- document your findings
- inform the consultant anaesthetist.

The management of every complication of RA is beyond the scope of this article but early recognition and management of serious complications is vital. Patients and their GPs must be informed about potential sequelae and when to seek help on discharge from hospital, so they can be appropriately readmitted if necessary.¹⁰ ◆

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