Management of intrathecal catheters in the obstetric patient

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Background, advantages, and disadvantages of intrathecal catheters

Intrathecal catheters (ITCs), also known as continuous spinal catheters, are considered to be a reliable and effective neuraxial technique for labour analgesia and surgical anaesthesia, with failure rates comparable with epidural analgesia and anaesthesia.1,2

Headache prevention

Intrathecal catheters may potentially decrease the incidence of postdural puncture headache (PDPH) and need for epidural blood patch (EBP) compared with resiting the epidural catheter, as the ITC occludes the dural hole and prevents efflux of CSF. However, the evidence is conflicting; most available data come from retrospective studies and RCTs are lacking.3,4 The duration that the catheter remains in place postpartum or after dural puncture appears to influence the risk of PDPH and the need for EBP, as a longer duration may create inflammation that closes the dural hole.5 Placing an ITC also has the advantage of avoiding additional attempts at epidural placement, thus avoiding repeat accidental dural puncture (ADP) or failure to place a neuraxial catheter at all.4

Infection

Although direct, continuous access to the CSF theoretically increases the risk of infection, there have been no ITC-associated infections reported in the obstetric literature.2,3

Medication errors

Medication-dosing error (an epidural dose given into the intrathecal space) can lead to high spinal anaesthesia, hypotension and respiratory arrest requiring tracheal intubation.2 Incorrect medication administration may also occur. There is one report of labetalol administration via an ITC to a parturient without adverse effects.5 Tranexamic acid, which is increasingly being used intravenously during obstetric haemorrhage, has caused seizures, ventricular fibrillation, and death when given in error intrathecally via a spinal needle or ITC.5,6

Decision-making: to place or not to place?

Advantage of placing an ITC

Avoiding additional attempts

Although ITCs can be placed electively, they are more commonly placed after ADP with an epidural needle (Fig. 1).2 Placing an ITC after many unsuccessful attempts avoids repeated ADP, or the inability to identify the epidural or intrathecal space again. This may be particularly relevant for patients who are difficult to position because of severe pain. No further delays in establishing a neuraxial catheter may be important for patients with non-reassuring fetal tracings.

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Advantages of resiting the epidural catheter

Unfamiliarity with intrathecal analgesia technique

Resiting the epidural catheter at an alternative level may be preferred in maternity units where anaesthetists or nurses are unfamiliar with ITCs. For patients who are expected to be in labour for many hours (e.g. ADP near the beginning of induction of labour), it may be preferable to manage neuraxial analgesia via a standard, familiar technique. Be mindful that epidural local anaesthetic can potentially cross the dural puncture and cause high spinal anaesthesia.

Option to administer prophylactic EBP

Resiting the epidural catheter facilitates the performance of a postpartum prophylactic epidural blood patch (PEBP). Although the evidence from RCTs does not uniformly support its effectiveness in decreasing the incidence of PDPH or the need for EBP, it may reduce the severity and duration of symptoms.7,8 Avoiding a postpartum EBP may be especially important for patients requiring postpartum therapeutic anticoagulation. A potential complication specific to PEBP is high spinal anaesthesia when the procedure is done before resolution of the neuraxial blockade.7

Safety practices

Identification

Clear identification that the catheter is not in the epidural space avoids inadvertent epidural dosing: label the catheter, infusion tubing, and infusion pump. A sign may be placed on the patient’s labour room door notifying providers that she has an ITC. The anaesthesia record, whether paper or electronic, should also include identification that the catheter is intrathecal (Supplementary Fig. S1).

Infection avoidance

Medications should be drawn up through filtered needles and given through a filter connected to the catheter to reduce the risk of contamination and particulate injection. The avoidance of frequent catheter disconnections and reconnections is also advisable. ‘Top-up’ boluses may be given as a bolus from the infusion pump. If an ITC remains in place postpartum in an attempt to lower the risk of PDPH or the need for EBP, the catheter may be knotted to prevent accidental injection.7 For patients who may be receiving additional medication doses postpartum (e.g. neuraxial morphine), the catheter should be tightly capped and carefully secured to avoid inadvertent CSF leakage.

Information sharing and monitoring

Nurses, midwives and obstetricians should be advised of the presence of an in situ ITC: the issue should be discussed during multidisciplinary rounds and huddles, and the risk of motor block, high spinal anaesthesia, and hypotension should be emphasised with all providers (Supplementary Fig. S1). In addition, it is advisable to place alerts regarding the presence of an ITC on the common information board (written or electronic) as a reminder to staff.

Education

Interdisciplinary educational sessions involving nurses, midwives and obstetricians are an excellent forum for providing education about ITC. Topics to discuss may include review of neuraxial space anatomy (epidural and intrathecal spaces), dosing for labour analgesia, dosing for Caesarean delivery, monitoring, and patient assessments during labour.

Labour analgesia

Choice of medication dosing

The optimal choice of medications (local anaesthetic or opioid), medication concentrations, and infusion settings
Management of intrathecal catheters

Table 1 Intrathecal catheter dosing for labour analgesia and surgical anaesthesia. Dilute local anaesthetic-opioid infusions commonly used for labour epidural analgesia may be used for intrathecal labour analgesia at reduced doses. Surgical anaesthesia is provided using typical bupivacaine concentrations with doses titrated to a T4 level.1,9,10 Account for filter dead space (0.6–1 ml) and catheter dead space (0.2 ml) when bolusing medications.

<table>
<thead>
<tr>
<th>Labour analgesia</th>
<th>Medication</th>
<th>Initial</th>
<th>Infusion only</th>
<th>Patient-controlled intrathecal analgesia</th>
<th>Top ups</th>
<th>Surgical anaesthesia</th>
<th>Dosing</th>
<th>Subsequent intraoperative dosing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dosing technique</td>
<td>Bupivacaine 0.25% 0.5–1 ml (1.25 –2.5 μg) + fentanyl 10–20 μg</td>
<td>Bupivacaine 0.05–0.125% + fentanyl 2–5 μg ml–1</td>
<td>Bupivacaine 0.125% + fentanyl 2 μg ml–1</td>
<td>Bupivacaine 0.25% 0.5–2 ml (1.25 –2.5 mg) with or without fentanyl 15–20 μg</td>
<td>Fentanyl 15–20 μg</td>
<td>Bupivacaine 0.125% 0.5–1 ml (1.25 –2.5 mg) initial dose, and then titrate to desired level with additional 0.5 ml (2.5 mg) boluses</td>
<td>Morphine 0.05–0.3 mg</td>
<td>Bolus bupivacaine to maintain desired anaesthetic level and patient comfort</td>
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<tr>
<td>Infusion only</td>
<td>Bupivacaine 0.05–0.125% + fentanyl 2–5 μg ml–1</td>
<td>Basal: 0.5–3 ml h–1</td>
<td>Basal: 1–2 ml h–1</td>
<td>Basal: 1–2 ml h–1</td>
<td>or Sufentanil 2.5–5 μg h–1</td>
<td>or Sufentanil 5 μg</td>
<td>or Sufentanil 2.5 mg</td>
<td>or Sufentanil 5 μg</td>
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<td>Patient-controlled intrathecal analgesia</td>
<td>Fentanyl 15–20 μg</td>
<td>or Morphine 0.05–0.3 mg</td>
<td>or Bupivacaine 0.125% + fentanyl 2 μg ml–1</td>
<td>or Fentanyl 15–20 μg</td>
<td>or Sufentanil 2.5 mg</td>
<td>or Fentanyl 15–20 μg</td>
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<td>Top ups</td>
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<tr>
<td>Surgical anaesthesia</td>
<td>Fentanyl 15–20 μg</td>
<td>or Morphine 0.05–0.3 mg</td>
<td>or Bupivacaine 0.125% + fentanyl 2 μg ml–1</td>
<td>or Fentanyl 15–20 μg</td>
<td>or Sufentanil 2.5 mg</td>
<td>or Fentanyl 15–20 μg</td>
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(continuous only, patient-controlled intrathecal analgesia, and programmed intermittent intrathecal boluses) has not been studied. Commonly used labour epidural infusions have been used successfully for ITC labour analgesia as either continuous or patient-controlled intrathecal analgesia (Table 1).1,5,12 Dosing for programmed intermittent intrathecal analgesia has not been described. High spinal anaesthesia is of particular concern, and very close monitoring of the mother is advisable.

Troubleshooting

Analgesia that is inadequate, lower than the level of T10, asymmetrical, or patchy may occur intrapartum. Troubleshooting may include changing patient position or providing a top up. An intrathecal dose may still be given via a catheter that does not aspirate CSF, but if pain relief does not occur, the catheter may no longer be within the intrathecal space. It may be judiciously dosed as being epidural. However, a catheter with an unclear location should ultimately be replaced. Patients who have inadequate bilateral analgesia after troubleshooting should have catheter replacement or an alternative method of analgesia.

Caesarean delivery

Choice of medication

Hyperbaric or isobaric bupivacaine at concentrations used for spinal anaesthesia for Caesarean delivery (0.5% or 0.75%) can provide surgical anaesthesia via an ITC.1 Hyperbaric bupivacaine is most commonly given for spinal anaesthesia for Caesarean delivery, as it reliably provides anaesthesia to a T4–T6 dermatomal level and allows manipulation of the sensory level with positioning if necessary. When dosing an ITC in a supine patient, hyperbaric medication given via an ITC may not spread adequately to T4–T6. Trendelenburg positioning may be helpful in augmenting cephalad spread. There is limited evidence that isobaric bupivacaine may provide better spread of medication. At our institution, both hyperbaric and isobaric preparations given through ITCs are successfully used during Caesarean deliveries. Initial dosing is with the patient supine.

Dosing

The goal of dosing an ITC for Caesarean delivery is to achieve adequate surgical anaesthesia whilst avoiding high spinal anaesthesia (Supplementary Fig. S2). Both under- and overdosing can be detrimental. Underdosing may lead to the patient experiencing intraoperative pain, whereas overdosing may lead to high spinal anaesthesia and potentially maternal hypotension, fetal bradycardia, maternal respiratory compromise, and need for tracheal intubation. Administering the entire ED95 dose may lead to high spinal anaesthesia and possible need for tracheal intubation. Unlike catheters in the epidural space, the catheter tip direction in the CSF is not known. Bolusing a catheter pointing in the cephalad direction may lead to local anaesthetic spread to the high thoracic or cervical levels.

We suggest dosing approximately 0.2–0.5 ml at a time and intermittently checking the level of anaesthesia, until a T4 sensory level has been achieved (approximately 10 min). Be mindful that the initial volume given will fill the filter dead space (0.6–1 ml) and catheter dead space (0.2 ml). For patients needing emergency Caesarean deliveries, a higher initial dose may be given to obtain a level more quickly, approximately half the ED95 dose. Consider both the anaesthetic level and the total dose of bupivacaine given when determining whether a patient is adequately anaesthetised for Caesarean delivery. If a T4–T6 sensory level is obtained with doses less than the ED95, re-dosing intraoperatively is appropriate to optimise patient comfort. Opioids (e.g. fentanyl, sufentanil, and morphine) may be given before or after bupivacaine. When given after, the dead space can be flushed to ensure all opioids are delivered to the CSF.

Conclusions

Intrathecal catheters are an effective and reliable neuraxial technique for labour analgesia and surgical anaesthesia. Catheter identification and communication with labour and...
delivery staff avoid errors during intrapartum administration.
Incremental dosing for surgical anaesthesia is recommended.

Declaration of interests
The author declares that they have no conflicts of interest.

Appendix A. Supplementary material
Supplementary data to this article can be found online at https://doi.org/10.1016/j.bjae.2020.02.004.

References