

Management of total spinal block in obstetrics

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Summary

Total spinal or a high neuraxial blockade is a recognised complication of central neuraxial techniques. A high number of incidents of a high neuraxial block are being reported in obstetrics following the increased use of neuraxial anaesthesia.

Unrecognised subdural or intrathecal placement of an epidural catheter and an intended spinal technique after a failed epidural analgesia are two main identified causes of high spinal block in obstetrics. The anaesthetist performing these procedures must be aware of this serious complication and must remain vigilant throughout. One should have a high level of suspicion of a high spinal while giving a test dose or topping up an epidural in the delivery suite or in the theatre especially if there is a rapid development of sensory and motor block within minutes.

Key words: total spinal block; high neuraxial blockade; unrecognised subdural catheter; intrathecal catheter; maternal cardiac arrest

INTRODUCTION

Total spinal or a high neuraxial blockade is a recognised complication of central neuraxial techniques that include spinal and epidural anaesthesia. A high number of incidents of a high neuraxial block are being reported in obstetrics following the increased use of neuraxial anaesthesia. The leading cause of maternal death in the UK during or up to six weeks after the end of pregnancy is due to thrombosis and thromboembolism.¹ But high neuraxial block is now identified as the leading cause of antepartum cardiac collapse in the UK.²

DEFINITION

A high neuraxial block is a sensorimotor block that has reached a spinal segmental level higher than that required to achieve surgical anaesthesia. The terms high, total or complete block are used interchangeably. A sensory level of T3 or above can be associated with significant cardiovascular and respiratory compromise and can hence be considered a high block. Involvement of the cranial nerves signifies intracranial spread of local anaesthetic which can culminate in complete loss of consciousness and cardiorespiratory arrest³.

EPIDEMIOLOGY

The incidence of high neuraxial block associated with

obstetric anaesthesia is not known. Estimates vary between 1:2,971⁴ and 1:16,200⁵ anaesthetics.

AETIOLOGY

Dosage - An accurate estimation of the required dosage of local anaesthetic (LA) to achieve an appropriate level of intrathecal anaesthesia is difficult and we rely on factors such as nature of surgery, patient anatomy and technique of injection. The baricity, volume/dose and injection technique can have an effect on the cephalad spread of intrathecal LA.

A dose of 10mg hyperbaric bupivacaine plus 10 microgram fentanyl is usually appropriate for caesarean section. If no fentanyl is available, administer hyperbaric bupivacaine 10mg alone.⁶

In general, the evidence suggests that faster injections produce greater spread with plain solutions, but that the effect is less marked with hyperbaric solutions.⁷ Short stature can be a risk factor for a high spinal as height influences lumbosacral CSF volume and hence intrathecal spread of drug.⁷ It is assumed that in obesity and pregnancy, the area of central neuraxial compartment could be reduced due to venous engorgement from raised intraabdominal pressure, and excessive adipose tissue.

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Evidence does not confirm that barbotage, by the repeated aspiration and re-injection of CSF and local anaesthetic, increases spread.⁷

Positioning of patient - Position of patient during and immediately after injection of local anaesthetic may determine the cephalad spread.

Pre-existing epidural block⁸ The interaction between epidural and spinal injections is not always easy to predict. Unexpected high block can happen when a spinal is administered after the epidural space has presumably been expanded – and the subarachnoid space compressed – by recent epidural top-ups.^{9a}

Unrecognised dural puncture and intrathecal injection of local anaesthetic following epidural top up.

Accidental subdural block. Subdural needle or catheter placement may account not only for delayed onset, profound and extensive conduction blockade, but also for ‘unexplained’ post epidural headaches, false negative aspiration tests and test doses, accidental total spinal, both early and late, some unilateral block and ‘unexplained’ neurological sequelae of spinal and epidural blockade.¹⁰

Accidental intradural space¹¹ Local anaesthetic can be injected into the substance of the dura, to create an intradural space, to form a localised and swelling collection within the layers of the dura. Repeated doses of local anaesthetic may escape retrogradely from the intradural space to the epidural space around the outside of the epidural catheter, eventually producing a clinically acceptable block. But there is a slight risk of an extensive block developing some time later, following rupture of the remaining layers of dura and sometimes the arachnoid as well, leading to diversion

of the intradural solution into the subdural or subarachnoid spaces.

PREVENTION

Unrecognised subdural or intrathecal placement of an epidural catheter and an intended spinal technique after a failed epidural analgesia are two main identified causes of high spinal block. The anaesthetist performing these procedures must be aware of this serious complication and must remain vigilant throughout with continual assessment of progression of the block in a well monitored environment.

Any abnormally functioning epidural must be followed up closely. Development of a dense motor block of lower limbs during epidural analgesia using a low dose epidural infusion is abnormal and a high-level suspicion of intrathecal placement must be maintained. This suspicion must be shared with the entire team looking after the patient and emphasised during handover care. Physical barriers in the form of prominent labels must be placed over the epidural catheter to prevent an accidental top up with large volume of LA.

Preparation prior to performing any neuraxial block

Ensure airway and resuscitation equipment, vasopressors and drugs essential for an emergency general anaesthesia are within immediate reach. In obstetrics, the team must be aware of the location of a perimortem caesarean section pack. A designated emergency team and a cardiac arrest team must be identifiable. The clinician must be familiar with the locally agreed protocols to activate the emergency call out system.⁹

Table 1: Symptoms, signs and management of the different levels of spinal block

Symptoms and signs	Root levels	System affected	Management
Bradycardia Hypotension+/- Nausea	T 1-4	Cardiac sympathetic fibres blocked	<ul style="list-style-type: none"> • Vagolytics like Atropine 0.6mg • Sympathomimetics such as Ephedrine 6 mg boluses • Left lateral tilt /wedge • Phenylephrine 50-100mcg boluses • Metaraminol 0.5mg boluses • Mephentermine 3-5 mg boluses • IV Fluids
Tingling of hand with progressive weakness of hand grip	C 6-8	Arms and hands Accessory muscles of respiration	<ul style="list-style-type: none"> • Reassure patient • Reverse Trendelenburg position in spinal block • Stop local anaesthetic injection in epidural top up
Difficulty in breathing Difficulty in speaking Desaturation	C3-5	Shoulder weakness Diaphragmatic innervation involved	<ul style="list-style-type: none"> • Assess airway • Oxygen supplementation • May require intubation and ventilation
Slurring of speech Sedation Loss of consciousness	Intracranial spread		<ul style="list-style-type: none"> • Call for help • Airway, Breathing, Circulation (ABC) approach • RSI with intubation and ventilation • Circulatory support with sympathomimetics or vasopressors • Epinephrine boluses of 50-100mcg may be required if persistent hypotension. • Foetal monitoring

Procedure

After a sub-arachnoid injection or epidural top up, close monitoring of heart rate, blood pressure, oxygen saturations, respiratory rate and level of neuraxial block is necessary. Monitoring should follow clear written protocols.¹² The frequency of observations should be determined by normal clinical considerations.¹² In hospitals in UK, clinical guidelines suggest that after each epidural bolus or top up for labour analgesia, blood pressure should be recorded for 5 min for the first 20 minutes and thereafter every 30 minutes.

Sensory levels can be tested with ice cubes, ice packs, ethyl chloride sprays, alcohol wipes or with pin-prick

During a spinal block, focus on:

- Dose of local anaesthetic required,
- Baricity of drug,
- Position of patient after spinal

During epidural test dose/top up:

- Always aspirate with a 2ml syringe for blood/CSF before any top up.
- For labour analgesia, test dose with a weaker solution, i.e., 10ml of 0.1% Levobupivacaine is enough to rule out sub arachnoid block. But go as per hospital protocol.
- Always check the level of neuraxial block before any epidural top up.
- If possible, top up epidural for procedural anaesthesia in theatre only for ease of managing emergencies.
- Always give local anaesthetic solution in increments.

Post procedure

Written documentation of any difficulty in neuraxial block is of utmost importance.

Staffing levels sufficient to provide the necessary standard of care are essential in areas providing care for patients with neuraxial blocks, but the individuals need to be trained to the requisite standard as well, and they must know when (and how) to obtain anaesthetic advice⁹.

HOW TO RECOGNISE HIGH/TOTAL SPINAL BLOCK

One should have a high level of suspicion of a high spinal while giving a test dose or topping up an epidural in the delivery suite or in the theatre especially if there is a rapid development of sensory and motor block within minutes.

After any neuraxial block, there should be constant monitoring of heart rate, blood pressure, respiratory rate and level of neuraxial block.

Constant communication with the mother is very important as it will help to detect any early changes in the voice, effort of breathing or the conscious levels.

Symptoms and signs of a high spinal correlate with the ascending level of neuraxial block.

Early detection and management can prevent deleterious effects to both mother and foetus.

MANAGEMENT OF HIGH SPINAL BLOCK

1. Recognition of high spinal and call for help

2. If only circulatory compromise

Correction of bradycardia and hypotension.

Lateral displacement of uterus manually, with a wedge under the patient or by tilting the theatre table.

Vagolytics like Atropine 0.6mg can be useful for severe bradycardia.

For hypotension, Phenylephrine¹³ boluses of 50-100mcg can be given. It can also be given as an infusion 20-40ml/hr (in a concentration of 100mcg/ml or as per hospital protocol).

Ephedrine¹³ in 6mg boluses can also be given if there is hypotension and bradycardia.

Metaraminol boluses of 0.5mg or as an infusion in a concentration of 0.5mg/ml.

Mephentermine¹⁴ has been used as a 3-5mg intravenous bolus or intravenous infusion of 2-5mg/min, or 25-50mg intramuscularly. Limited information is available regarding placental transfer and foetal metabolic effects, although it is a popular agent in a number of low and middle-income countries.⁶

IV fluids -500ml to 1 litre to be given rapidly. To be cautious in cardiac patients and in those with pre-eclampsia.

Reassure the patient as she might be nauseous and will feel faint. Keeping a conversation also will help to assess if the neuraxial block is ascending.

3. If circulatory and respiratory compromise +/- neurological deterioration

If neuraxial block is ascending with breathing difficulties and desaturation, then reassure the patient, assess the airway, and give supplemental oxygen.

If the patient loses her airway, becomes sedated or unconscious, then secure the airway which includes intubation with Rapid Sequence Intubation (RSI).

If high doses of vasopressors are required, consider epinephrine boluses of 50-100mcg (epinephrine dilution of 100mcg/ml) or infusion.

Maintain anaesthesia as there is possibility for awareness in an apparently unconscious patient.

Patient will have to be sedated and ventilated until neuraxial block has worn off, so intensive care will need to be involved.

In the event of a cardiac arrest, immediate cardiopulmonary resuscitation (CPR) as per Advanced Life support and to start perimortem caesarean section within 4 minutes of arrest.

4. Foetal monitoring

Assess the foetal wellbeing. If compromised, then the obstetric team to consider emergency delivery of foetus.

5. To rule out other causes of cardiovascular deterioration

These causes may include local anaesthetic toxicity if intravascular injection, thromboembolism, major haemorrhage, amniotic fluid embolism, profound vasovagal effect

6. Written documentation of the events is of utmost importance for continual care of patient, for future reference and for medico legal purposes.

7. After patient has been resuscitated and woken up (if applicable), update the patient and family on course of events and offer follow up if needed.

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