HIGH /TOTAL NEURAXIAL BLOCKADE

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31ST OCTOBER 2024.

OBJECTIVES

- INTRODUCTION
- TIMING OF HIGH REGIONAL BLOCK
- RISK FACTORS OF HIGH REGIONAL BLOCK
- SIGNS AND SYMPTOMS OF HIGH REGIONAL BLOCK
- RECOGNITION OF HIGH REGIONAL BLOCK
- MANAGEMENT OF HIGH REGIONAL BLOCK
- PREVENTION OF HIGH REGIONAL BLOCKS

WHAT IS ANAESTHESIA

The term anaesthesia comes from the Greek words **‘an’-** meaning without and **‘asthesis’** meaning loss of sensation.

A state of controlled, temporary loss of sensation or awareness that is induced for medical purposes.

TYPES OF ANAETHESIA

Types of anaesthesia broadly include

i. General anaesthesia(GA) e.g injectables and inhalationals.

ii. Regional anaesthesia e.g biers block, spinal, local and epidural anaesthesia.

SPINAL ANAESTHESIA

Spinal anesthesia is the injection of small amounts of local anaesthetics into the (CSF) at the level **below L2**, where the spinal cord ends.

Usually between L2-L3 and L4-L5 interspace.

Anesthesia of the lower body part below the **umbilicus** is achieved.

Also known subarachnoid block (SAB).

HIGH AND TOTAL REGIONAL BLOCK

- The occurrence of a high regional block or total spinal can be potentially catastrophic for the patient, and require immediate management.

- They may occur following spinal or epidural anaesthesia and therefore can occur outside of the operating theatre.

- Both are due to the inappropriately high spread of local anaesthetic affecting spinal nerves and as such are on a continuum of severity:

Cont…

High spinal/regional block: Spread of local anaesthetic affecting the spinal nerves **above T4**. The effects are of variable severity depending upon the maximum level that is involved, but can include cardiovascular and/or respiratory compromise.

Total spinal: intracranial spread of local anaesthetic resulting in **loss of consciousness**. A total spinal can also occur following epidural anaesthesia/analgesia

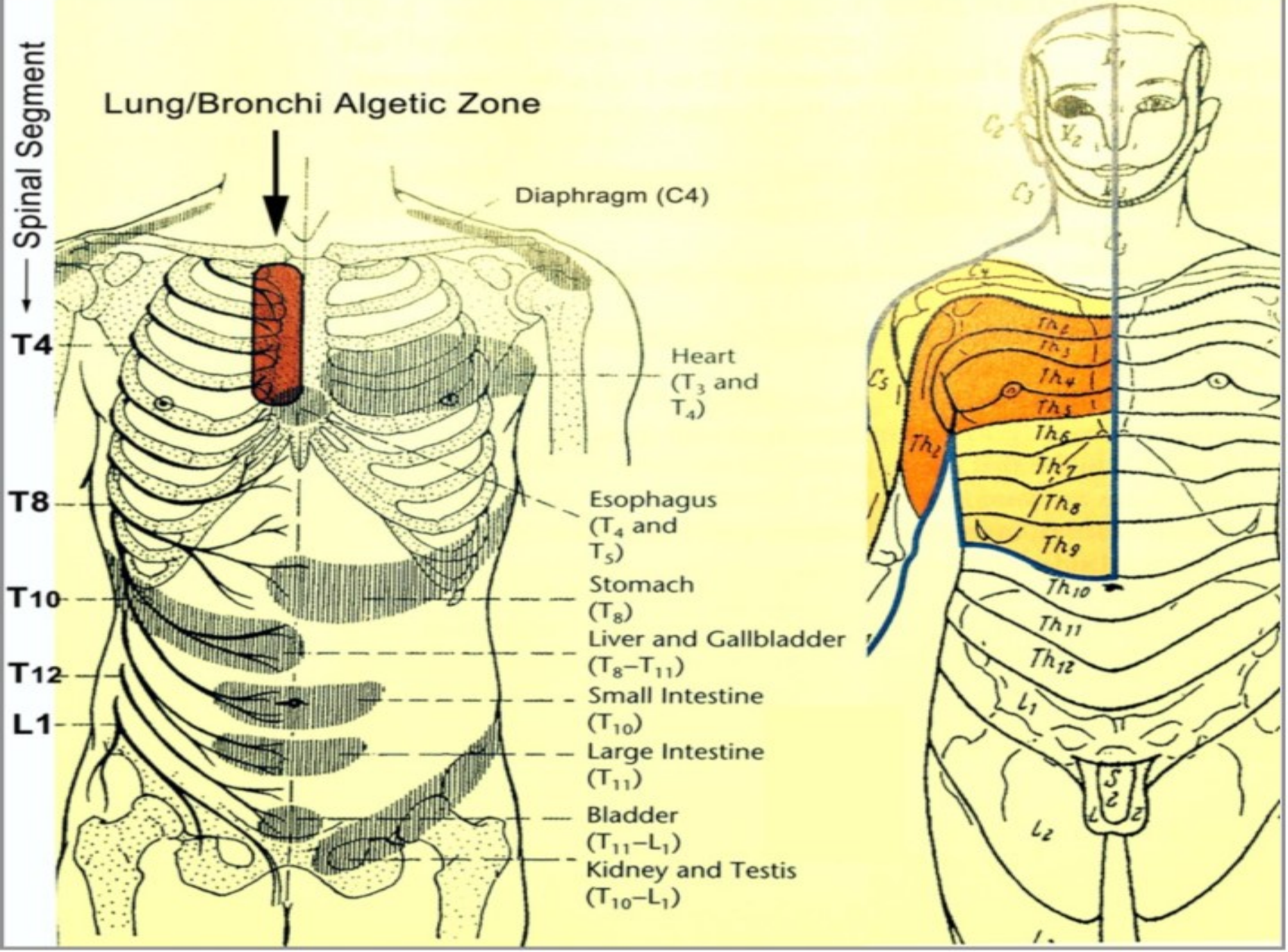

Figure 3. Algetic and Autonomic Reflex Projection of the

Dermatomal levels

- T10 – umbilicus
- T6 – xiphoid
- T4 – nipples
- T12, L1 – inguinal ligament , crest of ileum
- S2-S4 – perineum

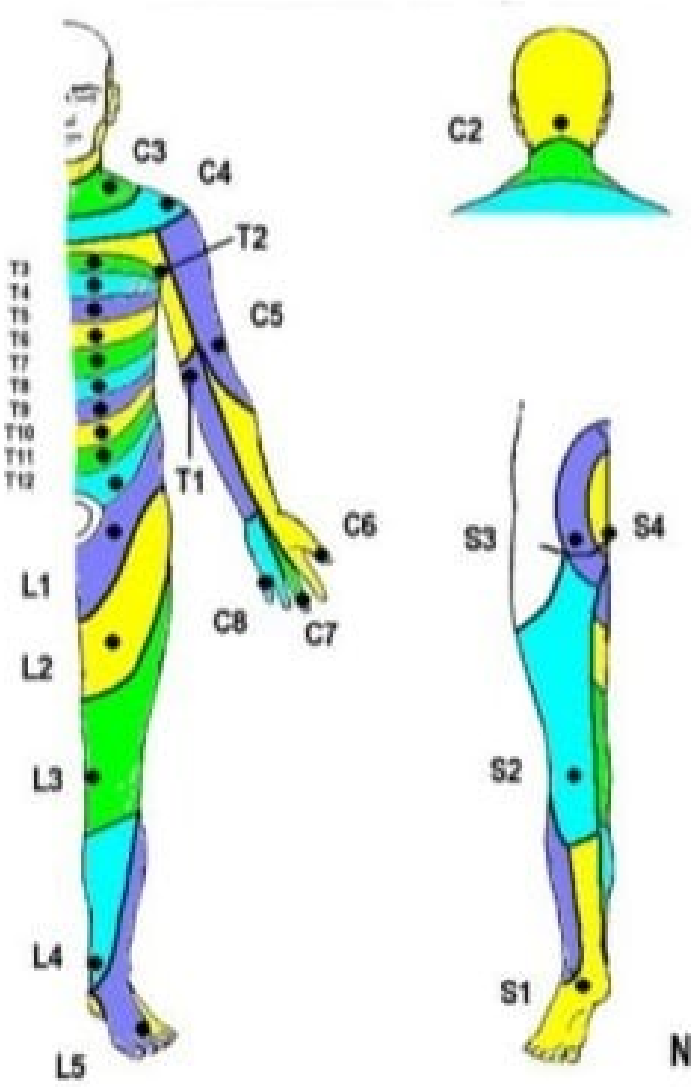

Table 6.2 Surface anatomy and dermatome levels

Surface anatomy	Sensory dermatome
Perineum	S2-S4
Lateral foot	S1
Knee and distal thigh	L3-L4
Inguinal ligament	T12
Umbilicus	T10
Tip of xyphoid process	T6
Nipple	T4
Inner aspect of forearm	T1-T2
Thumb and index finger	C6-C7
Shoulder and clavicle	C5-C4

Cont…

- As the above are different severities of the same process, they may both be referred to as high regional block.
- Left untreated, a high regional block can progress to a total spinal.
- Rapid recognition and management is necessary to ensure an optimal outcome for the patient.

TIMING OF HIGH REGIONAL BLOCK

During labour in a mother with an epidural block.

In theatre(intraoperatively)

Post-operatively (PACU)

During labour in a mother with an epidural

During labour in a mother with an epidural: following unrecognised dural puncture by either the Tuohy needle or epidural catheter itself:

Following a test dose, or

Following a top up (via pump or manual top up by anaesthetist

IN THEATRE

- Following epidural top up or spinal anaesthesia.

- Following a spinal anaesthetic in the presence of an existing epidural block(this increases the risk of a high block from a standard spinal anaesthetic dose

POST OPERATIVELY

- A high block can have a later onset so it is important to remain alert to the possibility, especially as attention will be diverted elsewhere.

- E.g. after delivery of the baby/procedure attention will be directed to the baby or new case

Factor predisposing to high regional block

- In general, the following factors need to be considered in order to minimize the risk of high or complete spinal block:
  - Drug factors
  - Patient factors
  - Technical factors

Drug factor

- An accurate estimation of the required dosage of local anaesthetic (LA) to achieve an appropriate level of 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 LA.

- A dose of 7.5-10mg hyperbaric bupivacaine plus 10-25 microgram of fentanyl is usually appropriate for caesarean section.
- In general, the evidence suggests that faster injections produce greater spread with plain solutions, but that the effect is less marked with hyperbaric solutions

Cont…

- Administration of excessive dose of LA.

- Failure to reduce dose in patients susceptible to excessive spread (i.e. the elderly, pregnant, obese, or short patients)

Technical factors

- Higher lumbar needle insertion may increase final block height
- Position at and following injection – sitting may minimize cephalad spread.
- Spinal needle – finer gauge and cephalad direction of needle hole may increase risk of higher block

Patient factor

- Body morphology – higher BMI or abdominal girth (including pregnancy) may reduce thecal volume and increase the risk of high block.
- 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
- Unusual excessive spread
- Short stature can be a risk factor for a high spinal as height influences lumbosacral CSF volume and hence spread of drug.
- Anatomical or pathological factors – compressed thecal sac (epidural fluid & dilated vessels), spinal canal abnormality can give higher risk
- Unusual patient sensitivity.

Signs and symptoms of high and total spinal anaesthesia

INITIAL SYMPTOMS(HIGH SPINAL ANAESTHESIA)

- Before complete spinal block patients often complain and manifest different clinical features, often depending on the level of spreads of local anesthetics agents.
- Patients often complain mild shortness of breath secondary to blockade of abdominal and intercostal respiratory accessory muscles (T1-T12)
- **Hypotension** with or without bradycardia is due to venous and arterial vasodilation resulting in a reduced venous return, cardiac output, and systemic vascular resistance, and due to direct blockage of the cardio accelerating fibers (T1-T4)
- Numbness or weakness in the arms, shoulders, and trunk (C5-T1), followed by
- Nausea, with or without vomiting.

Treatment

- Change the patients' position if a hyperbaric spinal technique is used.
- Stop the administration of epidural local anesthetics.
- Apply supplemental oxygen.
- Open up the intravenous fluids.
- Treat hypotension with ephedrine or phenylephrine.
- Treat tachycardia/bradycardia.

- Choose your vasopressors carefully:
  - If patient is **hypotensive and bradycardic then ephedrine** would be indicated. Ephedrine will increase heart rate as well as constrict blood vessels
  - If patient is **hypotensive and tachycardic or normal** in respect to heart rate then **phenylephrine** may be indicated. Phenylephrine can result in reflex bradycardia as it constricts blood vessels
  - **Refractory bradycardia and/or hypotension** should be treated rapidly with 5-10 mcg of **epinephrine.**

High Neuraxial Blockade- Spread to Cervical Dermatomes

Patients often complain mild shortness of breath secondary to blockade of abdominal and intercostal respiratory accessory muscles (T1-T12)

Hypotension with or without bradycardia is due to venous and arterial vasodilation resulting in a reduced venous return, cardiac output, and systemic vascular resistance, and due to direct blockage of the cardio accelerating fibers (T1-T4)

Numbness or weakness in the arms, shoulders, and trunk (C5-T1), followed by

Nausea, with or without vomiting secondary to cerebral hypotension,

Respiratory arrest secondary to diaphragmatic paralysis (C3-C5).

Treatment:

- The A,B,C's
- **Airway and breathing-** supplemental oxygen, maintain a patent airway, intubation, mechanical ventilation
- **Circulation-** aggressive intravenous fluid administration, ephedrine, phenylephrine, epinephrine
- **Bradycardia** should be treated with atropine
- Dopamine infusions may help

NB:

a. Early and aggressive treatment may avoid **cardiac arrest!**

b. Respiratory compromise associated with a high spinal is often transient.

c. Once the patient has been successfully treated and stabilized, surgery can often proceed.

Signs and symptom of Total spinal block

- Before complete spinal block patients often complain and manifest different clinical features, often depending on the level of spreads of local anesthetics agents.

- Patients often complain mild shortness of breath secondary to blockade of abdominal and intercostal respiratory accessory muscles (T1-T12)
- Hypotension with or without bradycardia is due to venous and arterial vasodilation resulting in a reduced venous return, cardiac output, and systemic vascular resistance, and due to direct blockage of the cardio accelerating fibers (T1-T4)
- Numbness or weakness in the arms, shoulders, and trunk (C5-T1), followed by :

CONT…

- Nausea, with or without vomiting secondary to cerebral hypotension
- Respiratory arrest secondary to diaphragmatic paralysis (C3-C5), and
- loss of consciousness (brainstem).
- Cardiac arrest may occur due to hypotension and hypoxemia or unopposed vagal dominance

Management

- Call (shout) 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.

Symptoms and signs	Root levels	System affected	Management
Bradycardia Hypotension+/- Nausea	T 1-4	Cardiac sympathetic fibres blocked	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 boluse Iv fluids
Tingling of hand with progressive weakness of hand grip	C 6-8	Arms and hands Accessory muscles of respiration	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	Assess airway • Oxygen supplementation • May require intubation and ventilation
Slurring of speech Sedation Loss of consciousness	Intracranial spread		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 monitorin

HOW TO RECOGNISE HIGH/TOTAL SPINAL BLOCK

- 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 of the patient.

PREVENTION OF HIGH REGIONAL BLOCK: GOOD PRACTICE

EPIDURAL ANALGESIA /ANAESTHESIA

Use low concentrations of local anaesthesia for labour analgesia
Prior to top up:

Assess block (to guide top up dosage)

Aspirate the epidural catheter with a 2ml syringe to rule out intrathecal or intravenous placement.

Consider giving large volumes of local anaesthetic in divided doses (clinical urgency may preclude this)

Cont…

- Technique:
  - Consider effects of speed of injection
  - Avoid excessive barbotage.

- If performing a spinal following an epidural, a dose reduction may be necessary depending on the existing level of block (reductions to 1-1.5ml of local anaesthetic have been suggested following a failed epidural top up); there is no clear consensus on this.

Spinal anaesthesia:

- Consider the level [and therefore local anaesthetic dose] required for surgery.

- Patient position: block height can be manipulated for up to 30mins when using hyperbaric (“heavy”) anaesthetics – if using head down position to establish block, remember to remove it as soon an possible

- Patient characteristics: consider dose reduction in short or morbidly obese patients

For epidural and spinal anaesthesia:

Don’t inject during a contraction/cough/Valsalva as this can increase cephalad spread of local anaesthetic.

The use of the Oxford wedge is recommended to prevent cephalad spread of local anaesthetic (and to optimise airway positioning in the event of requiring general anaesthesia)

REFERENCES AND FURTHER READING

- 1. Obstetric Anaesthetists' Association Guideline Initiative – High Regional Block Guideline Examples - Southampton University Hospitals/Stockport NHS Foundation Trust/University Hospitals Coventry and Warwickshire. Available at http://www.oaa-anaes.ac.uk/ content (OAA membership required to access).
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THANK YOU