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The Management of High Spinal Anaesthesia in Obstetrics: Suggested Clinical Guideline in the South African Context

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SASA GUIDELINES

The management of high spinal anaesthesia in obstetrics: suggested clinical guideline in the South African context

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Introduction

Spinal hypotension during Caesarean section is common, requiring intervention in ≥ 50% of cases. The precipitating causes and management have been extensively researched.[1] Isolated spinal hypotension should be distinguished from high spinal anaesthesia at Caesarean section, which is a rare, but potentially devastating complication. The exact clinical presentation is not well understood. The Third National Audit Project of the Royal College of Anaesthetists in the UK, as well as Swedish and French audits, failed to define this emergency condition clearly.[2–4] An early UK publication suggested an incidence of 1 in 5 334 in elective Caesarean sections, while the incidence rose to 1 in 3 019 in emergency cases.[5] An incidence nearer to 1% was suggested in a Danish study, albeit in subjects who had received prior labour epidural analgesia.[6] It was suggested in another study that high spinal anaesthesia may be more common when administered after an unsuccessful epidural top-up.[7] An overall decrease in mortality relating to spinal anaesthesia in South Africa was cited in the *Saving Mothers 2011-2013: Sixth report on confidential enquiries into maternal deaths in South Africa*. Unfortunately, details on the proportion of deaths due to high spinal anaesthesia were not reported. Although the reporting doctors frequently referred to the events surrounding the maternal deaths as "high spinal anaesthesia", clearly some of them were from uncontrolled hypotension, and not high motor block. The quality of information in the notes precluded judgement in other cases. Overall, 105 deaths were directly attributable to anaesthesia, which comprised 2% of the maternal mortality.[8]

This document addresses the deficiency of an official set of guidelines to aid the clinician in the management of high spinal anaesthesia in obstetrics. The intention is to supplement existing teaching and contextualise this life-threatening complication. This information should also assist with the classification of complications of obstetric spinal anaesthesia, and the facilitation of appropriate, timeous treatment. Improved data collection would help to establish the true incidence of high spinal anaesthesia in obstetrics in South Africa. The recommendations are specifically and deliberately designed to be user-friendly and simple, in order to ensure their acceptance in the clinical setting. The provision of cardiac and respiratory support is the overarching principle. The challenge is that these are often required simultaneously.

This guideline aims to assist clinicians who are inexperienced in the administration of obstetric anaesthesia, isolated from experienced clinicians, and stationed in resource-poor environments.

It hopes to address:

- The minimum equipment that should be available, i.e. equipment immediately at hand, and readily available equipment.
- The minimum pharmacological agents that should be available, i.e. pharmacological agents immediately available for injection, and readily available pharmacological agents.
- The identification of high spinal anaesthesia.
- The management of high spinal anaesthesia. A tiered response from the clinician is envisaged. He or she should rapidly establish the extent of cardiorespiratory support required, and institute management accordingly.

Definitions

Definitions are as follows:

- *High spinal anaesthesia:* Intrathecal anaesthesia, where a level of motor block ensues such that cardiovascular and respiratory embarrassment develops, seriously jeopardising patient safety.
- *Uncontrolled spinal hypotension:* A rapid decrease in systolic blood pressure after the administration of spinal anaesthesia, which may lead to loss of consciousness and cardiac arrest.
- *Equipment immediately at hand:* This refers to equipment that must be opened from its packaging and be within immediate reach of the clinician.

- *Readily available equipment:* This refers to equipment that need not be opened prophylactically, but can be opened immediately should the need arise.
- *Pharmacological agents immediately available for injection:* Drugs prepared in syringes, as per the South African Society of Anaesthesiologists infection control guidelines.
- *Readily available pharmacological agents:* These drugs need not be drawn up, but should be available to be drawn up immediately when the need arises.

Equipment

Equipment immediately at hand

The equipment described in this section should be available prior to the commencement of neuraxial anaesthesia.

Equipment that should be immediately at hand is as follows:

- An appropriately sized face mask.
- A gum elastic bougie or an introducer.
- An oropharyngeal airway of an appropriate size, selected prior to the administration of anaesthesia.
- Equipment to deliver positive pressure ventilation by face mask or endotracheal tube, i.e. a working bag connected to an anaesthesia workstation or Ambu® bag.
- Two laryngoscopes with working lights and blades of differing sizes which are interchangeable.
- Suction with an adequate length of tubing to reach the patient, and a patented Yankauer® nozzle.
- A dedicated syringe to inflate the cuff of the endotracheal tube, should intubation become necessary.

Readily available equipment

Equipment that should be readily available is as follows:

- *Endotracheal tubes*: One of the most appropriate size for the patient, and one of size 6.0 mm internal diameter.
- *Strapping:* Nonallergenic tape to secure the endotracheal tube.

Rationale

The rationale behind this is that the rapid loss of the airway in a patient population predisposed to difficult intubation and consequent hypoventilation and hypoxia, is believed to be the major contributor to morbidity and mortality in this scenario.

Pharmacological agents

Pharmacological agents immediately available for injection

The pharmacological agents described in this section should be available prior to the commencement of neuraxial anaesthesia. They should not be sourced only after the development of cardiorespiratory derangement.

Agents immediately available for injection are as follows:

- *One cardioaccelerator:* Atropine 0.5 mg, prepared in a 5 ml syringe as 0.1 mg/ml; or ephedrine 50 mg, prepared in a 10 ml syringe as 5 mg/ml.
- Phenylephrine 10 mg in 200 ml (50 ug/ml), then 500 ug drawn up in a 10 ml syringe.
- *Muscle relaxant:* Suxamethonium 100 mg, drawn up in a 2 ml syringe.

Readily available pharmacological agents

Agents that should be readily available are as follows:

- *An induction agent:* Preferably etomidate.
- *Adrenaline:* Adrenaline 1 mg. Do not routinely draw up adrenaline in low-risk cases because this predisposes to a potentially fatal drug error.
- *Colloid:* 130/0.4 (6%) hydroxyethyl starch is preferable, but crystalloid is acceptable.

Rationale

The rationale behind this is that the haemodynamic status can deteriorate quickly, and is not always reversible by a single intervention that allows the clinician immediate control.

Table 1: A tiered approach to the identification of high spinal anaesthesia

Symptoms	Respiratory system	Cardiovascular system	Diagnosis
A weak cough, or early signs of dyspnoea	• RR ≥ 12–15 per minute • SpO_2 ≥ 95% • Function is at • preoperative status	Hypotension and no bradycardia*	High spinal anaesthesia is unlikely
Progressive dyspnoea Weak hand grip strength (C8/T1) Can't touch nose (C5/C6) Ineffective cough	• RR: 12-15 per minute • SpO_2 ≤ 95% • Function diminished	Hypotension, and no bradycardia*	Early signs of high spinal anaesthesia
Unable to speak	• Hypoventilation • SpO_2 ≤ 90% • Function poor	Hypotension ± bradycardia*	High spinal anaesthesia is likely
Unable to speak	• Apnoea	Hypotension + bradycardia*	High spinal anaesthesia is established

RR: respiratory rate, SpO_2: oxygen saturation
* bradycardia is a heart rate ≤ 60 beats/minute

Identification of high spinal anaesthesia

A tiered approach to the identification of high spinal anaesthesia is described in Table 1.

The following points are to be borne in mind. It should be recognised that hypoventilation, defined by a significantly decreased respiratory rate and tidal volume, may be precipitous. Should the clinical conditions deteriorate quickly, the clinician need not wait for apnoea or bradycardia to develop to regard the situation as established high spinal anaesthesia.

Management of high spinal anaesthesia

A tiered response (Table 2) is envisaged, as this often allows inexperienced clinicians to confirm their diagnosis and immediately provide support as necessary, rather than await cardiorespiratory collapse and only then initiate cardiopulmonary resuscitation.

In the event of likely high spinal anaesthesia, where both systems are simultaneously and rapidly deteriorating, intubation and ventilation should be undertaken immediately after the prompt administration of ephedrine. Ephedrine is favoured over phenylephrine in this situation because cardiac deafferentation is more likely in the situation of high spinal anaesthesia than in simple spinal hypotension.

Management after tracheal intubation is as follows:

- *Ventilation:* Administer tidal volumes at 7 ml/kg ideal body weight. Keep the peak airway pressure ≤ 30 cmH_2O, and titrate the fraction of inspired oxygen to maintain oxygen saturation ≥ 95%.
- *Haemodynamic support:* Ephedrine boluses should be 5-10 mg, and phenylephrine boluses 50-100 ug as required.
- *Hypnosis:* Provide hypnosis by means of volatile agents as usual for Caesarean section under general anaesthesia.
- *Ongoing vigilance:* Ongoing vigilance is necessary with respect to deteriorating haemodynamic status and the resolution of respiratory failure. Typically, the respiratory status rapidly recovers so that the patient can usually be extubated at the end of the Caesarean section.
- *Advice:* Advice should be sought on ongoing care as soon as possible.

Key principles

1. Though rare in obstetrics, the clinician should always be prepared for high spinal anaesthesia.
   - This includes ensuring that certain equipment is immediately at hand, and certain further equipment is readily available.
   - This also includes drawing up certain drugs and having others readily available.
2. Early recognition of high spinal anaesthesia is crucial.
3. Respiratory support should be initiated immediately after prompt administration of ephedrine.
4. After tracheal intubation, run adrenaline by infusion if cardiac output is not immediately restored.
5. Avoid propofol and thiopentone for tracheal intubation in this situation.
6. Do not place the patient in the anti -Trendelenburg position.
7. Continue to monitor for haemodynamic instability and respiratory recovery.
8. Call for help and advice. Either a trained nurse or another doctor should be in theatre at all times.

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Table 2: Management of high spinal anaesthesia

Diagnosis	Respiratory system	Cardiovascular system
High spinal anaesthesia is unlikely	Reassure the patient and monitor the patient for signs of deterioration	
Early signs of high spinal anaesthesia	Provide face mask oxygen at 100%	Feel the patient's pulse, and monitor heart rate and blood pressure
	Call for help	
High spinal anaesthesia is likely	Provide gentle positive pressure ventilation with a tight-fitting face mask (100% O_2), including cricoid pressure (if this does not impair ventilation). Reassure the patient	• Bradycardia: Ephedrine 10 mg intravenously, and run colloid freely • No bradycardia: Fluid only • Monitor the patient closely for deterioration, and titrate vasopressor and fluid
High spinal anaesthesia is established	Provide rapid sequence tracheal intubation and ventilation after the administration of a small dose of etomidate or isoflurane if face mask oxygen is being provided, and suxamethonium 1 mg/kg. Do not not use propofol or thiopentone in this situation	• Ephedrine 10–20 mg intravenously • In the absence of the immediate return of an adequate cardiac output, run 500 ml hydroxyethyl starch freely, containing 1 mg adrenaline

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Notes

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