New Horizons for the management of maternal hypotension following spinal anaesthesia

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Elizabeth Garrett Anderson
1836–1917
The first woman to qualify as a doctor in Britain lived here
Disclosures

• I have no disclosures

• Except:

  • I personally have had 3 elective caesarean sections!

  • Recent editorial in Anaesthesia
Introduction

• Background
• Current vasopressor use
• Smart systems for administering drugs
• Alternative vasopressor drugs - Norepinephrine
• Fluids during elective caesarean section
• Cardiac Output (CO) monitoring
• Can we predict those at risk of spinal hypotension
Background

• Spinal anaesthesia preferred

• Hypotension is a common sequelae

• Consequences of spinal hypotension
  • unpleasant for mother
  • adverse effect on fetal base deficit

Management of Spinal Hypotension: Is it important?

- Mother
- Unpleasant
- Quality of care and patient outcome/experience
Question for the audience

• What is your 1st line vasopressor for the treatment of spinal hypotension?
  
  • a. Ephedrine
  
  • b. Phenylephrine
Ephedrine

- High level evidence against the use of ephedrine
- Lee et al (2002)
  - Clinical significance
- Veeser et al (2012)
  - Evidence for true fetal acidosis

![Ephedrine molecule](image)

**True Fetal Acidosis**

- Favours Ephedrine
- Favours Phenylephrine


Phenylephrine

- Vasopressor of choice?
- Fast onset of action
- Good maternal BP control
- Favourable effect on fetal cord gases
- But......
Maternal Hypertension

Dose-dependent effects


Beilin Y. The treatment should not be worse than the disease. Anaesthesiology 2006; 104: 1348-49.

Question for the audience

• When using vasopressors:

• When do you treat?

  • a. Prophylactically (before spinal hypotension has occurred)

  • b. Reactively (only after spinal hypotension gas occurred)
When should we treat?

- Think about 2 situations:
  - 1. Maternal circulation in response to hypovolaemia
  - 2. Maternal circulation in response to spinal anaesthesia
- Suggests prophylactic treatment superior
- Supported by the evidence

Question for the audience

- When using vasopressors:
  - Do you administer vasopressor drug by:
    - a. An infusion
    - b. Bolus doses
Infusion or bolus administration?

- Only limited data available comparing prophylactic PE infusions with prophylactic PE boluses

- Das Neves et al: compared 3 patient groups
  - continuous infusion group had lowest incidence of hypotension and vomiting
  - However, bolus dose used was small - George et al, Tanaka et al


Infusion versus bolus administration

- Infusions can reduce the workload of the attending anaesthetist
- Allowing more time to focus on other aspects of patient care

However…

If you adopt a reactive approach to treatment

Phenylephrine infusion versus bolus regimens during cesarean delivery under spinal anesthesia: a double-blind randomized clinical trial to assess hemodynamic changes.

Doherty A1, Ohashi Y, Downey K, Carvalho JC.

Continuous Invasive Blood Pressure and Cardiac Output Monitoring during Cesarean Delivery

A Randomized, Double-blind Comparison of Low-dose versus High-dose Spinal Anesthesia with Intravenous Phenylephrine or Placebo Infusion

Eldrid Langesæter, M.D.,* Leiv Arne Rosseland, M.D., Ph.D.,* Audun Stubhaug, M.D., Ph.D.†


Ideal infusion regimen

• Search for the ‘Holy Grail’

• Control maternal blood pressure

• Avoiding maternal hypertension

• Minimising reductions in maternal HR and CO

• Consider using HR as a surrogate marker for CO


Closed-loop double vasopressor automated system

- Sia et al (2012): preliminary study
- Double vasopressor
- CNAP for continuous SBP and HR
- Good BP control and minimal interventions

Comparison of automated system with manual system

- Sng et al (2014)
  - manual bolus vasopressor or closed-loop automated bolus system
  - Automated group had better SBP control

- Ngan Kee et al (2013)
  - PE by closed-loop automated infusion or manual-controlled infusion
  - Automated group had better BP control

Sng BL, Tan HS, Sia AT. Closed-loop double-vasopressor automated system versus manual bolus vasopressor to treat hypotension during spinal anaesthesia for caesarean section: A randomised control trial. Anaesthesia 2014; 69(1): 37-45
Is it time for a change?

- Should we consider alternative vasopressor drugs?
  - Maintain maternal BP
  - less bradycardia
  - less impact on maternal CO
Randomised double-blinded comparison of norepinephrine and phenylephrine (Ngan Kee et al 2015)

- Elective cesarean delivery under SA
  - NE 5mcg/ml (n=49)
  - PE 100mcg/ml (n=52)
- Infusion regulated by computer-controlled closed-loop feedback system to maintain SBP
• NE effective at controlling SBP

• NE associated with:
  • Greater CO
  • lower SVR
  • ? less fetal stress
  • ? better uteroplacental BF

Fluids
Crystalloid

- Preload
  - No
- Coload
  - Yes


Colloid

- Preload
  - Yes
- Coload
  - Yes


Cardiac Output (CO) Monitors

Minimally- and non-invasive assessment of maternal cardiac output: go with the flow!

S. Armstrong, R. Fernando, M. Columb

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b Department of Anaesthesia, University Hospital of South Manchester, Manchester, UK

Need to consider Clinical Situation

What do we want from a cardiac monitor?
Non-invasive monitors

- Doppler velocimetry using ultrasound
- Bioimpedence techniques
- Bioreactance techniques
- Modelflow/ Nexfin CO-trek
Minimally-invasive monitors

• Arterial waveform Analysis
  • LiDCO
    • LiDCO plus
    • LiDCO rapide
  • FloTrac-Vigileo
Trans-thoracic Echo

- ROSE scan
  - rapid obstetric screening echocardiography scan
    - Diagnosis and response to therapy
    - Embolism
    - FH assessment

Can we predict those at risk of spinal hypotension?

• Predictors of spinal hypotension
  • Caval compression
  • Maternal BMI
  • Maternal HR
  • Advanced maternal age

Novel methods for predicting spinal hypotension

- Compensation for spinal hypotension requires a functioning ANS
- Heart rate variability
  - Chamchad et al
  - Hanss et al
- Pupillary light reflex
  - Riffard et al


Riffard et al. Intérêt de la pupillométrie pour prédire le risque d’hypotension artérielle après rachianesthésie pour césarienne. SFAR Le Congres. R476.
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Thank you