The pleth variability index and blood pressure during spinal anaesthesia for caesarean section

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What is the Pleth Variability Index (PVI)?

- Measured by some pulse oximeters – e.g. Radical Seven®
- The Perfusion Index (PI) is the ratio of pulsatile to non-pulsatile infra-red signal
- PVI = variation in PI over a respiratory cycle
Pleth Variability Index (PVI) = \( \frac{P_{I_{\text{max}}} - P_{I_{\text{min}}}}{P_{I_{\text{max}}}} \times 100 \)

\[
\begin{align*}
(5 - 4) & / 5 \\
& \times 100
\end{align*}
\]
\( = 20 \)
Background

• PVI predicts fluid responsiveness in ventilated patients with high sensitivity and specificity

• Some evidence that patients who become hypotensive post-spinal for caesarean section have higher baseline PVI

• Spinal anaesthesia induces relative hypovolaemia

• Could changes in PVI detect hypotension during caesarean section under spinal anaesthesia?
Methods
The pleth variability index and blood pressure during spinal anaesthesia for caesarean section

- Ethically approved observational study
- 19 patients
- Spinal anaesthesia for elective caesarean section
- BP measurement with finometer
- Radical seven pulse oximeter
- Supported by grant from OAA
Spinal anaesthesia

- Discretion of attending anaesthetist
- 16gauge IV access - Hartmann’s one litre
- No active preload
- NIBPM/ SaO2/ ECG
- Boluses of vasopressors as required
- Patient seated for insertion
- 0.5% heavy bupivacaine 2.4 to 2.6ml with 300 mcg of diamorphine
Results
Single case
Changes in PVI for all cases

![Graph showing Changes in PVI for all cases](image-url)
Change in PVI units (median, range and interquartile range) during spinal anaesthesia

PVI (mean +/- 1 standard deviation) for 11 cases SBP fell by more than 25% (●) and 8 cases SBP fell by less than 25% (○)
Perfusion Index (mean, plus or minus one standard deviation) for 11 cases where systolic BP fell by more than 25% (●) and eight cases where systolic BP fell by less than 25% (○).
Conclusions

- PVI falls and PI rises post spinal anaesthesia
- PVI and PI values show wide variation
- Intraoperative PVI is not helpful to manage low BP during spinal for CS
- Changes in PVI may be more closely linked with changes in PI rather than fluid status
References


PVI during brachial plexus block

British Journal of Anaesthesia May 2015

• Sympathetic block decreases PVI
• PVI reflects PI or local conditions only
• PVI cannot be a measure of central circulatory factors alone
• PVI – dependent on local sympathetic tone and intrathoracic pressure changes
Dicrotic wave:

- Pulse oximeter morphology changes with onset of hypotension post initiation of spinal anaesthesia
- Changes may precede most profound hypotension

<table>
<thead>
<tr>
<th>TIME</th>
<th>Pre spinal</th>
<th>One minute post spinal</th>
<th>Two minutes post spinal</th>
<th>Three minutes post spinal</th>
<th>Four minutes post spinal</th>
</tr>
</thead>
<tbody>
<tr>
<td>BP</td>
<td>150/85</td>
<td>132/75</td>
<td>120/71</td>
<td>97/56</td>
<td>72/41</td>
</tr>
<tr>
<td>Pulse oximeter waveform</td>
<td><img src="image1.png" alt="Image" /></td>
<td><img src="image2.png" alt="Image" /></td>
<td><img src="image3.png" alt="Image" /></td>
<td><img src="image4.png" alt="Image" /></td>
<td><img src="image5.png" alt="Image" /></td>
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<tr>
<td>PARAMETER</td>
<td>VALUE (n=19)</td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>----------------------------------------</td>
<td>--------------</td>
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<tr>
<td>BMI</td>
<td>27.0 (5.8)</td>
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<tr>
<td>Volume of bupivacaine for spinal (ml)</td>
<td>2.51 (0.1)</td>
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<tr>
<td>Block height to cold</td>
<td>T3 (2-5)[3-4]</td>
<td></td>
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<tr>
<td>Block height to touch</td>
<td>T5 (3-6)[4-5]</td>
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<tr>
<td>Phenylephrine (µg)</td>
<td>340(196)</td>
<td></td>
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<tr>
<td>Glycopyrrolate (µg)</td>
<td>113(146)</td>
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<tr>
<td>Syntocinon infusion</td>
<td>10</td>
<td></td>
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<tr>
<td>Temperature in theatre (°C)</td>
<td>23.4(0.6)</td>
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<tr>
<td>Length of surgery (minutes)</td>
<td>32.7(12.7)</td>
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</tbody>
</table>

**Table one:** Demographic data for the study presented as either number, mean (SD) or median(range)[IQR].