



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

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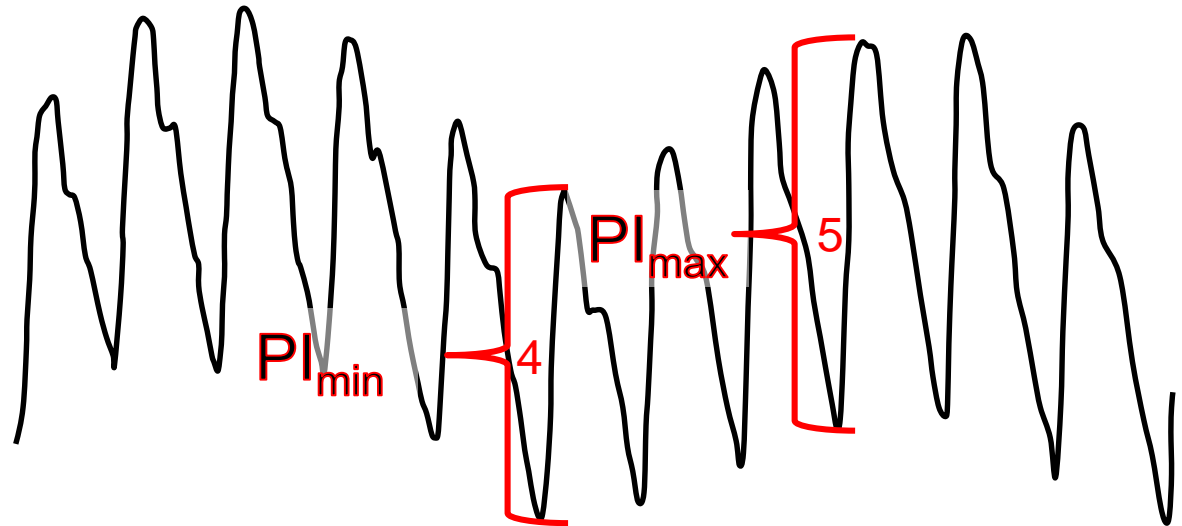
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NHS Trust

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NHS Foundation Trust

# What is the Pleth Variability Index (PVI)?

- Measured by some pulse oximeters – e.g. Radical Seven<sup>®</sup>
- The Perfusion Index (PI) is the ratio of pulsatile to non-pulsatile infra-red signal
- $PVI = \text{variation in PI over a respiratory cycle}$

# Pleth Variability Index – definition



Pulse oximeter trace

$$\text{Pleth Variability Index (PVI)} = (PI_{max} - PI_{min}) / PI_{max} \times 100$$
$$(5 - 4) / 5 \times 100 = 20$$

# 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

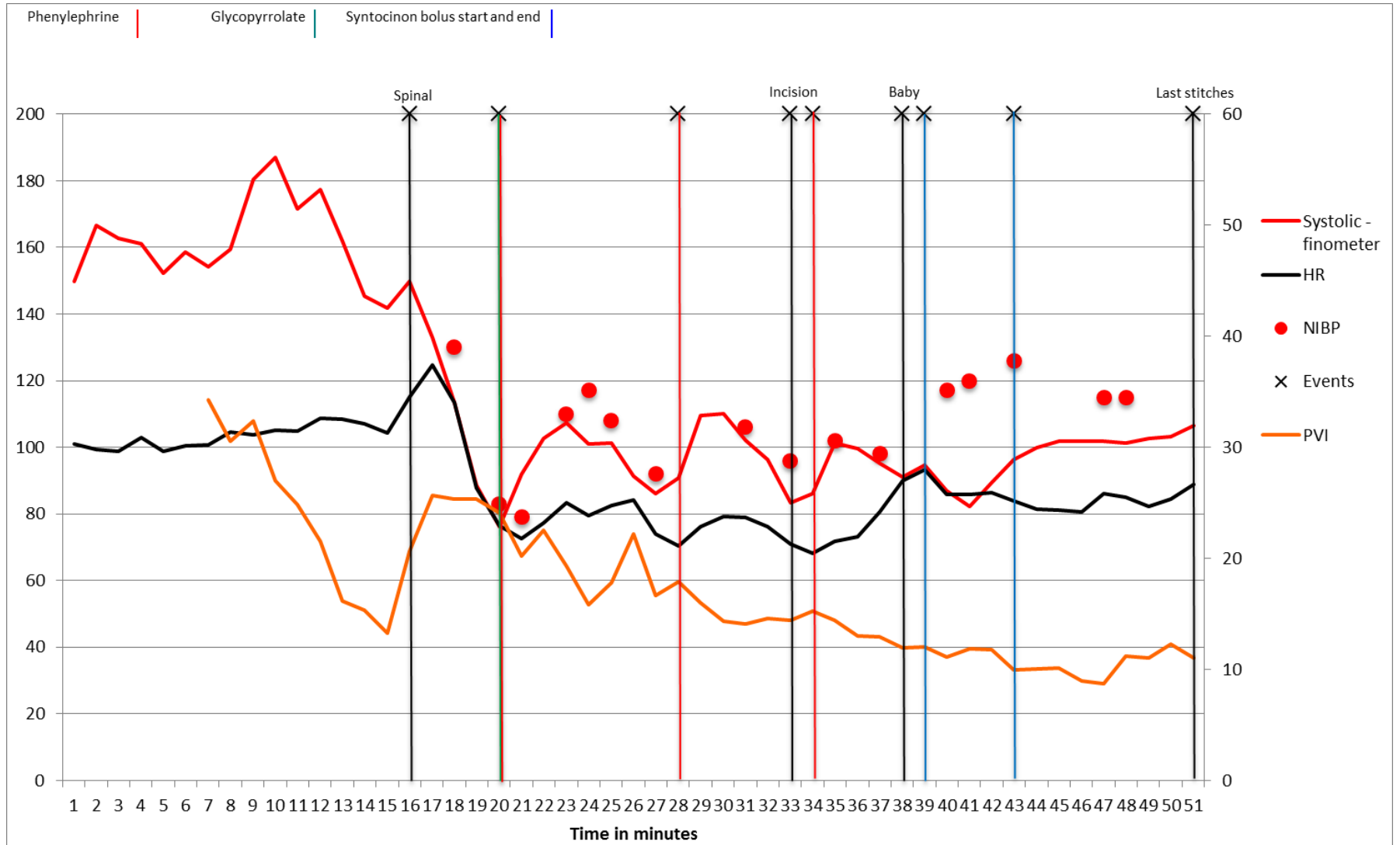
# Spinal anaesthesia

- 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

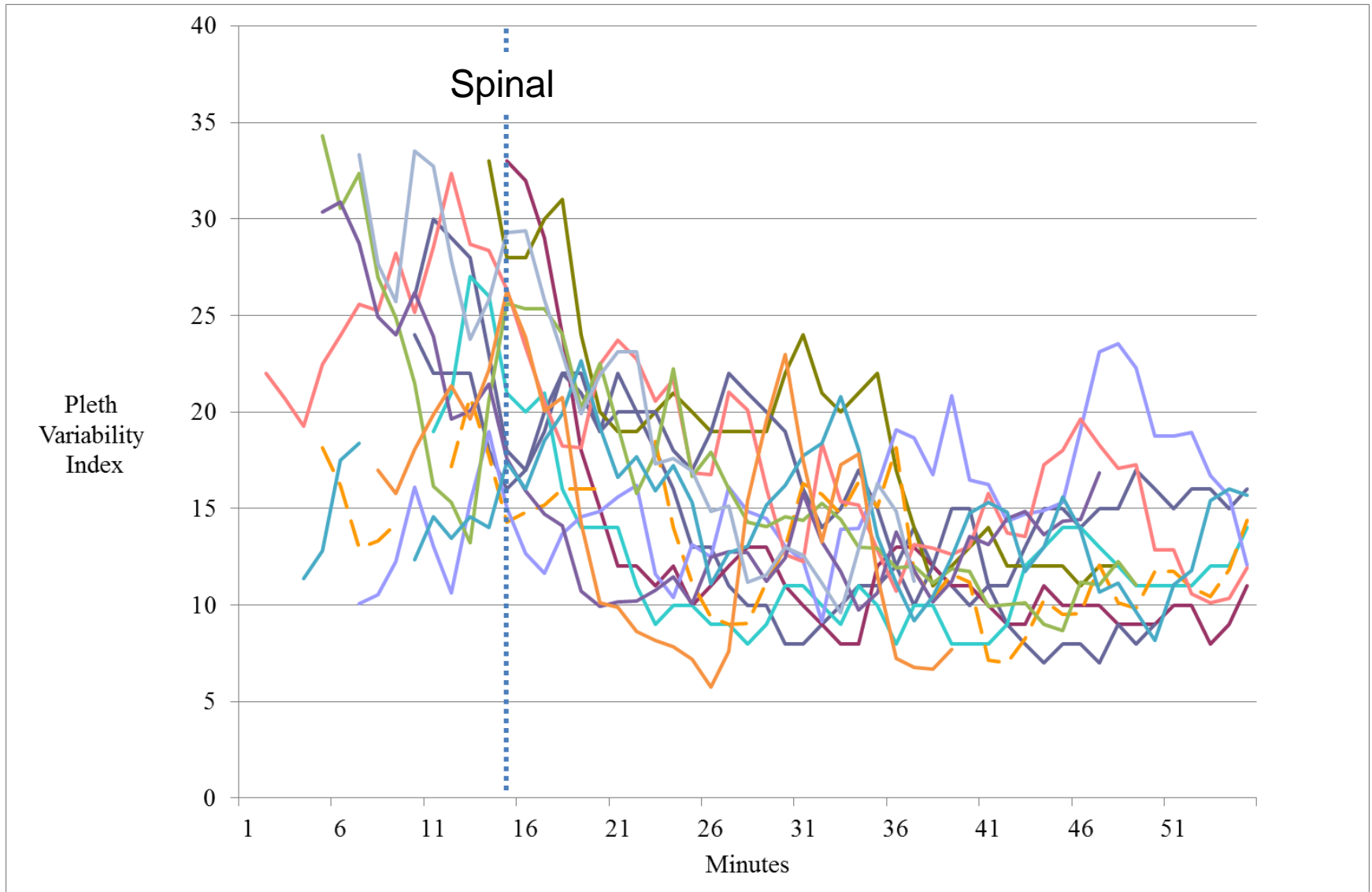
# Results

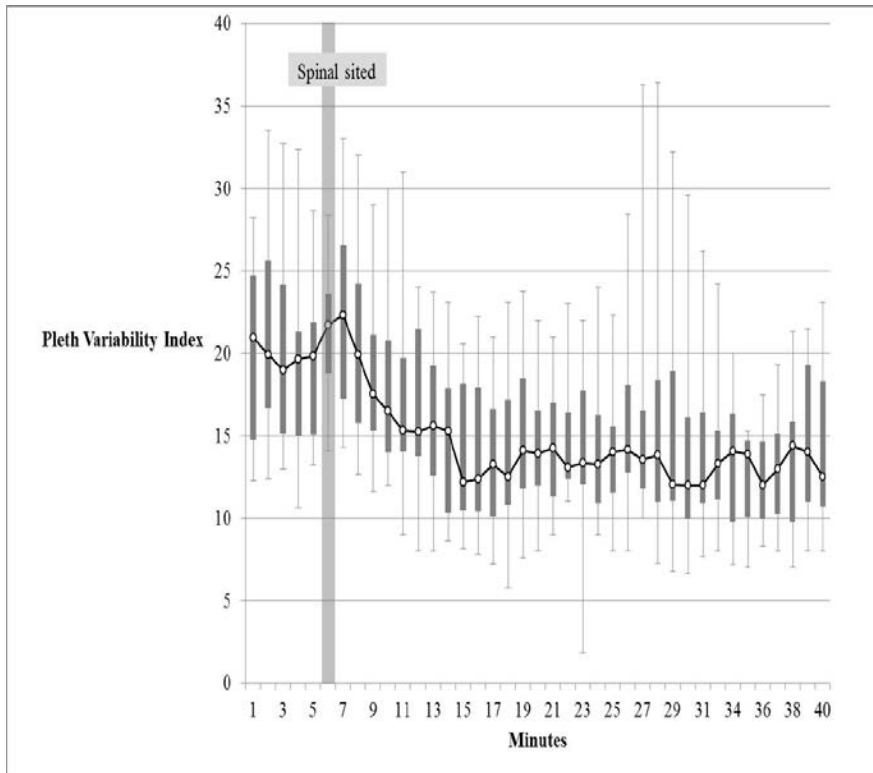


# Single case

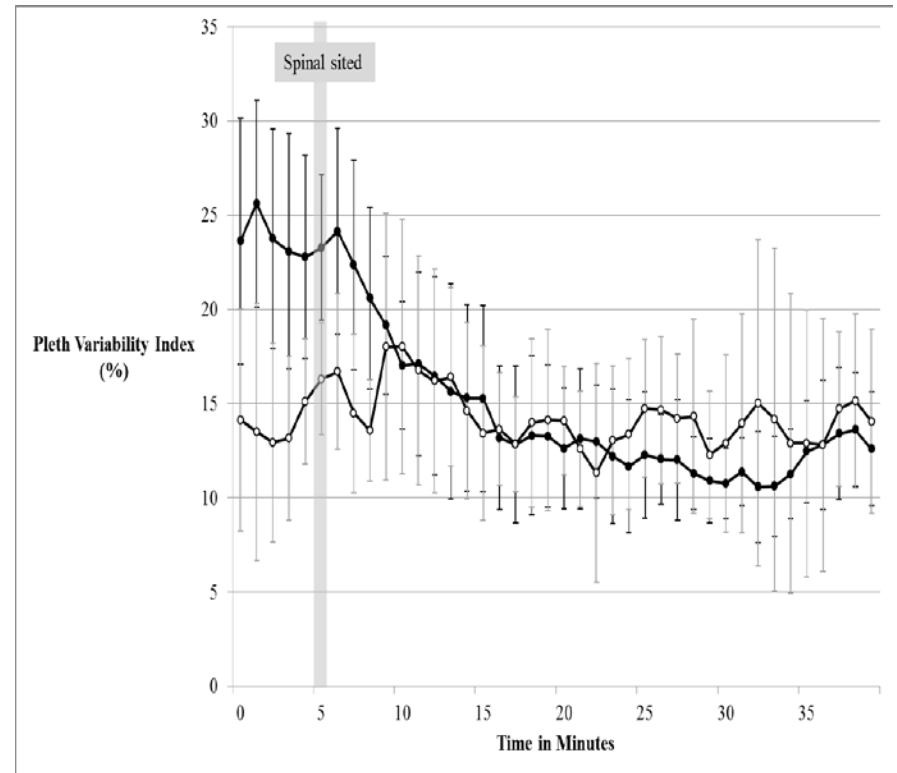


# Changes in PVI for all cases



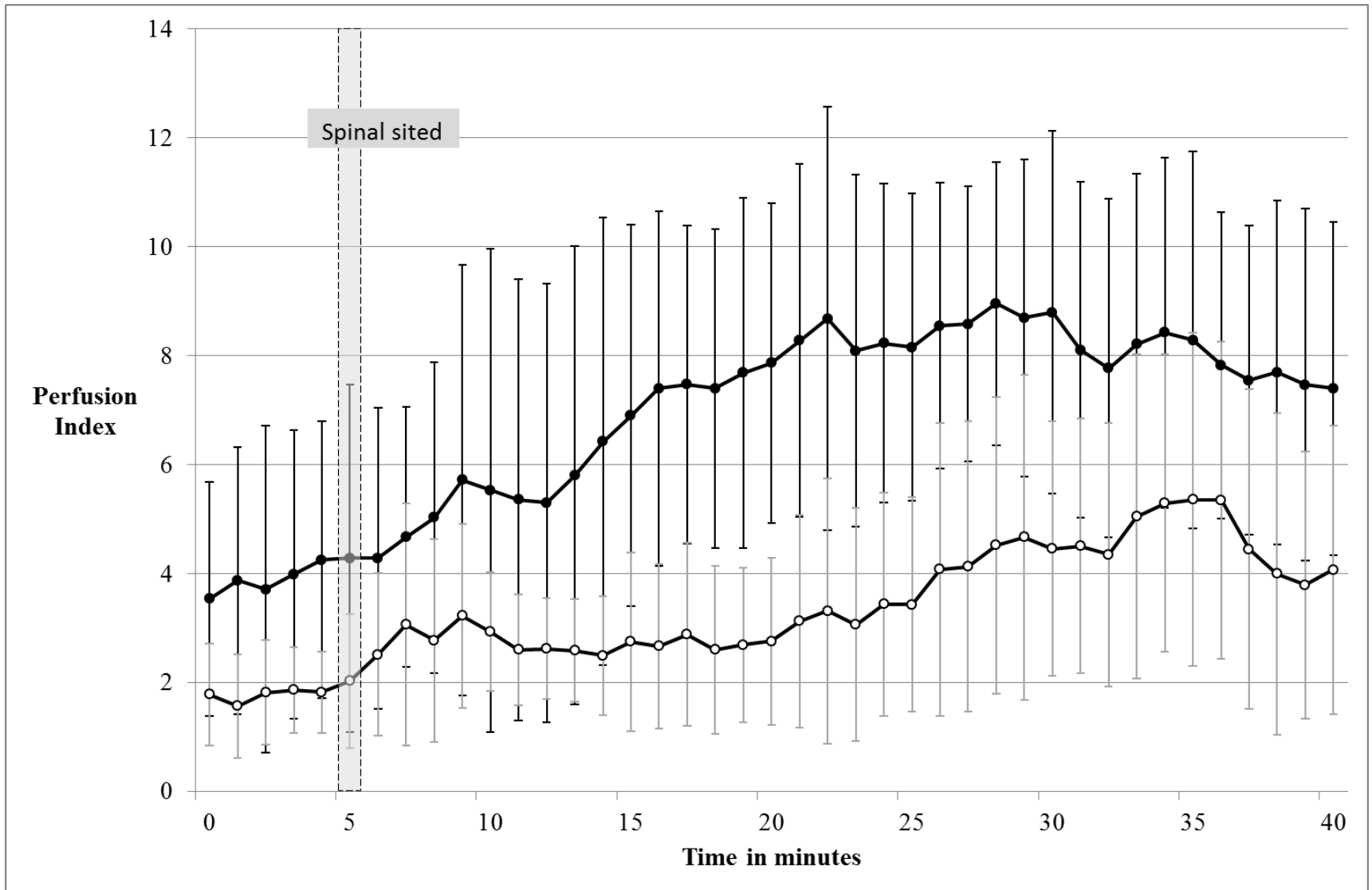


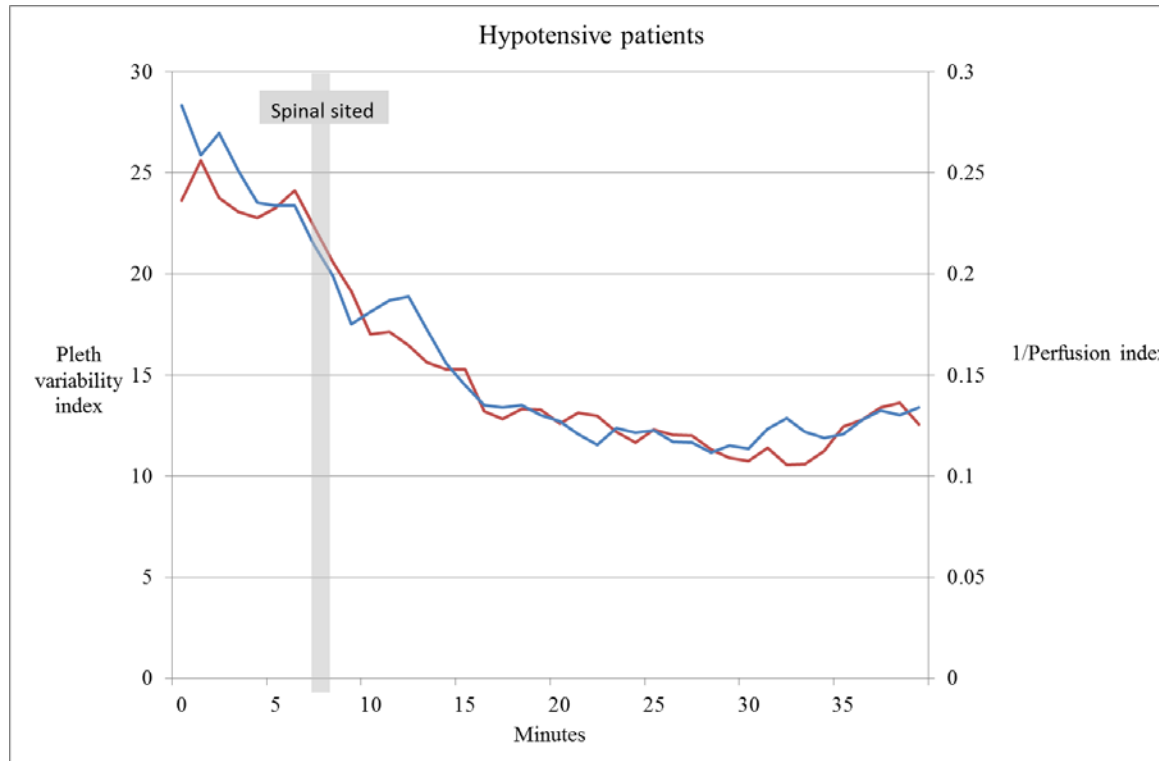
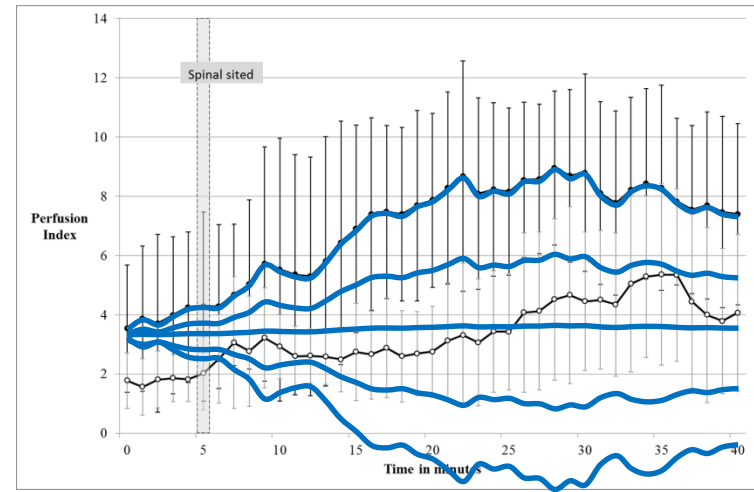
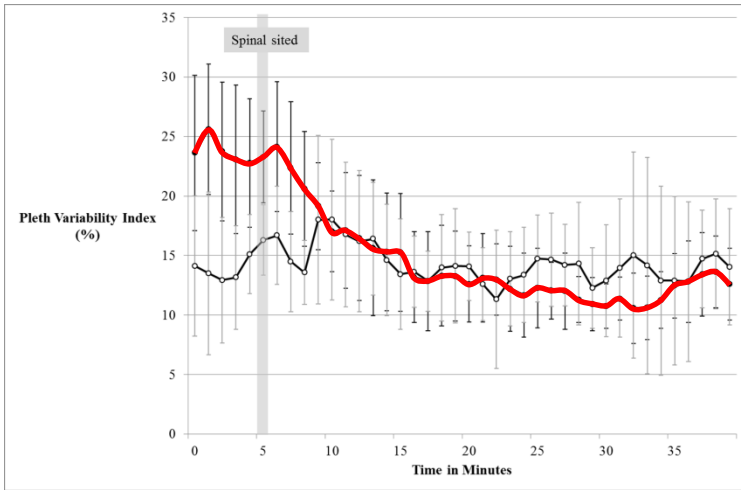
Change in PVI units (median, range and interquartile range) during spinal anaesthesia



PVI (mean  $\pm$  1 standard deviation) for 11 cases SBP fell by more than 25% (●) and 8 cases SBP fell by less than 25% (o)

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

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2. Sun S, Huang SQ. Role of pleth variability index for predicting hypotension after spinal anesthesia for cesarean section. *International Journal of Obstetric Anesthesia* (2014) 23, 324-329
3. Toyoma S, Kakumoto M, Morioka M et al. Perfusion index derived from a pulse oximeter can predict the incidence of hypotension during spinal anaesthesia for Caesarean delivery. *British Journal of Anaesthesia* (2013) 111 (2): 235-41
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# PVI during brachial plexus block





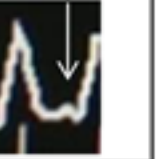
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- Sympathetic block decreases PVI
- PVI reflects PI or local conditions only
- PVI cannot be a measure of central circulatory factors alone
- **PVI – dependent on local sympathetic tone and intrathoracic pressure changes**



# Dicrotic wave:

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

TIME	Pre spinal	One minute post spinal	Two minutes post spinal	Three minutes post spinal	Four minutes post spinal
BP	150/85	132/75	120/71	97/56	72/41
Pulse oximeter waveform					

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PARAMETER	VALUE (n=19)
BMI	27.0 (5.8)
Volume of bupivacaine for spinal (ml)	2.51 (0.1)
Block height to cold	T3 (2-5)[3-4]
Block height to touch	T5 (3-6)[4-5]
Phenylephrine (µg)	340(196)
Glycopyrrolate (µg)	113(146)
Syntocinon infusion	10
Temperature in theatre (°C)	23.4(0.6)
Length of surgery (minutes)	32.7(12.7)

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