The clinical efficacy of near-infrared spectroscopy in cesarean section during spinal anaesthesia; a comparison of planned and emergency surgery

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Background

- During spinal anaesthesia for cesarean section, cerebral oxygenation decreases may be related to cerebral low perfusion due to hypotension.
- Near-infrared spectroscopy (NIRS) is a relatively old tool that allows continuous noninvasive monitoring of oxygenation in brain ¹⁾.
- A recent study²⁾ successfully used NIRS to monitor cerebral blood flow (CBF) and cerebral oxygenation (CBO) in cesarean section (CS) during spinal anaesthesia.
- Pregnancy-specific complications, especially in emergency operations, can suddenly affect maternal brain circulation, but NIRS is still not commonly used.

Purpose

- To measure the changes in maternal CBF and CBO using NIRS during spinal anaesthesia and to evaluate the difference between planned and emergency operations.

Materials and Method

- 51 patients undergoing CS were monitored using NIRS system (NIRO-200NX, Hamamatsu Photonics) (July 1, 2018- September 30, 2018)
Group P: planned CS (n=34), Group E: emergency CS (n=17)
- We estimated CBF from total-Hb and CBO from tissue oxygen index (TOI)) changes³⁾.
- Systolic and diastolic arterial pressure (SAP and DAP), SPO2 and HR were also recorded every 2 min.
- Data were taken from the following five points.
before spinal anaesthesia (1) , injection of bupivacaine (2) , and at 10 (3), 20 (4), and 30 (5) minutes after injection. (Fig.1)
- Data were calculated using unpaired t-test, Mann-Whitney U test, Fisher's exact test, repeated-measures ANOVA and Turkey- Kramer multiple comparison test.

Anaesthetic procedures

- A combined spinal-epidural anaesthesia. (Intrathecal hyperbaric bupivacaine 8 mg, fentanyl 0.4ml (20µg)).
- If hypotension (SAP<90mmHg) was observed, the patient was treated with ephedrine and/or phenylephrine as required.

Results and Discussions

- There were no significant differences in demographic and clinical data between groups. (Table.1)
- SAP, total- Hb and TOI significantly decreased ten minutes after spinal anesthesia in both groups (P<0.05). This decrease in CBF and CBO was likely the result of hypotension after spinal anesthesia.
- SAPs were significantly higher in the emergency group. We hypothesized that this significant difference would also be shown in estimated CBF and CBO, but it did not correspond to significant differences in total-Hb and TOI between groups.
- Of note, HR at 20 and 30 minutes after injection of bupivacaine was higher in Group E than Group P (P<0.05).
- Our sample size was small so further study is needed to examine the relationship between SAP and NIRS acquired data.

Conclusions

In our study there was no significant difference in the change of maternal CBF and CBO after spinal anaesthesia between planned and emergency cesarean section although SAP was significantly higher in the emergency CS group.

Table 1. Patients` characteristics and clinical data

	Group P (n=34)	Group E (n=17)
Age (years)	35 [25–43]	37 [26–42]
Height (cm)	156.3 [145–170]	153 [146–163]
Weight (kg)	61.4 [49.3–77.7]	56.7 [36.4–83.8]
Gestational age (days)	269 [259–277]	270 [219–291]
Block height (10min, dermatome)	Th4 [Th1–Th6]	Th4 [C8–Th6]
Anesthesia duration (min)	41.5 [27–63]	40 [29–60]
Total Fluids (ml)	1030 [500–1640]	1060 [600–1350]
nausea (n)	17	7
ephedrine use (n, mg)	12,4	7,4

Median [range]

Fig.1 Change in NIRS parameters and hemodynamics
* P<0.05 between groups

Reference

- 1) Anouar Jarraya. Near-infrared spectrometry in pregnancy: progress and perspectives, a review of literature. Pan African Medical Journal 2016
- 2) Noriya Hirose. Relationship between regional cerebral blood volume and oxygenation and blood pressure during spinal anesthesia in women undergoing cesarean section. J Anesth (2016) 30:603–609
- 3) Kondo Y. Effect of spinal anesthesia for elective cesarean section on cerebral blood oxygenation changes: comparison of hyperbaric and isobaric bupivacaine, Adv Exp Med. 2013;765:109-14