Research Article

A case series evaluating the impact on adult patient's hemodynamics during lower intestine and hip treatments between constant spinal sedation and one-shot spinal anaesthesia

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ABSTRACT

Purpose : The process of starting and sustaining spinal anaesthesia with tiny, incremental doses of local anaesthetic injected sporadically via catheter into the subarachnoid space is known as continuous spinal anaesthesia, or CSA. In high-risk patients, the use of conventional Single Shot Spinal Anaesthesia (SSSA) is largely limited by hemodynamic instability caused by high block. Our main goal was to monitor hemodynamic changes, total fluid and vasopressor consumption, and the frequency of meningitis, focal sensory block following CSA, and Post Dural Puncture Headache (PDPH) in young adults.

Methods : 44 patients in total, ASA grades I–III, ages 18 to 60, who were scheduled for lower abdominal and hip surgery were given the option of receiving either SSSA with a 25G Quinkes spinal needle (Group SSSA, n=22) and 0.75 percent isobaric ropivacaine, or CSA using a 19G paediatric epidural Touhy needle and 22 G catheter (Group CSA; n= 22). Records were kept on hemodynamics, total fluid and vasopressor consumption, and the frequency of adverse events.

Results : Patients in each group were similar in terms of their demographics. Comparable levels of HR and DBP were observed both within and between groups (p>0.05). Following induction, there was a significant drop in SBP in the SSSA group from 10 to 45 minutes relative to baseline and from 5 to 25 minutes when compared to the CSA group. Group SSSA had a higher mean fluid infused (p=0.0176). Significant hypotension was observed in five patients in the SSSA group but not in any CSA patients (p=0.190). None of the patients had focal sensory block, meningitis, or PDPH.

Conclusion : When compared to SSSA, CSA offers superior hemodynamic stability and a lower incidence of adverse events in young patients undergoing hip and lower abdominal surgeries with 0.75% Ropivacaine.

INTRODUCTION

Seven years after Single Shot Spinal Anaesthesia (SSSA) first appeared, in 1906, Henry Percy Dean described Continuous Spinal Anaesthesia (CSA), although its acceptance and continued existence have always been questioned [1]. In CSA, a needle or catheter is inserted into the subarachnoid space and left there, with medication administered in small amounts as needed. Because of the high rate of complications, CSA is not used as much as it could be, despite its clear advantages over the SSSA [1–5]. Following the development of micro-catheters, the technique was resurrected in the 1980s [5–6]. Unfortunately, kinking, breaking, and a high incidence of cauda equina syndrome were associated with a high failure rate for these catheters, making them difficult to manipulate. Therefore, the US Food and Drug Administration outlawed the use of catheters finer than 24 G in 1992 [3–4]. It has been restricted to use in high-risk elderly patients due to misconceptions about its dangers outweighing its benefits [3, 7-8]. The primary benefit of CSA is that it can be used in high-risk patients since it allows for the administration

of incremental, minimally effective doses and the prolongation of the block while preserving cardiovascular stability [3].The fact that CSA has been effectively employed for hip and lower limb surgeries [9–12], in high-risk elderly patients [3, 7-8], and in young patients [3, 13] is surprising, though, as it has not received much testing in young, healthy patients, in whom any supposed danger would theoretically be considerably lower. We conducted this study to compare the safety profile and hemodynamic effects of two spinal block techniques—continuous and single shot—with isobaric ropivacaine 0.75% for lower abdominal and hip surgeries in young patients, as the majority of studies regarding the risk-benefits of CSA were inconsistent.

Methods

44 ASA physical status I–II adult patients, aged 18–60, scheduled for lower abdominal and hip surgeries under CSA (n = 22) and SSSA (n = 22), were included in a prospective, observational study following approval from the institutional ethics committee and written informed consent from each patient. The study was carried out between September 2017 and July 2018.Patients with significant cardiopulmonary, neurological, psychiatric, or sensory block levels greater than T8 dermatome in either group, or who declined enrollment, were not included in the study. Following a thorough pre-anesthesia evaluation, patients were moved to the operating room. While breathing room air, baseline vitals such as heart rate (HR), diastolic blood pressure (DBP), systolic blood pressure (SBP), and arterial oxygen saturation (SpO2) were measured. The 18 G intravenous line was inserted to gain access. An intravenous cannula was placed across the hand's dorsum, and an infusion rate of 5–6 ml/kg/h of Ringer Lactate (RL) was initiated. All patients received intravenous ranitidine (50 mg) and ondansetron (4 mg) as premedication. For this study, two operating rooms were allocated, and patients were categorised into groups, CSA and SSSA, correspondingly, one for each operating room. SSSA and CSA were carried out while seated. Using a 19G Tuohy paediatric epidural needle (Vygon 95440, ECOUEN France) and all aseptic precautions, the subarachnoid space was accessed in the CSA group following the injection of a local anaesthetic in midline at the L4-L5 interspace. A 22G catheter primed with 0.5 ml of 0.75% Ropivacaine was inserted through the needle into the subarachnoid space once the free flow of CSF had been confirmed. In order to maintain a 4 cm length within the intrathecal space, the catheter was fixed in place. After the patients were

turned to a supine position, 1 ml of the first bolus of 0.75% ropivacaine was administered, and CSF flow was confirmed once more using the catheter. Following a 5-minute interval in which the sensory block level was assessed, aliquots containing 0.5 ml of 0.75% Ropivacaine were given until the T10 anaesthetic level was reached. This process continued until the sensory block level was reached.

The T10 sensory level was maintained throughout the procedure in all patients by repeating the same aliquots as needed. After every bolus dosage, 0.5 ml of normal saline was used to prime and flush the catheter and filter because they had 0.5 ml of dead space. After the procedure was finished, the catheter was removed.Under all aseptic precautions, the subarachnoid space was accessed in the SSSA group using a 25G Quinke spinal needle at the L4-L5 interspace. Following aspiration through the needle to confirm the free flow of CSF, 3 ml of single-shot 0.75% Ropivacaine was injected into the subarachnoid space.

The Pin-prick method was used to measure the degree of sensory block, and a 3-point rating system was used to record the patient's level of discomfort (Category A: no discomfort, Category B: mild discomfort not requiring systemic analgesia, and Category C: discomfort requiring systemic analgesic). The degree of motor block was measured using the Modified Bromage score, which goes from Grade 1 (inability to elevate extended leg but ability to flex knee) to Grade 4 (inability to flex ankle and move only the foot). Every patient in both groups was timed to reach the sensory level of T10 dermatome.

HR, SBP, DBP, and SpO2 were monitored after the LA injection every five minutes for the first thirty minutes, and then every fifteen minutes until all patients had finished the surgery. A 20% drop in SBP from baseline was considered hypotension, and intravenous Ringer lactate was used to treat it. When mean blood pressure dropped by 30% from baseline, it was classified as severe hypotension and was treated with intravenous mephentermine. Bradycardia was defined as a heart rate less than 50 beats per minute, which was treated with 0.6 mg of atropine. To manage rigours, 50 mg of intravenous tramadol was given gradually over a 10-minute period. Along with the total amount of fluids and mephentermine given, the length of the procedure, the complications [PDPH, meningitis, and focal sensory block], side effects [severe hypotension, bradycardia, rigours, nausea, vomiting, and delayed micturition], and watched and took new notes. For the purpose of power analysis and sample size, we used the data of Sabre R et al [14], who compared CSA and SSSA in 34 high-risk elderly patients following orthopaedic limb oper-

ations. Patients were followed up for seven days for meningitis and thirty days for localised sensory block. He discovered that the first proportion (CSA) of patients with severe hypotension was 0.08 and the second proportion (SSSA) was 0.51 for both groups. Considering this, prior to the trial, we computed the difference between these two proportions with a 95% confidence level, α err probability 0.05 in 90% power, and the result was a sample size of 44 patients overall (n=22, according to Epitools Software).Thus, Data from 22 patients underwent continuous spinal anaesthesia (Group CSA) and 22 patients underwent single shot spinal anaesthesia (Group SSSA) during their surgeries.The statistical software programme Graph Pad was used to conduct the analysis. The findings were given as mean ± SD, total, and percentage (%). Unpaired Student's t-test was used to analyse normally distributed data, and the chi-square test was used to compare the results, with a p value (0.05 used as the significance level) reported at the 95% confidence level.

Results

The groups' mean time to reach T10 dermatome, length of surgery, and demographic information were all statistically similar (Table 1).Baseline HR was 85.40 ± 14.22 bpm in Group SSSA and 89.86 ± 14.90 bpm in Group CSA (p=0.3156). Up until the end of the procedure, post-induction HR was similar both within and between the groups (Graph 1).For groups CSA and SSSA, the baseline mean SBP was 125.09 ± 8.82 mmHg and 123.59 ± 8.84 mmHg, respectively (p=0.5761). In the SSSA group, there was a notable decrease in SBP from 10 minutes to 45 minutes from the baseline value. Additionally, group SSSA's SBP significantly decreased from 5 to 25 minutes when compared to group CSA (Table 2).Group CSA had a baseline mean DBP of 72.90 ± 5.15 mmHg, while Group SSSA had a baseline mean DBP of 72.86 ± 6.35 mmHg. These values were statistically equivalent (p=0.9188).Additionally, there were similarities in the post-induction DBP values between the two groups (Graph 2).The study found that there was a significant difference in the mean volume of fluid provided between Group SSSA and Group CSA (p=0.0176). While 4 (18.18%) patients in the SSSA group needed a total of 12 mg of mephentermine to treat their hypotension, none of the patients in the CSA group needed a vasopressor (Table 3). No patient in the CSA group experienced hypotension or bradycardia, whereas 4 (18.18%) and 1 (4.54%) of the SSSA group, respectively, experienced these conditions (p=0.0381). In the SSSA group, rigour and nausea affected 9 and 5 patients, re-

spectively, but the differences were not statistically significant. No patient in either group had focal sensory block, meningitis, or vomiting (Table 4).

Discussion

Neuraxial blocks are linked to erratic hemodynamic changes and may be harmful to high-risk adults as well as the elderly. Therefore, it is crucial to take the necessary steps to effectively attenuate these changes in order to reduce the risk of periop-erative morbidity and mortality. Specifically, aliquots of dose administration in CSA may be useful in mitigating the adverse effects of neuraxial techniques. In order to compare CSA and SSSA, we therefore set out to measure hemodynamic changes as our main goal and the total amount of vasopressor fluid administered as well as the incidence of adverse effects as our secondary goals. The following hemodynamic parameters and adverse events should be assessed during both CSA and SSSA: HR, SBP, and DBP; and severe hypotension, PONV, rigours, delayed micturition, PDPH, meningitis, and focal sensory block, respectively.Until the surgery was finished, HR in the current study was comparable both within and between the groups. Analogous findings were also observed in studies by Sabre R et al., [14], Klimscha W et al., [7], Favarel-Garrigues JF et al., [8], Lundorff L et al., [15], Maurer K et al., [11], Fettes PDW et al., [16], Baydilek Y et al., [17], and Seetharam KR et al., (2018). Although the HR in CSA fell significantly (p<0.05) from baseline, Ebied RS et al.'s findings [19] were still within the clinically acceptable range, which may have been caused by the addition of fentanyl. throughout their investigation, they used 0.5% iso-baric bupivacaine into the subarachnoid area.

In our investigation, a noteworthy decrease in baseline SBP was noted in SSSA between 10 and 45 minutes. Additionally, SBP in group SSSA was significantly lower from 5 to 25 minutes of time interval when compared to group CSA. Despite this, DBP was comparable across all time intervals of measurement for both groups. Sabre R et al., [14], Klimscha W et al., [7], Favar-el-Gar-rigues JF et al., [8], Lundorff L et al., [15], Maurer K et al., [11], Fettes PDW et al., [16], and Pitkanen M et al., [9] all produced findings that were similar to each other. Because they had pre-loaded all of the patients with 8 ml/kg, Minville V et al. [12] did not find any significant variation in BP in either group (CSA or SSSA) following induction. RL resolution. The administration of 2.5–3 ml of 0.5% isobaric bupivacaine along with 1 mg of preservative-free Midazolam intrathecally as bolus rather than titrat-

ing or fractionating the dose in the CSA group while achieving the sensory blockade level of T4–T6 may have contributed to the hemodynamic variations that Parthasarthy S et al. [1] observed, even though they were within acceptable limits. The Mean Blood Pressure (MBP) in the SSSA group was considerably lower (p<0.05) than the CSA group at 90-180 minutes and 4-24 hours, according to Baydilek Y et al. [17]. On the other hand, MBP was much lower than control levels in the SSSA group for all observed time intervals and at 2.5–30 min in the CSA group (p<0.05).

This may be the result of premedication of all elderly ASA grade I-III patients with IM midazolam 0.03 mg/kg, which has a depressant effect on the sympathetic nervous system, particularly in elderly patients, and block levels greater than T10. In the SSSA group, we found a noticeably higher incidence of hypotension (p=0.0381). Bradycardia, rigours, and nausea were more common in the SSSA group, but the differences were not statistically significant (p > 0.05). In neither group did any of the patients experience focal sensory block, meningitis, or vomiting. Similar incidence of adverse events were noted by Sabre R et al., [14], Favarel-Garrigues JF et al., [8], Baydilek Y et al., [17], Seetharam KR et al., [18], Pitkanen M et al., [9], and Mc-Namee DA et al., [20].

Two CSA group patients were observed to be uncomfortable by Klimscha W et al. [7] because they were unable to move their legs during postoperative analgesia. This condition may have been brought on by the use of micro catheters, which frequently cause drug maldistribution. One patient (3.84%) in the CSA group and two patients (7.69% in the CSA and 6.66% in the SSSA) in each group experienced unilateral paraesthesia in the operative lower limb; these observations were reported by Lundorff L et al. [15] and were explained by trauma during the needle-catheter placement and ischemic disturbances brought on by surgery. The inclusion of ASA grade II–IV patients with a variety of co-morbidities may have contributed to the significantly higher incidence of hypertension and severe hypotension observed by Minville V et al. [12] in the SSSA group compared to the CSA group. Two patients experienced PDPH, which was treated with oral analgesics in two days, according to Parthasarathy S et al. [1]. This could have been caused by the use of bigger bore 16 G needles and 18 G catheters for CSA. Higher incidences of arterial hypotension (3.41%) and PDPH (2.33%) were observed in the CSA group by Imbelloni LE et al. [21], which may have been caused by the study's higher than average number of older female participants. Bradycardia (5.95%) was also noted,

which may have resulted from all patients' premedication with fentanyl. The SSSA group in our study received a mean volume of fluid administration that was statistically higher than that of the CSA group (p=0.0176). While 4 (18.18%) patients in the SSSA group needed a total of 12 mg of mephentermine to manage their hypotension, none of the patients in the CSA group needed a vasopressor. Similar results were shown in studies by Klimscha W et al., [7], Favarel-Garrigues JF et al., [8], Sabre R et al., [14], Baydilek Y et al., [17], Minville V et al., [12], and Andres JD et al., [13]. This could be due to similar drug aliquot and preloading patterns. According to Lundorff L et al. [15], the SSSA group consumed more ephedrine than the CSA group, which may have resulted from a higher block level. The results of our investigation cannot be generalised to other procedures requiring higher level of block because of the limited sample size, observational study design, and restriction of the block to T10 (lower level of block). Additionally, post-operative analgesia was not addressed by medication delivery in the current study. Because of this, the same research can be expanded to include post-operative analgesia and performed as a randomised control trial with a large sample size for surgeries requiring a higher level of block.

Conclusion

When young patients undergoing lower abdominal and hip surgeries using 0.75% isobaric ropivacaine, continuous spinal anaesthesia offers better hemodynamic stability with little to no incidence of adverse events.

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