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Continuous spinal anaesthesia, an underutilised neuraxial technique in current anaesthesia practice: a timely reminder

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Abstract

Continuous spinal anaesthesia (CSA) is a cardio-stable technique used in high-risk patients undergoing surgery. However, this technique appeared to decline over the last decades due concerns of complications that arise from using this technique, such as post-dural puncture headaches and neurological deficits. We report two cases of elderly patients, one at high cardiac risk and one with dementia and multiple comorbidities, under CSA for orthopaedic surgery with no reported complications. CSA is an adequeate anaesthetic technique with a low failure rate and complications. Proper technique should be taken into consideration to increase the success rate for this procedure.

Keywords: continuous spinal anaesthesia, high-risk, orthopaedic surgery

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Introduction

Continuous spinal anaesthesia (CSA) is currently a less popular mode of anaesthesia. CSA is suitable for frail populations with fixed cardiac output and severe respiratory disease. Compared to other neuraxial and general anaesthesia techniques, CSA is acknowledged for its flexibility in dosage titration and increment, rapid onset, and indefinite block duration with haemodynamic stability.[1,2] Intraoperative hypotension is independently associated with poor non-cardiac surgery outcomes.[3]

Neurotoxicity, particularly cauda equina syndrome, was its most significant drawback in the United States in the 1990s. Further research revealed that high local anaesthetic concentration and maldistribution around spinal roots are the culprits.[4] Other downsides of CSA include difficult catheter insertion, the risk of anaesthesia failure due to catheter occlusion, post-dural punctuate headache, infection, hematoma, and catheter fracture. Lack of experience, expertise, and equipment prevent some anaesthetists from performing CSA. CSA popularity is re-emerging, and a newer study described using thoracic CSA for high-risk patients undergoing major abdominal surgery in Italy.[5] Nevertheless, thoracic CSA requires expertise due to its potential cardiac, respiratory, and spinal cord complications, which needs further analysis to prove its advantages.[6]

Cases

We performed CSA on two elderly patients with intertrochanteric fractures using the Pajunk IntraLong CSA set (Pajunk, Geisingen, Germany) (Fig 1), which is technically easy to perform, even for beginners. The IntraLong is the only CSA set available in Malaysia. Table 1 summarises their background. Both cases were performed by a resident anaesthesiologist who was using the IntraLong set for the first time under the consultant's supervision.

The following were steps in performing CSA for the above cases:

1. A spine sonography using transverse interspinous view (static guidance) was performed to measure the depth to the epidural space.

2. Case 1 was placed in sitting position, while Case 2 was placed in right lateral position (patient could not sit upright due to contracture). After cutting the skin, a 21-G 90-ml Sprotte needle was inserted.

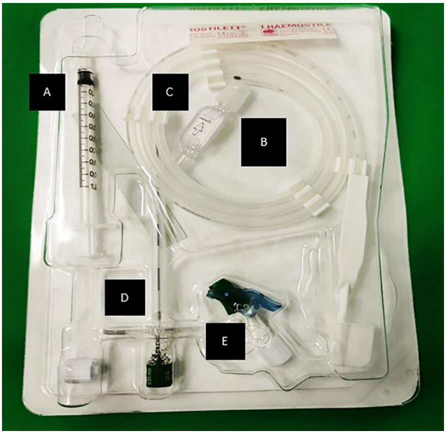

Fig. 1. Pajunk IntraLong. (A) 1 ml Luer syringe. (B) IntraLong spinal catheter (25-G with closed tip and three lateral openings) (C) Filter (the filling volume is approximately 0.35 ml). (D) IntraLong needle (Sprotte) 21-G (atraumatic tip minimises the chance of post-dural punctuate headache and reduces the chance of shearing off the catheter, also allowing easy catheter threading. (E) Clamping adapter.

Table 1. Background history of the two cases

Case information	**Case 1**	**Case 2**
Background history	85-year-old male, ASA III with coronary artery disease and HT. CFS score of 3.	87-year-old female, ASA III, with thoracic scoliosis and interstitial lung disease with mild bronchiectasis, HT, and type II DM, vascular dementia, L5/ S1 spondylolisthesis, L1 and L5 vertebra old compression fracture without neurological deficit. CFS score of 7.
Physical examination and investigations	Physical examination was unremarkable. Echocardiography showed global hypokinesia with a reduced ejection fraction of 30%. Chest X-ray revealed cardiomegaly. Revised cardiac risk index of 1 with 6% 30-day mortality, myocardial ischaemia, and cardiac arrest.	Physical examination was unremarkable. HRCT of the thorax showed interstitial lung disease with mild bronchiectasis.
Operation	Proximal femoral nailing	

American Society of Anaesthesiologists (ASA); clinical frailty scale (CFS); high-resolution computed tomography (HRCT); HT: hypertension; DM: diabetes mellitus

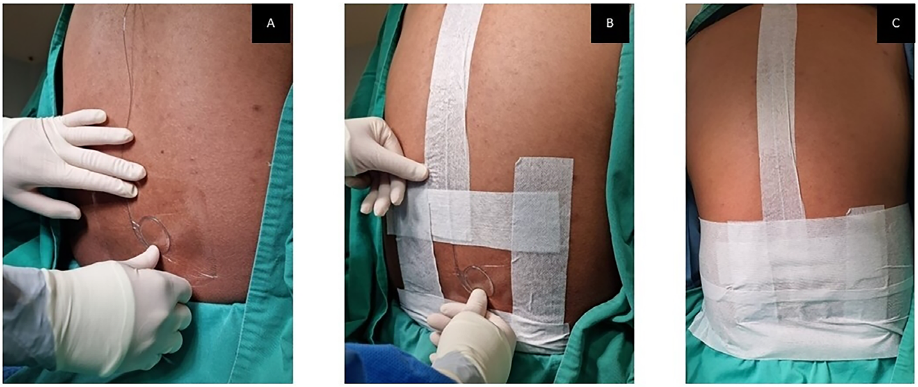

Fig. 2. (A-C). Spinal catheter was securely anchored with 3M® hypafix tape. The dead space volume, which includes the adapter, catheter and filter, is 0.9 ml.

3. The stylet was removed with demonstrable free-flowing cerebrospinal fluid (CSF). The length of the needle to reach the subarachnoid space (skin-to-space) was noted.

4. The spinal catheter was inserted using the catheter-through needle technique to adequate length. Next, the needle was removed from the skin carefully without pulling out the stylet guide wire. Then, the catheter was pulled out to the marking at the skin with 3 cm left in the subarachnoid space. Both the needle and stylet guide wire were carefully removed; no adjustment to the catheter should be performed thereafter.

5. The catheter was attached to the clamping adapter and bacterial filter, which had been primed with heavy bupivacaine 0.5%.

6. The catheter was secured with visible dressing at the insertion point and 3M hypafix surround the dressing frame (Fig. 2).

7. An initial bolus of 1 ml heavy bupivacaine 0.5% was given.

8. Assessment was made with pinprick for sensory block and modified Bromage scales for motor block.

9. Further top-up doses of 0.5 ml heavy bupivacaine 0.5% were given at 10 minutes intervals to achieve T10 dermatome.

The LA dosing for CSA may vary according to local protocol. The total spinal volume for both cases was approximately 1.5 ml. The key to safe practice is to

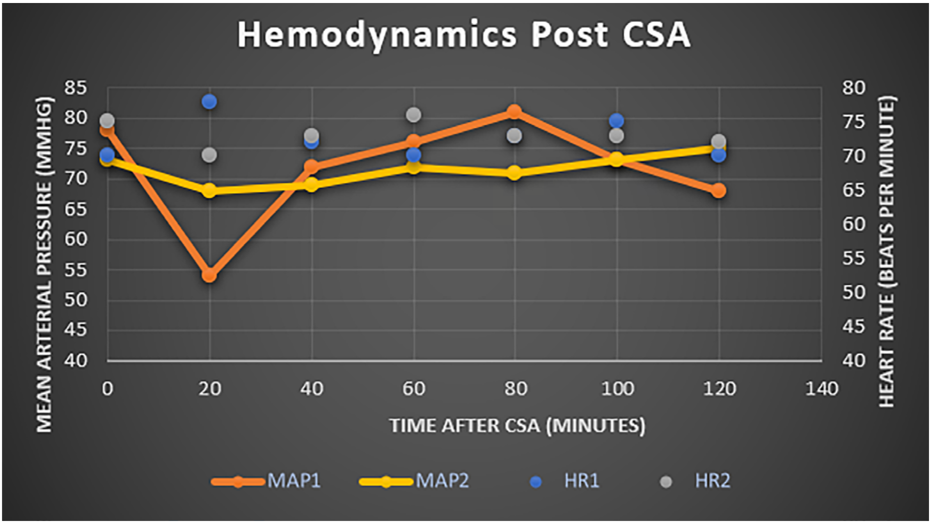

Fig. 3. Intraoperative blood pressure and heart rate trends. MAP1: mean arterial pressure of Case 1; MAP2: mean arterial pressure of Case 2; HR1: heart rate of Case 1; HR2: heart rate of Case 2.

administer the initial bolus in low volume[7] to avoid profound hypotension followed by small top-up doses during the interval. The titratability of CSA enables a more haemodynamically stable anaesthetic than that produced by a single shot spinal anaesthesia. This is the main advantage in patients with cardiovascular respiratory comorbidities whereby neuraxial anaesthesia remain the safest option. The duration of surgery was approximately 1.5 hours for both cases. Figure 3 showed the trends of intraoperative, non-invasive blood pressure (BP) and heart rate (HR) for both cases. Case 1 had one episode of transient hypotension (BP = 80/50 mmHg) which resolved with intravenous 6 mg of ephedrine. The patient's BP subsequently remained stable throughout the surgery. Prior to removing the spinal catheter, both cases received intrathecal top up 0.5 ml heavy bupivacaine 0.5% plus 25 mcg fentanyl. They reported pain scores of 1 at the sixth hour after surgery.

Recommendations to perform CSA

The following are some recommendations to perform CSA: utilize ultrasound for spine sonography to locate the intervertebral space and intrathecal depth, gently advance the catheter into the subarachnoid space, use the CSF gravity test to confirm catheter placement, and avoid cephalad local anaesthetic (LA) spread by using isobaric or hyperbaric bupivacaine. To minimize the risk of neurotoxicity, avoid using LA which exceeds the recommended concentration. To prevent infection and ensure patient safety, label the spinal catheter and remove it after usage, and use bacterial filter with strict aseptic technique during handling.[8] The CSA catheter may be utilised with caution as a postoperative analgesic modality. Alessandro *et al.* showed that intrathecal levobupivacaine 1.25 mg per hour administered via spinal catheter was associated with reasonable postoperative pain control in hip and knee replacement surgeries.[9] To reduce the risk of catheter breakage during removal, withdraw the catheter gently and as close to the insertion point with the patient in flexed position. Several of the above recommendations and tricks were adopted from the accidental dural punctuate case scenario.[10] CSA can also be performed by alternatively using a combined-spinal-epidural set or Tuohy epidural set (B. Braun Melsungen AG, Germany), if the CSA IntraLong set is not available.

Conclusion

CSA is an effective method of delivering titratable neuraxial blockade. The potential benefits of CSA compared with other titratable neuraxial anaesthetic techniques include faster onset, improved haemodynamic stability, and low intraoperative failure rates. We strongly recommend developing a comprehensive local protocol with supervised training to encourage younger trainees to familiarise themselves with CSA.

Declarations

Informed consent for publication

We confirm that both patients consented to the use of the clinical data and images contained in this report. MyJA Informed Consent for Publication form was submitted along with the manuscript.

Competing interests

None to declare.

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