Continuous spinal anesthesia: A forgotten technique revisited in a high-risk patient

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Abstract

Although continuous spinal anesthesia (CSA) was introduced nearly a century ago, its clinical use remains limited due to concerns about safety and potential complications. However in carefully selected high-risk patients, CSA may provide a valuable alternative to general or epidural anesthesia. This article presents a clinical case involving a patient with severe pulmonary (tuberculosis complicated by hemoptysis, a significant history of smoking, chronic obstructive pulmonary disease (COPD), and severe pulmonary emphysema) and cardiovascular (stable angina and 70% stenosis of the left descending artery) comorbidities undergoing colostomy closure surgery. In this context, general anesthesia posed significant risks such as difficult airway management and the potential need for prolonged postoperative mechanical ventilation, while epidural anesthesia carried the risk of cardiovascular collapse. A review of relevant literature is also provided to highlight considerations for the safe implementation of CSA in similar contexts.

Keywords: Continuous spinal anesthesia, high-risk patient, abdominal surgery.

Introduction

In specific patients undergoing abdominal surgery where general anesthesia is contraindicated due to significant comorbidities, spinal or epidural techniques are commonly considered. While epidural anesthesia offers a longer duration of block, it is associated with a higher failure rate and provides less muscle relaxation compared to spinal anesthesia. This case involves a patient with significant respiratory comorbidities, including a history of prolonged postoperative mechanical ventilation following previous surgeries. For colostomy closure, continuous spinal anesthesia (CSA) was chosen to enable titratable dosing and

minimizing systemic effects. CSA may represent a viable anesthetic strategy in patients with elevated perioperative risk.

Case Description

A 65-year-old male patient with a complex cardiopulmonary history was scheduled for colostomy closure. His medical history included pulmonary tuberculosis complicated by hemoptysis, a significant smoking history, chronic obstructive pulmonary disease (COPD), and severe pulmonary emphysema. He also had documented coronary artery disease, with stable angina and 70% stenosis of the left descending artery confirmed by coronary CT angiography. The patient had undergone two previous surgeries- a tonsillectomy for tonsillar cancer and one sigmoid resection for ruptured diverticulitis—both of which were complicated by prolonged postoperative pulmonary failure requiring mechanical ventilation for approximately one month after each procedure. In light of these comorbidities, anesthetic planning required careful risk assessment.

During the initial pre-anesthesia evaluation, the patient was identified as having a potentially difficult airway. He exhibited a limited mouth opening of approximately 2 cm. The patient demonstrated reduced neck flexion and an absence of neck extension, indicating significant cervical mobility limitation. A fiberoptic nasopharyngolaryngoscopy performed by the otolaryngology (ENT) team revealed significant narrowing of the left nasal passage and extensive anterior glottic adhesions, likely sequelae of prior radiotherapy for tonsillar carcinoma, leaving only a small posterior glottic opening measuring approximately 4–5 mm. Given the patient's history of prolonged mechanical ventilation requiring tracheotomy during two separate episodes, a CT scan of the neck and thorax was obtained for further airway assessment. Imaging revealed mild tracheal narrowing at the T1 level, with an anteroposterior diameter of approximately 11 mm. Although no prior imaging was available for direct comparison, the CT scan also showed severe, diffuse alveolar overdistension. These findings were suggestive not only of underlying COPD but also of upper airway obstruction secondary to glottic adhesions and restricted airflow.

Airway management in this patient posed significant challenges due to both anatomical abnormalities and his complex clinical history. Placement of a laryngeal mask airway, endotracheal intubation, and even tracheostomy were all anticipated to be technically difficult. Furthermore, even if endotracheal intubation were to be achieved, the risk of postoperative respiratory failure remained substantial.

Given these challenges, regional anesthesia was considered as an alternative. Available options included single-shot spinal anesthesia, epidural anesthesia, or a combination of both. However, the patient's previous abdominal surgery— performed for peritonitis secondary to a ruptured sigmoid diverticulitis, raised concerns that the current procedure—colostomy closure—would require extensive adhesiolysis and a potentially prolonged operative time. These factors influenced the choice of anesthetic technique.

With regard to block duration, continuous epidural anesthesia offered a theoretical advantage. However, epidural techniques may have a higher failure rate and may not provide sufficient muscle relaxation. Furthermore, administering a large bolus dose via the epidural catheter to enhance block quality could precipitate significant hypotension and cardiovascular instability, particularly in a patient with coronary artery disease. To balance efficacy and safety, continuous spinal anesthesia (CSA) was selected. This technique allowed for precise titration of local anesthetic, providing reliable muscle relaxation and a sustained anesthetic effect while minimizing the risk of hemodynamic compromise.

In this case, continuous spinal anesthesia was performed using a dedicated CSA kit consisting of a 27G introducer needle and a 30G microcatheter. Under real-time ultrasound guidance, the catheter was

inserted at the L2–L3 interspace. The microcatheter was advanced into the subarachnoid space, with 5 cm of the catheter left in situ. An initial intrathecal bolus of 4 mg bupivacaine 0.5% (without opioid) was administered. Shortly thereafter, the patient experienced transient hypotension (70/40 mmHg) and bradycardia (heart rate of 40 bpm). The block level, confirmed via cold sensation testing, reached T6 (patient height: 170 cm). Hemodynamic stability was promptly restored with intravenous administration of 6 mg ephedrine and a fluid bolus. Moderate sedation was maintained using a dexmedetomidine infusion, following a loading dose of 1 mcg/kg over 10 minutes. Surgical laparotomy proceeded uneventfully. After approximately one hour, the patient reported mild incisional discomfort, which was managed with an additional 2 mg bolus of bupivacaine 0.5%, allowing the procedure to continue without complications. We repeated the injection twice. Total surgical time was 2.5 hours. At the end of surgery, the intrathecal microcatheter was removed in the post-anesthesia care unit. To manage postoperative pain, an erector spinae plane block was performed at the T8 level. The patient was discharged on postoperative day 5 without complications.

Discussion

Continuous spinal anesthesia (CSA), first introduced by Henry Dean in 1907, was later demonstrated by Lemmon et al. to provide prolonged anesthesia without the systemic toxicity of large single-shot intrathecal doses.[1-2] However, concerns over complications such as cauda equina syndrome (CES), transient paresthesia, and postdural puncture headache (PDPH) have limited its widespread use.[3] Despite these concerns, CSA remains a valuable option in selected high-risk patients, particularly when general anesthesia poses significant risks and precise titration of block level and duration is required.

In our patient, with a history of difficult airway, COPD, coronary artery disease, and prior prolonged mechanical ventilation, a failed block or conversion to general anesthesia would have carried significant risk. Although single-shot spinal anesthesia with higher doses could have provided adequate anesthesia, it carried a significant risk of hemodynamic instability. Epidural anesthesia, although theoretically advantageous for longer procedures, often lacks adequate muscle relaxation when used alone. In contrast, CSA allowed for low-dose titration and block extension as needed, optimizing both efficacy and safety in this high-risk case.

Even with a small initial intrathecal dose of 4 mg bupivacaine 0.5%, the patient developed significant hypotension and bradycardia, with a T6-level block. This was likely due to a combination of a relatively high puncture site (L2–L3), deep catheter advancement (5 cm), and high injection pressure through a narrow microcatheter, which may have facilitated cranial spread of the anesthetic.

The safety of CSA has been re-evaluated in recent literature. Earlier FDA safety alerts regarding Cauda Equina Syndrome were attributed more to the neurotoxic effects of intrathecal lidocaine than to the use of spinal microcatheters themselves.[4] Although microcatheters were subsequently withdrawn from the U.S. market, they continue to be used internationally without increased rates of neurologic complications when compared to single-shot spinal anesthesia.[5] Moreover, a 2008 randomized study using 28G intrathecal catheters in 329 patients reported no permanent neurologic deficits.[4]

Proper technique is essential to minimizing risk. Excessive advancement of soft microcatheters (>3 cm) may lead to looping around nerve roots, increasing the risk of nerve traction and paresthesia upon catheter removal.[6] Some authors also emphasize the importance of ensuring adequate distribution of the first bolus; failure to achieve this may result in localized pooling and neurotoxicity.[4]

Regarding PDPH, studies suggest that the use of microcatheters (e.g., 30G through a 24G introducer) does not increase PDPH incidence compared to SSA.

In fact, some evidence indicates that microcatheters may reduce PDPH rates by promoting local inflammatory sealing of the dural puncture.[7]

This case, along with supporting evidence from the literature, highlights CSA as a viable alternative in high-risk abdominal surgery, provided that catheter advancement is limited to ≤3 cm and anesthetic distribution is carefully monitored.

Conclusion

Although continuous spinal anesthesia (CSA) has declined in routine use due to historical safety concerns and the emergence of newer techniques, this case underscores its potential in carefully selected high-risk patients. When performed with appropriate precautions—such as limited catheter advancement, cautious dosing, and close monitoring of drug spread—CSA may offers reliable titration, stable hemodynamics, and adequate muscle relaxation for some abdominal surgeries. As illustrated in this case, even a historically underutilized technique can be used when standard approaches pose unacceptable risk. Anesthesiologists should remain familiar with CSA as a valuable part of their repertoire, especially in complex or high-risk clinical scenarios.

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