



Combined Spinal-epidural Anesthesia for Hip Fracture Surgery in Two Geriatric Patients with Low Ejection Fractions

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Authors' contributions

This work was carried out in collaboration between all authors. Authors OO and EUK designed the case report, wrote the protocol and wrote the first draft of the manuscript. Authors DK and MAK wrote the second draft of the manuscript. Authors ZA, FK and MM managed the literature searches. All authors read and approved the final manuscript.

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Case Study

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ABSTRACT

Aims: To present the combined spinal-epidural anesthesia and postoperative analgesia in two geriatric patients, with low Ejection Fractions (EF) that underwent hip fracture surgery.

Presentation of Case: Herein, 90 and 106-years-old geriatric patients respectively, with low ejection fractions were admitted to the orthopaedic ward because of hip fracture. These patients were planned to undergo hip prosthesis surgery. Anesthesia and postoperative analgesia were achieved by Combined Spinal-Epidural (CSE) techniques in both patients. We observed that spinal anesthesia using low dose hyperbaric bupivacaine with fentanyl was an effective and safe method, and post-surgical patient controlled analgesia via an epidural catheter provided sufficient pain control for 48 h.

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Discussion: In older patients with hip fracture, comorbidities such as cardiac disease increase the risk of perioperative morbidity and mortality. Individuals that undergo hip prosthesis surgery are usually geriatric patients, and comorbidities can increase their risk of perioperative morbidity and mortality during surgery. Regional anaesthesia techniques are widely utilized for surgical procedures (especially obstetrics, orthopaedics, urology, general surgery) and pain management, and they are known to have favourable effects on the vital signs and endocrine and metabolic responses after the operation compared with those of general anesthesia. In addition, regional anaesthesia is preferable because of its superior results in relation to postoperative pain control.

Conclusion: Combined spinal epidural anaesthesia with low-dose hyperbaric bupivacaine and fentanyl in hip fracture surgery is a safe and efficient method when used in geriatric patients with low EF. In addition, we find that patient controlled epidural analgesia is a considerably effective technique in postoperative pain management.

Keywords: Spinal anesthesia; postoperative pain; geriatric patients; bupivacaine.

1. INTRODUCTION

Hip fracture is an important cause of morbidity and mortality in geriatric patients [1]. Surgical treatment is required in these patients and comorbidities such as cardiac, renal, respiratory and cerebral disease can increase the risk of perioperative morbidity and mortality [2]. Regional anesthesia techniques are generally preferred over general anesthesia in hip fracture surgery due to some advantages, such as the maintenance of cardiovascular stability and early postoperative mobilisation. It allows the administration of local anaesthetics in small incremental doses titrated to the patient's requirements, has minimal cardiovascular and respiratory side effects and provides postoperative analgesia, allowing the application of intrathecal local anaesthetics postoperatively [3,4]; among these techniques, single dose and continuous spinal anesthesia are most commonly used [4,5]. In patients undergoing spinal anesthesia, local anesthetics and opioids are frequently combined to increase the quality and duration of anesthesia and decrease the side effects. The combination of opioids with local anesthetics provides anesthesia that is more efficient [6,7]. Patients undergoing hip replacement surgery are usually elderly. These patients have increased morbidity and mortality for orthopaedic surgery due to co-morbidities, such as cerebral, cardiac, renal and respiratory diseases. Regional anaesthesia techniques are usually preferred in high-risk patients due to some advantages, such as the maintenance of cardiovascular stability and early postoperative mobilisation. In previous studies, it was shown that adding opioids to local anesthetics increases the quality and duration of analgesia regardless of sympathetic, sensory and motor block and that it decreases the side effects caused by local anesthetic drugs by reducing their dose [7].

Combined spinal-epidural anesthesia was preferred in these present cases with low ejection fractions as it allows the administration of local anesthetics in small incremental doses titrated to the patient's requirements, has minimal cardiovascular and respiratory side effects and provides postoperative analgesia, allowing the application of intrathecal local anaesthetics postoperatively. Also the risk of infection is increased when the CSE technique is used in place of epidural block alone. Despite a recent flurry of reports of meningitis with CSE procedures, there is no evidence the CSE block is more hazardous than epidural or subarachnoid block alone. Arguably, the single-space, needle-through-needle CSE technique will continue to improve with new needle designs and other advances to improve further the success rate and reduce complications, such as neurotrauma, postdural puncture headache, and infection. One of the most important problems after surgery is postoperative pain; when left uncontrolled, it can lead to untoward reflex, endocrine and metabolic responses, and consequently, pulmonary, renal and cardiac problems [8]. Several methods exist for sustainable and efficient postoperative analgesia. Patient Controlled Analgesia (PCA) via an epidural catheter is an effective method for postoperative pain control [9]. In this report, we present two elderly patients with high cardiac risk who were managed successfully by combined spinal epidural anesthesia during hip fracture surgery and postoperative pain control after the procedure.

2. PRESENTATION OF CASE

Informed consent was acquired from each patient before they were transferred preoperatively. Once in the operation room, an infusion of Ringer's lactate solution at a dose of 2 mg/kg/min was initiated through an 18-G

intravenous line. Invasive arterial blood pressure, electrocardiographic and peripheral oxygen saturation were also monitored. In the left lateral position and under aseptic and antiseptic conditions, the epidural space was cannulated between the third and fourth lumbar intervertebral areas using an 18-G Tuohy needle (Espocan[®], B. Braun, Melsungen, Germany) with a negative pressure technique after intra/subdermal application of 2% lidocaine. After cannulation of the dura mater with a 27-G spinal needle and observation of cerebrospinal fluid flux, 5 mg of 0.5% bupivacaine and 20 µg of fentanyl were injected into the patient. After positioning of the epidural catheter, each patient was placed in a supine position with his head 20° upwards. The inhalation of oxygen at 3 l/min was started via a face mask, and 1 mg of midazolam was administered intravenously for sedation. The level of sensoric and motoric block was assessed by using pinpricks and the modified Bromage scale (scale 0 = full flexion of foot, knee and hip, i.e. no motor block; scale 1 = full flexion of foot and knee, unable to perform hip flexion; scale 2 = full flexion of foot, unable to perform knee and hip flexion and scale 3 = total motor block, unable to perform foot, knee and hip flexion), respectively. The surgical procedure was initiated after sensorial block was achieved to the level of the tenth thoracic vertebra. Both patients were transferred to the intensive care unit post-operatively. During intensive care unit follow up and after the Bromage score of the patient decreased to scale 1, PCA was administered through the epidural catheter using 0.125% bupivacaine in 100 ml normal saline solution. PCA was programmed as follows: 3 ml bolus dose, unlocked period of 30 min and infusion at a rate of 3 ml/h. The patients' visual analogue scale (VAS) (0–10, no pain to very severe pain, respectively) was evaluated for 48 h.

2.1 Case 1

A 90-year-old male patient was admitted for cementless bipolar partial right hip prosthesis surgery. He weighed 65 kg, was 170 cm in height, had a history of hypertension and a previous myocardial infarction 15 years ago. During preoperative evaluation, he was allocated an American Society of Anesthesiologists (ASA) score of III. His laboratory examination was within normal limits. In his general physical examination, his cognitive functions were normal and chest auscultation revealed bilateral rales in the basal lung zones. The chest X-ray revealed bilateral infiltration in the basal pulmonary segments with pleural effusion. In his

transthoracic echocardiography, we detected apical dyskinesia and a dilated left ventricle with an Ejection Fraction (EF) of 15–20%. The medical treatment was evaluated and rearranged by cardiology and pulmonology clinics. His preoperative arterial blood pressure was 110/70 mmHg with an apical heart rate of 87 beats per minute (bpm) and oxygen saturation (SpO₂) of 90% in room air. The surgical procedure was completed 65 min after the application of the anaesthesia protocol without any bradycardia, hypotension or respiratory problems. The patient did not require any additional medication intraoperatively. After 24 h follow up in our intensive care unit, he was transferred to the orthopaedics clinic without any complications. The patient did not require any additional analgesia except PCA because his VAS score was ≤4.

2.2 Case 2

A 106-year-old male patient was admitted for hip fracture surgery involving the proximal femoral nail technique. He weighed 60 kg, was 168 cm in height and had a history of hypertension and previous gastric and prostate surgery. During preoperative evaluation, he was allocated an ASA score of 3. In his general physical examination, his cognitive functions and the results of bilateral auscultation of the chest were normal. In a chest X-ray, an increase of bronchovascular markings was found with cardiomegaly and a prominent aortic knob. In his transthoracic echocardiography, the left ventricle was dilated with a low EF (35–40%). The medical treatment was evaluated and rearranged by cardiology and pulmonology clinics. His pre-operative arterial blood pressure was 105/65 mmHg with an apical heart rate of 80 bpm and SpO₂ of 92% in room air. The surgical procedure was completed 30 min after the application of the anaesthesia protocol without any bradycardia, hypotension or respiratory problems. The patient did not require any additional medication from the epidural catheter intraoperatively. After 24 h follow up in our intensive care unit, he was transferred to the orthopaedics clinic without any complications. The patient did not require any additional analgesia except PCA because his VAS score ≤4.

3. DISCUSSION

This report indicates the safety and efficacy of spinal and postoperative PCA via an epidural catheter in two geriatric patients with low EFs on whom low dose hyperbaric bupivacaine and

fentanyl was used during and after hip surgery. Individuals that undergo hip prosthesis surgery are usually geriatric patients [1], and comorbidities can increase their risk of perioperative morbidity and mortality during surgery [2]. Regional anaesthesia techniques are widely utilized for surgical procedures and pain management, and they are generally known to have favourable effects on the vital signs and endocrine and metabolic responses compared with those of general anesthesia. In addition, regional anesthesia is preferable because of its superior results in relation to postoperative pain control [10]. In a previous study, the risk of deep venous thrombosis and mortality in the early postoperative period after hip fracture surgery was found to be lower in patients managed by regional anesthesia than those operated on under general anesthesia. The beneficial effects on thromboembolism are probably explained by several factors, such as hyperkinetic blood flow in the lower legs, reduced tendency to coagulation, and improved fibrinolytic function. The effects of local anesthetics on leukocytes, platelets, erythrocytes, and plasma proteins and on the interactions among various blood cells and endothelial cells are other factors in the protection against thromboembolism [11]. Epidural and spinal anesthesia may present some problems in elderly patients. Performing epidural and spinal anesthesia may be more difficult in elderly patients. Decreased cardiac reserves, structural changes in the arterioles and changes in the autonomic nervous system with increasing age may also play a role. Changes in body composition and characteristics of tissues and organs within the body may have an impact on the rate and extent of systemic absorption, distribution and elimination of local anesthetics used for regional anesthesia. Changes in the clinical profile with epidural and spinal anesthesia are best explained by anatomical considerations and possibly pharmacodynamic, rather than pharmacokinetic, changes in the elderly. The plasma clearance of bupivacaine decrease with increasing age. Taking into account the age related decreased clearance of bupivacaine, the administration of multiple intermittent injections or continuous epidural infusion can lead to increased accumulation of these agents. Consequently, the potential of developing side effects, including toxicity may be enhanced. But in the end, the rationale for combining local anesthetics with adjuvant drugs is to use lower doses of each agent and to sustain analgesia with fewer side-effects. A reduced dose of bupivacaine in combination with fentanyl

provided reliable spinal anesthesia for the repair of hip fracture in aged patients with few episodes of hypotension and little need for vasopressor support. Other studies suggest that regional anesthesia is preferred most of the time during hip surgery [4]. We decided to use low dose bupivacaine in our patients because of their advanced age and high cardiac risk. The addition of an opioid to a local anaesthetic drug in single dose spinal anesthesia is an alternative method [7,12]. A previous report suggested that the addition of an opioid increased the quality and duration of anesthesia and decreased the necessary dose of the local anesthetic drug [7]. We used a combination of 5 mg bupivacaine and 20 µg fentanyl in our patients.

Sufficient pain control is an important part of postoperative management; however, approximately 30–80% of the patients complain about moderate to severe pain postoperatively. Because of ineffective postoperative pain control especially under general anesthesia, sympatho-neural and neuro-endocrine systems are activated leading to potentially deleterious effects such as tachycardia, hypertension, hyperglycemia, immune suppression and a decrease in the regional blood flow [13]. PCA can be administered through intravenous, intramuscular, subcutaneous and epidural routes and can be administered either in bolus doses, bolus doses followed by infusion or continuous or intermittent infusion. By integrating the advantages of an epidural catheter and PCA, patient controlled epidural analgesia provides analgesia that is more efficient with fewer side effects in suitable patients [14]. In our patients, we used patient controlled epidural analgesia to provide adequate postoperative pain control. After monitoring the patients' VAS scores for 48 h, we observed the efficacy of this method because neither of our patients required additional analgesic.

4. CONCLUSION

We conclude that combined spinal epidural anaesthesia with low-dose hyperbaric bupivacaine and fentanyl in hip fracture surgery is a safe and efficient method when used in geriatric patients with low EF. In addition, we find that patient controlled epidural analgesia is a considerably effective technique in postoperative pain management.

CONSENT

All authors declare that 'written informed consent was obtained from the patient (or other approved

parties) for publication of this case report and accompanying images.

ETHICAL APPROVAL

Ethical approval was not applicable for this case report.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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