CONTINUOUS SPINAL ANAESTHESIA WITH POPLITEAL SCIATIC NERVE BLOCK FOR BELOW KNEE AMPUTATION IN A PATIENT WITH MULTIPLE COMORBIDITIES FOR EARLY REHABILITATION

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KEYWORDS

ABSTRACT:

A male patient in his late fifties, with a history of coronary artery disease, chronic kidney disease, and sepsis, required below knee amputation under tourniquet. Due to a heart rate of 110/minute, blood pressure of 90/60 mm Hg, and noradrenaline support, along with elevated creatinine levels and moderate systolic dysfunction, the patient's perioperative management was challenging. To decrease risks, continuous spinal anaesthesia (CSA) at a low dose (0.5ml of bupivacaine) was combined with a popliteal sciatic nerve block. CSA provided effective anaesthesia with minimal hemodynamic fluctuations, ensuring a stable intraoperative course. The addition of a popliteal sciatic nerve block aimed to enhance early postoperative pain management. The patient maintained hemodynamic stability without anaesthesia-related complications. However, postoperatively, after two days recurrent pulmonary oedema ensued, necessitating dialysis, diuretics, and non-invasive ventilation. CSA demonstrated superiority over general anaesthesia for high-risk patients, offering improved cardiovascular stability and faster recovery. This faster recovery ensured early rehabilitation and physiotherapy

BACKGROUND

The rising prevalence of coronary artery disease (CAD) attributed to improved diagnostic techniques and an aging population highlights the need for meticulous anaesthesia management, present with considerable risks. Given their limited cardiac reserve, meticulous preoperative preparation assumes paramount importance. The cardinal aim during anaesthesia for patients with compromised ejection fraction remains the preservation of adequate forward flow to avoid complications. Regional anaesthesia (RA), notably continuous spinal anaesthesia (CSA), emerges as a preferred modality over general anaesthesia (GA) owing to its hemodynamic advantages. CSA offers extensive nerve blockade with reduced local anaesthetic doses and expedited onset, mitigating the risk associated with hemodynamic instability. Herein, we present our anaesthesia strategy for a challenging case: a patient with a septic diabetic foot, severe ventricular dysfunction, and chronic kidney disease, requiring a below knee amputation. This case highlights the judicious application of CSA in mitigating perioperative risks in high-risk patients. [1.2] By detailing our approach, we highlight the significance of tailored anaesthesia techniques in optimizing outcomes in complex clinical scenarios.

CASE PRESENTATION

A male patient of the late fifties weighing 70 kg and classified as American society of anaesthesiology (ASA) IV, presented with foot ulcers on the left side, measuring 5 x 7 cm on the dorsum of the foot and 12 x 7 cm on the medial aspect of the leg, with exposed tendons, posted for below knee amputation. [Figure1], He has a medical history of Type 2 diabetes mellitus for 20 years, recently diagnosed hypertension, and past treatment for pulmonary tuberculosis. Additionally, the patient has a history of coronary artery disease, with coronary artery bypass grafting performed 13 years ago. The patients heart rate was 110/minute with a blood pressure of 90/60 mm Hg. He was on noradrenaline support in the dose of 0.1 mcg/kg/minute. Reduced urine output led to the diagnosis of acute onset chronic kidney disease, required dialysis. Radiological findings revealed bilateral pleural effusion on chest X-ray and echocardiographic evidence of LV chamber enlargement with global left ventricular hypokinesia and biventricular dysfunction, with an ejection fraction of 32%. Laboratory results showed a haemoglobin level of 8 g/dL, blood urea level of 81mg/dL, and creatinine level of 2.49mg/dL. Other blood investigations were within normal limits.

Continuous spinal anaesthesia, combined with sciatic nerve block, was planned after obtaining informed consent due to the high-risk nature of the procedure. The patient's baseline heart rate was 110/min, and blood pressure was 90/60 mmHg. Sciatic nerve block was performed via the popliteal approach using 10 ml of 0.5% bupivacaine under strict aseptic conditions and ultrasound guidance. The patient was then shifted to lateral position and a 20-gauge Portex® epidural catheter was inserted into the L3-4 intrathecal space using an 18-gauge Tuohy needle. (Figure2) Before catheter threading, an initial bolus of 0.5 ml of 0.5% bupivacaine with 50 mcg (1 ml) of Fentanyl was administered intrathecally, achieving a sensory level of T12. Further boluses of 0.5 ml of 0.5% bupivacaine were administered at 45-minute intervals, with a total of two additional doses required for the surgery. Each top-up of bupivacaine administered via the catheter was supplemented by 0.9 ml of normal saline after the drug administration due to the presence of dead space in the epidural catheter. This ensured efficient dosing of bupivacaine.

Due to the presence of preoperative anaemia, anticipating massive blood loss during the surgery, a pneumatic tourniquet was used. The total surgery duration was 180 minutes with a blood loss of 1050 ml with the presence of a tourniquet which was released after 100 minutes. Throughout the surgery, a total of 500 ml of fluid, consisting of Ringer's lactate solution and 1 unit of packed red blood cells, was administered. The patient remained hemodynamically stable during the procedure, without experiencing bradycardia or hypotension requiring vasopressors (a decrease of >20% in mean arterial pressure) throughout the procedure. (Figure3) The level of blockade was maintained at T12. There was no necessity for additional vasopressor support during the procedure.

DISCUSSION

Patients with coronary artery disease (CAD) undergoing non-cardiac surgery confront elevated risks like myocardial ischemia, infarction (MI), cardiac failure, arrhythmias, and heightened morbidity and mortality. Anaesthetic management aims to avert myocardial ischemia by mitigating factors that upset the balance of myocardial oxygen supply and demand. Factors such as tachycardia, increased wall tension, hypertension, and heightened myocardial contractility elevate oxygen demand, exacerbating ischemia in CAD patients. Conversely, reduced coronary blood flow, tachycardia, hypotension, increased preload, hypoxia, coronary spasm, decreased oxygen content, and anaemia diminish oxygen supply[3]

Managing perioperative volume in surgeries involving substantial fluid loss poses challenges due to compromised kidney and heart function. Individuals with coronary artery disease (CAD) and severe ventricular dysfunction may struggle with rapid hemodynamic shifts and fluid

administration, especially common in anaemic amputations, potentially further compromising tissue oxygenation and complicating perioperative resuscitation.[4]

General anaesthesia has profound effects on heart rate, rhythm, and peripheral tone, exacerbated by incomplete pain receptor blockade and surgical stimulation. This triggers sympathetic surges and hemodynamic fluctuations, delaying patient recovery especially pulmonary recovery in lungs afflicted with old tuberculosis. These hemodynamic changes along with anticipated fluid and blood loss contributing to electrolyte imbalances can worsen the patient's condition during the perioperative period. [5]

In contrast, regional anaesthesia techniques, by completely blocking afferent pain receptors, maintain cardiovascular stability (avoids hypotension and associated tachycardia), helps easier fluid management, expedite postoperative recovery, and reduce polypharmacy and need for vasopressor use due to the hemodynamic changes inflicted by drugs used in general anaesthesia thereby reducing complications associated with CAD and CKD. Continuous epidural anaesthesia (CEA) is often preferred for lower limb surgeries in high-risk patients, yet technical challenges such as difficulties in placing of epidural catheter, insufficient anaesthesia, migration of catheter tip into blood vessels and the need for larger doses make continuous spinal anaesthesia (CSA) a compelling alternative. [6]
CSA offers superior anaesthesia with minimal cardiovascular side effects, facilitated by smaller incremental doses of local anaesthetics, ensuring a rapid onset (when compared with epidural) with a controlled sympathetic block. [7]Its technical ease of catheter placement and confirmation via cerebrospinal fluid aspiration enhance its appeal. While single-shot spinal anaesthesia shares similar advantages over continuous epidural anaesthesia, it induces significant hypotension due to vasodilation and reflex tachycardia causes reduced perfusion to an already compromised heart thereby starting a cascade of complications starting from hemodynamic instability to cardiac arrest. CSA's titratable local anaesthetic dosing enables a slower controllable onset of block, promoting better hemodynamic stability and control over sensory and motor block levels.[8] We opted to add popliteal sciatic nerve block with low doses of bupivacaine to improve the quality of afferent blockade especially in times of intrathecal very low dose bupivacaine.[9]
This helps maintain better oxygenation of the tissues in an anaemic patient in sepsis thereby enabled us to provide safer anaesthesia for patient in need of emergency surgery but not effectively optimized.
Though intrathecal catheters pose technical challenges, larger catheters mitigate failure rates and prevent slow injections through microcatheters, minimizing inadequate anaesthesia. Hence the authors preferred epidural catheters for the same[10] and the incidence of post dural puncture headache is reported to be negligible.
Chamseddine et al [11]have proved that regional anaesthesia is better than General anaesthesia in patients undergoing lower limb surgeries with vascular diseases. We preferred to have nerve blocks with titrated continuous spinal to decrease hemodynamic imbalances which is more significant in vascular diseases.
Mufarrih et al [12]in their meta-analysis have shown that GA could be associated with a higher rate of respiratory failure and sepsis compared with RA for sick lower limb amputations.

CONCLUSION:

In summary, successful anaesthesia management of high-risk patients like those with chronic kidney disease and coronary artery disease and low ejection fraction undergoing below-knee amputation involving CSA with low-dose hyperbaric bupivacaine, ensuring safe and effective anaesthesia with minimal hemodynamic changes and early recovery. The authors have tried to use a sparsely used technique of continuous spinal anaesthesia in sick patients. This technique

provided safe surgical conditions by removing the dead tissue which in turn improved rehabilitation in such sick patients

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FIGURE/VIDEO CAPTIONS

Figure 1 Showing the extent of infected wound

figure 2 Showing the dripping of CSF and catheter getting inserted

figure 3 Showing intraoperative stable haemodynamics.