Combined spinal epidural for Total Knee Replacement in patients with low Ejection Fraction: A Case Series

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Case Report

ABSTRACT

Many geriatric patients present with heart disease resulting in heart failure leading to low Ejection Fraction (EF). EF is a measure of the effectiveness of the heart in pumping out blood and is used in diagnosis and progress or worsening in heart failure (HF). In 25% of patients, acute exacerbation of heart failure takes place in the perioperative period. Maintaining forward flow and heart rate and cardiovascular stability in the perioperative period are important. Acute exacerbation of heart failure in the perioperative period may occur in 25% of patients. We report three geriatric patients with EF of 40-45%, 35% and 26% who successfully underwent Total knee replacement (TKR) surgery under combined spinal epidural anaesthesia.

INTRODUCTION

With increase in life expectancy, the number of geriatric patients with poor cardiac reserve, presenting for surgery continues to rise. Heart failure is defined as structural or functional impairment of ventricular filling or ejection. Ejection fraction (EF) is an important measurement of the effectiveness of the heart in pumping out blood and is used in diagnosis and progress or worsening in heart failure (HF). Providing safe perioperative care in the operating room is a challenge for the anaesthesiologists in patients with low EF undergoing noncardiac surgery. Normal EF varies at 55% to 70%, while EF 40% to 55% indicates myocardial damage which may be due to past myocardial infarction but not necessarily HF. However, measurement <40% may show evidence of HF or cardiomyopathy; EF<35% may result in many life threatening cardiac complications in the perioperative period. \[1\] Ejection fraction < 30% is associated with a significant increase in mortality and myocardial infarctions. Acute exacerbation of heart failure in the perioperative period may occur in 25% of patients. \[2\] For long, general anaesthesia was considered the technique of choice for patients with heart failure undergoing major surgery. Recent guidelines suggest that neuraxial blockade may be considered for patients with cardiac disease. \[3\] We report successful combined spinal epidural (CSE) anaesthesia for three patients with low EF who underwent Total knee replacement (TKR).

CASE REPORT

Case 1

A 66 years old male, a known case of hypertension (HTN) type 2 diabetes mellitus for last 1year, presented in orthopaedics department with complaints of bilateral knee pain with limping for last 15 years for which TKR was planned. He had a normal airway and Metabolic Equivalent of Tasks (METs) was > 4. General examination and systemic examination were normal. ECG showed tall ‘T’ waves and Echocardiography showed regional wall motion abnormality and moderate Ventricular Septal Defect with severe calcified aortic valve without any gradient across the valve and the EF = 40-45%. Pulmonary Function Test (PFT) showed normal study. Rest of the investigations were normal. For his medical condition patient was on oral once daily aspirin 75mg, Hydrochlorothiazide 12.5mg, Atorvastatin 20mg, Metoprolol 25mg, Telmisartan 40mg, Amlodipine 10mg and Metformin 500mg twice a day.

After taking high risk consent and explaining the anaesthetic procedure the patient was taken up for the planned surgery. ECG, non invasive blood pressure and pulse oximetry were used for monitoring the patient. Preoperative vitals were normal with heart rate of 70 beats/minutes, BP of 120/80 mm Hg and 100% oxygen saturation on room air on pulse oximetry. After initial preloading with 500ml warm Ringer’s Lactate (RL) solution we proceeded with combined spinal epidural (CSE) block in the sitting position. After placing the epidural catheter at L3-L4 interspace and fixing it at 8 centimetre, spinal anaesthesia was given at L4-L5 interspace with 1.8ml of Injection Bupivacaine (0.5%Heavy) and T10 level block was achieved. Test dose of 3ml Injection 2% Lignocaine was given through epidural catheter after 30 minutes of starting of surgery. The pulse rate and blood pressure were maintained to within 20% of the initial value with adequate fluid replacement. The duration of spinal anaesthesia was about 3 hours and covered the duration of surgery so epidural top up with bupivacaine was not required. At the end of the surgery epidural top up was given with Injection Dexamethasone 8mg in 4ml normal saline for postoperative analgesia and the level of block was reassessed as T10. Intraoperative and postoperative (monitored for 24 hours) periods were uneventful (no episodes of hypotension, tachycardia, arrhythmia, chest pain, ECG changes etc.) and the vitals were normal.
**Case 2**

A 76 years old, female, a known case of HTN (for 3 years) presented in orthopaedics department with complaints of bilateral knee pain for last 3 years for which TKR was planned. She was optimized with oral once daily Atenolol 50mg, Metoprolol 25mg, Ramipril 2.5mg, Frusemide10mg, spironolactone 15mg and Amlodipine 5mg for HTN and Metformin 500mg and Injection Insulin on sliding scale for type 2 diabetes mellitus. General and systemic examination was normal. As the patient was unable to stand and walk, METs could not be assessed. ECG showed Left ventricular hypertrophy (LVH) and 2D Echocardiography showed regional wall motion abnormality and severe hypokinesia of anterior wall with mild mitral regurgitation (MR) and EF = 35%. PFT was normal. Preoperative vitals were normal with heart rate of 82 beats /minutes, BP of 145/80 mm Hg and 100% oxygen saturation on pulse oximetry. A similar technique of CSE as the previous case was used and an adequate T8 level block was achieved with 2ml of Injection Bupivacaine (Heavy) (0.5%). After giving a test dose of 3ml Injection lignocaine epidural top up was given. Duration of spinal anaesthesia was 2 hours i.e. 2 segment recession started after 2 hours so epidural top up was given with 3ml of Injection bupivacaine (0.5%) whenever two segment recession occurred ensuring that a T10 level of block was maintained throughout the surgery. The pulse rate and blood pressure were maintained to within 20% of the initial value with adequate fluid administration. Intraoperative and postoperative (monitored for 24 hours) periods were uneventful and the vitals were normal. At the end of the surgery epidural top up was given with Injection Dexamethasone 8mg in 4ml normal saline for postoperative analgesia.

**Case 3**

A 75 years old male, a postoperative case of Coronary Artery Bypass Grafting (CABG) done on four years ago for triple vessels disease presented in orthopaedics department with complaints of bilateral knee pain for last 2 years for which TKR was planned. He was on oral once daily aspirin 75mg and Rosuvastatin 10mg. General and systemic examinations were unremarkable and he had a normal airway. ECG showed Left Axis Deviation with Q waves. Recent 2D Echocardiography showed dilated Left Ventricle(LV) with trace MR grade III left ventricular dysfunction and EF = 26%. PFT was normal. Preoperative vitals were heart rate of 68 beats/minutes, BP of 135/82 mm Hg and 100% oxygen saturation on room air on pulse oximetry. Similar technique for establishing CSE as in previous cases was followed. 2ml of Injection Bupivacaine (Heavy 0.5%) was given intrathecally and T10 level block was achieved. After giving a test dose of 3ml Injection Lignocaine, epidural top up was given with bupivacaine 0.5% solution after 2 hours when 2 segment recession occurred and a T10 level of block was maintained throughout the surgery. At the end of the surgery epidural top up was given with Injection Dexamethasone 8mg in 4ml normal saline for postoperative analgesia. Intraoperative and postoperative (monitored for 24 hours) periods were uneventful and the vitals were normal.

**DISCUSSION**

It is important to optimise patients with significant heart disease for surgery preoperatively. This is done with pharmacological support of agents such as calcium channel blockers, angiotensin converting enzyme inhibitors, angiotensin-II receptor blockers and diuretics. In a comparison of cohorts with or without heart failure undergoing noncardiac surgery. It was found that HF is associated with twice the incidence of postoperative death, increased pulmonary complications, infections, and renal complications. Neuraxial blockade with or without general anesthesia has been found to reduce the incidence of significant infections, bleeding, deep-vein thrombosis, pulmonary embolism, myocardial infarction, stroke, pneumonia, unplanned intubation, prolonged mechanical ventilation and renal complications.
Regional anaesthesia used alone or in combination with general anaesthesia has advantage of reducing preload and afterload which can improve cardiac output. However, hypotension must be prevented to avoid myocardial hypoperfusion. Also, subarachnoid block may be associated with inability to control the level of block which can result in considerable hemodynamic imbalance. Therefore, administration of combined spinal-epidural anaesthesia after preloading with crystalloid Ringer’s lactate (RL) was our modality of choice. We gave spinal anaesthesia with low volume of drug in the sitting position so that high levels were not achieved and the epidural catheter provided backup in case of very low spinal levels and for maintaining the level of blockade when there was recession of the level of blockade. It permitted the advantage of an early onset of effect as well as the flexibility of graduated doses of local anaesthetics through epidural catheter. This not only helped to titrate the level of block but also was advantageous in maintenance of hemodynamic stability. Previous studies have shown that low dose of spinal anaesthetic may help in increasing the ejection fraction due to absence of change in the pressure-volume ratio contractility index. Epinephrine infusion rather than volume loading has been recommended for management of hypotension which was not required in our patients. \[6\] Postoperative analgesia was given with epidural dexamethasone which causes neither respiratory depression nor hemodynamic instability. \[7\] Nerve blocks such as femoral nerve catheter block, adductor canal block and the local anesthetic infiltration between the popliteal artery and capsule of the knee (IPACK) block have been successfully used recently for postoperative analgesia following TKR, \[8\] however local anesthetic toxicity is always a concern when large volumes are used and can further depress the myocardium in the patients presented so we avoided them. \[9\]

Recent metaanalysis of high risk patients undergoing major surgery under neuraxial blockade with or without general anesthesia have shown lower incidence of perioperative cardiac complications and significant hypotension in those receiving neuraxial blockade. \[10, 11\] The joint statement of the European society of cardiologists and anesthesiologists published in 2014 recommended that neuraxial anaesthesia alone can be considered as the anaesthetic technique of choice in patients with heart disease after careful assessment of the risk/benefit ratio for each patient. They also concluded that, neuraxial analgesia results in better post-operative outcome and should therefore be considered as the technique of first choice. \[12\] While there are reports of patients with heart failure undergoing surgery under graded epidural anaesthesia, there is not much literature supporting spinal anesthesia. \[13\] We believe CSE with low dose spinal anesthesia with titrated epidural topups may be the answer to anesthesia for orthopedic surgeries of the lower limb in such patients.

**DECLARATION OF CONFLICTING INTEREST**

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**REFERENCES**


