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## Case Study

### **EPIDURAL ANAESTHESIA REDUCES PERI-OPERATIVE MORBIDITY AND MORTALITY IN PATIENTS WITH SIGNIFICANT CARDIO-RESPIRATORY DISEASES: FIVE CASE SERIES**

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#### **ABSTRACT**

Peri-operative management of patients with significant cardio-respiratory disease scheduled for non-cardiac non-thoracic surgeries requires great expertise to ensure a successful outcome. Patients with cardio-respiratory diseases are prone to developing some intra-operative complications such as delayed recovery from anaesthesia, persistent poor arterial oxygen saturation, haemodynamic instability, myocardial ischaemia, arrhythmias or cardiac arrest. The aim of this case series is to present our experience of anaesthetic management of five patients with multiple co-morbid cardio-respiratory diseases who had surgeries in the presence of severe respiratory and cardiovascular systems compromise. The anaesthetic technique of choice was titrated-dose epidural anaesthesia with hyper-vigilant monitoring, rational use of vasoconstrictor agents and restrictive intraoperative fluid administration. Except for episodes of hypotension in three of the patients which responded to vasoconstrictors, the outcomes were excellent and patients and surgeons were satisfied.

**Key words:** Dose-titrated epidural anaesthesia, cardio-respiratory disease, haemodynamic instability, vasoconstrictors, reduced morbidity and mortality.

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## Introduction

Catheter-based epidural anaesthesia is a form of regional anaesthetic technique that facilitates dose-titrations of local anaesthetic (LA) agents during peri-operative management of patients. The interval administration of titrated doses of LA agent prevents sudden drop haemodynamic parameters and allows development of compensatory mechanisms that further contribute to patient safety by preventing any significant reduction in blood pressure that can cause deleterious effects. The realization of this physiologic concept forms the basis of employing this anaesthetic technique in some conditions such as cardio-respiratory diseases to achieve good surgical outcomes.

Patients with significant co-morbid medical conditions can develop surgical pathologies that may require surgical interventions on an elective or emergency basis; and the offered pre-operative optimizations may not improve the preoperative status well enough to guarantee patients' safety during spinal or general anaesthesia. Most times, this can lead to reluctance to provide definitive surgical care to patients or outright cancellation of the procedures by the surgical team, especially anaesthetic team, to avoid undesirable intraoperative morbidity and/or mortality.

Generally, surgical outcomes in patients with severe cardio-respiratory diseases will depend largely on the ability of proposed anaesthetic technique to lessen the challenges imposed on the compromised system(s) during intra-operative maneuverings. In this instance, the option of neuro-axial anaesthesia can be carefully explored if the pathology is located within the thoraco-abdominal region and there is required expertise to access the epidural space in any part of thoraco-lumbar region.

Studies have shown that epidural anaesthesia is effective in reducing morbidity and mortality in patients with ischaemic heart disease who had non-cardiac surgery (Kehlet H, 1997; Carli F and Klubien K, 1999). A recent study also described good surgical outcome following high thoracic epidural in patients with serious cardio-respiratory co-morbidities and proposed its usefulness in patients with significant risk of haemodynamic instability (Onk D *et al*, 2015).

One of most important peri-operative safety practices in patients with significant cardio-respiratory diseases is invasive monitoring techniques which allow real-time intra-operative physiological indices to be obtained and subsequent utilization of the information to intervene appropriately in the course of care. However, such equipment is in short supply in our environment and therefore the use of anaesthetic technique that can cause little or no changes to the cardio-respiratory systems can contribute to good outcome.

The objective of this case series is to highlight the benefits of catheter-based dose titrations epidural anaesthesia in patients with significant cardio-respiratory diseases who had major surgeries in the absence of invasive monitoring techniques.

## Method and Description of the procedure

This study was carried out at University of Ilorin Teaching Hospital, Ilorin, Nigeria. The procedure was performed in the operating room equipped with standard anaesthetic machine (Drager Fabius plus, Drager Medical AG & Co KG Germany, 23542 Luberk, Germany), piped anaesthetic gases and multi-parameter patient's monitor (Dash 4000, GE Medical System

Information Technology, 8200W, Tower Avenue, Milwaukee Wisconsin USA). Resuscitation drugs and equipment such as adrenaline, dopamine, endo-tracheal tubes and automatic portable defibrillator (NIHON KOHDEN CORPORATION, Japan 31-4, Nishiochial, Shinjuku, Tokyo, Japan) were readily available. Consent to perform the procedure was obtained and intravenous access was secured in the forearm with 16G intravenous canula and infusion of 0.9% saline was started after the baseline vital signs were recorded. Using aseptic technique and patient in sitting position, an epidural catheter via Tuohy needle was inserted into epidural space (T9-10, T10-11 and L4-L5) using loss of resistance to air technique; and fixed 3.5cm catheter was left in the epidural space. Mixture of 0.5% plain bupivacaine and fentanyl (2µg/ml of

bupivacaine) was titrated in 2mls aliquot to achieve the desired block level. Between 10 to 15mls of 0.5% plain bupivacaine with 20 to 30µg/ml of fentanyl was used to achieve block level of T4 to L2. Intravenous paracetamol 1g was infused in all patients before knife on skin. The postoperative pain management was provided epidurally with 5mls of 0.125% of plain bupivacaine 4 hourly for 24 hrs.

Five patients (Table 1) with severe cardio-respiratory diseases who had non-cardiac surgeries under either thoracic or lumbar epidural anaesthesia are presented. The surgical procedures, anaesthetic considerations and available options were discussed with the patients and they chose epidural anaesthesia.

Patient	Age (yrs)	Sex	ASA Status	Diagnosis	Co-morbid conditions	Epidural Anaesthesia	EF(%)
One	17	F	4E	Huge OM	RF	Thoracic	-
Two	6	F	4E	MS	RF	Thoracic	-
Three	81	M	3E	FF	DM/HHD	Lumbar	29%
Four	99	F	4E	FF	HHD	Lumbar	32%
Five	69	M	4E	VCF	HHD	Lumbar	32%

OM= ovarian mass, MS=Meig's syndrome, FF=femoral fracture, VCF= septic vesico-cutaneous fistula  
RF=respiratory failure, DM=diabetes mellitus, HTN, hypertensive heart disease

**CASE REPORTS**

**Case 1**

Patient FI was a 17-year female presented with 3 months history of progressive abdominal swelling, constipation, vomiting, generalized body weakness, difficulty in breathing, weight loss, abdominal pain and bilateral leg swelling. Examination showed a chronically ill-looking patient in severe respiratory distress, jaundiced

with bilateral pitting pedal oedema. Her respiratory rate was 34 cycles per minute with evidence of right pleural effusion, reduced air entry on the right middle and lower lung zones with coarse basal crepitations. Her abdomen was massively distended with demonstrable ascites. Her pulse rate was 154bpm, blood pressure 150/100mmHg and her peripheral arterial oxygen saturation (SpO<sub>2</sub>) was 86% in room air. Abdominal CT scan revealed huge abdomino-

pelvic mass with multiple para-aortic and pelvic lymph nodes and evidence of liver metastasis.

A provisional diagnosis of huge ovarian tumour was made and patient was scheduled for exploratory laparotomy and surgical debulking but physiologically unstable to tolerate general anaesthesia. Following pre-anaesthetic assessment patient was graded as ASA IVE and airway assessment was Mallampati I. Her ability to tolerate any form of general anaesthesia without developing morbidity or mortality could not be guaranteed.

The surgery was done under thoracic epidural at T11/T12 inter-space using 24µg of fentanyl in 12mls of 0.5% plain bupivacaine. Haemodynamic parameters were stable peri-operatively and she was discharged to the ward after the surgery.

### Case 2

Patient AA was a 37-year-old female who presented with 2 months' history of huge abdominal mass, severe respiratory distress and significant weight loss. Clinical and ultrasonographic examinations revealed a huge abdominal mass with ascites. Her medical and surgical histories were unremarkable. Her pulse rate was 106bpm, blood pressure was 130/85mmHg and her SpO<sub>2</sub> was 82% and 89% in room air and with supplemental oxygen respectively.

A provisional diagnosis of **Meigs'** syndrome was made and patient was planned for closed thoracotomy and tube drainage (CTTD), exploratory laparotomy and ovarian cystectomy under thoracic epidural anaesthesia. Following preanaesthetic assessment, patients was graded ASA IVE and airway assessment was mallampati III.

The thoracic epidural was established at T9/T10 inter-space using 20 µg of fentanyl in 10mls of 0.5% plain bupivacaine, the ensued hypotension, lowest blood pressure (BP) being 58/33mmHg, was treated with 12mg of ephedrine. The patient was discharged to the ward in a stable condition.

### Case 3

Patient AA was an 81 year-old elderly male with right femoral fracture of two and half month duration. He was hospitalized in previous year on two occasions due to stroke and congestive cardiac failure respectively. Pre-anaesthetic review revealed an elderly man in resolving phase of congestive cardiac failure. He had an elevated jugular venous pulse, a small volume pulse of 80 bpm with a regular rhythm, BP of 110/60mmHg and normal first and second heart sounds. The New York Heart Association (NYHA) classification was 3 and his respiratory rate was 22cpm with bilateral basal crepitations. Airway assessment was Mallampati 3 and ASA classification was IVE. He was on intravenous furosemide 40mg once daily, subcutaneous insulin 10 IU daily, oral lisinopril 2.5 mg daily and oral crestor 10mg daily. However, clexane, metformin and clopidogrel were appropriately discontinued before the surgery. Serum urea and electrolytes showed mild uraemia of 7.9mmol/L (normal range 2.5-5mmol/L), Fasting blood sugar was 13.3mmol/L, packed cell volume was 39% and electrocardiogram (ECG) showed left anterior hemiblock, complete right bundle branch block, bifascicular block, left atrial enlargement and prolonged QT interval. Echo-cardiogram showed ejection fraction of 29% with left ventricular failure secondary to dilated cardiomyopathy.

**Open reduction and internal fixation of the fracture with plate and screws** was done under lumbar epidural anaesthesia using 30µg of fentanyl in 15mls of 0.5% plain bupivacaine. The resultant hypotension, lowest BP recorded being

88/45mmHg, was managed with ephedrine, the surgery lasted for about 90 minutes, patient transferred to the recovery room and discharged to the ward 2 hours later.

#### Case 4

Patient AA was a 99 year old elderly woman who presented with two days history of severe pain in her left hip and inability to walk following a fall. She was a known hypertensive and irregular on her medications.

Physical examination revealed a chronically ill-looking elderly woman, conscious and oriented. Her respiratory rate was 36 cycles per minute with clear lung fields; pulse was irregular with rate of 88 beats per minute with missed beats of 14 in a minute. Blood pressure was 120/80 mmHg, first and second heart sounds with pansystolic murmur were heard. **She had a score of II on the New York Heart Association (NYHA) functional classification.** Echocardiogram showed ejection fraction of 32% and mixed aortic regurgitation.

Plain X-ray of her left hip joint showed supracondylar femoral fracture. Patient was classified ASA IVE and Mallampati I and **the fracture was fixed with plate and screws** under epidural anaesthesia using 12mls of 0.5% plain bupivacaine and 24 µg of fentanyl. Intraoperative hypotension (lowest BP was 60/35mmHg), which lasted for 20 minutes was treated with ephedrine and the patient was discharged to the ward after spending 1 hour in the recovery room.

#### Case 5

Patient OA was a 69 year old elderly male admitted with 4 weeks history of high grade fever, urine leakage and suprapubic wound post-prostatectomy done four months prior to presentation. Examination showed a conscious

elderly man with mild bilateral pitting pedal oedema. His respiratory rate was 18 cycles per minute with good air entry in both lung fields. Pulse rate was 108 beats per minutes, **irregular with missed beats** (14 in 1 minute) and thickened arterial wall. **Blood pressure was 170/100mmHg and first and second hearts sounds were heard and frequent ectopic beats.** Serum urea and electrolytes were normal; and packed cell volume was 40%. ECG showed frequent ventricular ectopic, VPs in couplets and complete LAE. Echocardiogram revealed moderate aortic regurgitation, and ejection fraction of 32%. A diagnosis of septic vesico-cutaneous fistula was made.

Pre-anaesthetic evaluation showed an ASA IVE patient and his airway assessment was mallampati I. **He had a score of II on the New York Heart Association (NYHA) functional classification.** The patient had his eviscerated bladder repaired under lumbar epidural anaesthesia using 8mls of 0.5% plain bupivacaine and 16 µg of fentanyl. Intraoperative hypotension (lowest BP being 48/37mmHg) was treated with dopamine infusion which was discontinued in the recovery room after the BP has been stabilized at systolic BP of 91-125mmHg and diastolic BP of 58-82mmHg. He was then discharged to the ward.

#### Discussion

General anaesthesia is preferred for thoracic and upper abdominal surgery while regional anaesthesia is useful in lower abdominal and lower limbs surgery. However, general anaesthesia may promote the need for post-operative ventilation in patients with concurrent respiratory disease. Some inhalational anaesthetic agents cause life-threatening arrhythmias and severe hypotension in patients with significant cardiac abnormalities. Our patients had respiratory compromises (severe respiratory distress and poor arterial oxygen

saturation) and hypertensive heart diseases complicated by heart failure (EF <40%) which discouraged the choice of general anaesthesia that may lead to serious complications or even death. Therefore, good surgical outcomes obtained from this study demonstrated the versatility of dose-titrated epidural anaesthesia in reducing peri-operative morbidity and mortality in patients with significant cardio-respiratory diseases. These findings are in congruence with the encouraging results from several retrospective, prospective and meta-analysis studies that showed good surgical outcomes under epidural anaesthesia through its desirable effects on peri-operative lung functions, elimination or attenuation of surgical response to surgery and excellent analgesia (Park WY *et al*, 2001; Grass JA, 2000; Yeager MP *et al*, 1987). By all standards, our patients were high risk; and the use of epidural anaesthesia was thoughtful since studies have revealed that fewer cardiac complications were associated with the technique than when general anaesthesia was offered to such group of patients (Park WY *et al*, 2001; Beattie WS *et al*, 1993) Furthermore, it has been shown that there are 4-fold reduction in the incidences of post-operative congestive cardiac failure, myocardial infarction, and death in patients managed with epidural anaesthesia in comparison to those offered general anaesthesia and relaxant technique (De Leon-Casasola OA *et al*, 1995). Some beneficial effects of epidural anaesthesia highlighted from the above cited literatures might have contributed to the desirable surgical outcomes in our patients who were treated with dose-titrated epidural anaesthesia.

The major drawback of regional anaesthesia is hypotension secondary to unhindered blockade of sympathetic system. The hypotension may be a cause of myocardial ischaemia if it is not actively managed with rapid fluid infusion or administration of vasoconstrictor. Myocardial muscle toxicity and depression has been

ascribed to high dose of local anaesthetic agent during regional anaesthesia (Kaul TK *et al*, 2007). Significant hypotension occurred in most of our patients despite the preventive steps taken; local anaesthetic agent was given slowly in small aliquots until the desired level of block was reached. The encountered haemodynamic instability in our study is dissimilar to the results from some studies where stable haemodynamic parameters were observed from use of the same anaesthetic method (Onk D *et al*, 2015; Kiran LV *et al*, 2014). However, the hypotension was successfully managed with ephedrine alone or infusion of cardiac dose of dopamine up to the immediate post-operative period in the recovery room under continuous monitoring.

**Catheter-based** dose titrated epidural anaesthesia helped in reducing morbidity and mortality in these high risk patients, perhaps due to the lower concentrations of myocardial norepinephrine, angiotensin II, endothelin-1 and tumour necrosis factor alpha which can cause over-stimulation of stress response to surgery and worsen the outcomes. All these hormones and cytokines have been shown to be significantly reduced in a study on rat model where comparative effects of regional versus general anaesthesia were examined (Zhao YJ *et al*, 2014). **Microscopic examination showed higher number of myocardial cells indicative of more damage in general anaesthesia group compared with high thoracic epidural group.**

### Conclusion

This case series shows that catheter-based epidural anaesthesia, titrated to desired level of block, can serve as a rescue anaesthetic technique in high risk surgical patients with significant cardio-respiratory diseases. **The technique can avoid the need for postoperative ventilation; prevent prolonged hospital length of stay and possible nosocomial infections with resultant good surgical outcome. However,**



generalization of the results of this case series should be cautiously considered due to the small size of the reported patients.

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