

Perioperative management of open abdominal infrarenal aortic aneurysmal repair in a resource-poor setting

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Abstract

Background: Aortic aneurysmal repair is associated with unique perioperative challenges which are often worsened by coexisting illnesses. We report five cases of infra-renal abdominal aneurysmal repairs which were done in Port Harcourt, Nigeria.

Methods: Consenting adult patients presenting with infrarenal abdominal aortic aneurysm for open repairs between January 2019 and June 2024 were recruited in this study. Abdominal ultrasonography and CT angiography were commonly used diagnostic tools, while clinical details of patients' demographics, history including drug history and ancillary investigation details were retrieved from patients' and ICU data base of the hospitals. All patients were optimized prior to elective open surgery and haemodynamically stable during the perioperative periods and postoperatively admitted into the intensive care units.

Results. Five patients aged 46years to 65years with average aneurysmal diameter of 7.7cm (range 6.5cm – 8.1cm) had satisfactory open repairs using trouser grafts. A combination of general anaesthesia and thoracic epidural anaesthesia were effective anaesthesia techniques with smoother perioperative course using a combination of intravenous propofol, isoflurane and epidural bupivacaine to manage elevated blood pressure changes at cross-clamping. Post clamping hypotension was managed with phenylephrine and norepinephrine. Postoperative analgesia was managed with epidural morphine, diclofenac suppository and intravenous paracetamol. All five patients had successful repairs. Two patients with unplanned prolonged cross clamping above two hours suffered spinal cord ischaemia with clinical lower limb paresis which was self-limiting.

Conclusion: In resource limited environments, GA using propofol and isoflurane and thoracic epidural morphine/ bupivacaine could be utilized to manage cross clamping blood pressure changes during infra renal open abdominal aortic aneurysmal repairs with excellent outcome.

Keywords: Anaesthesia, infrarenal aneurysmal repair, resource poor setting

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INTRODUCTION

Abdominal aortic aneurysm (AAA) is a multifactorial vascular disease whose prevalence is poorly reported in Nigeria, although the risk factors for its causation abound in the country. Reported risk factors include: cigarette smoking, hypertension, coronary artery disease, dyslipidaemia, chronic obstructive airway disease, cerebrovascular diseases, claudication, obesity, chronic renal insufficiency, and infections such as retroviral disease, streptococcus, tuberculosis, schistosomiasis etc.¹⁻⁴

AAA is reported to have a strong predilection for males, increasing age, and a positive family history of aneurysm. Family history necessitates screening programme with noninvasive bedside ultrasonography^{5,6} in advanced climes. In the general population, the prevalence is reported to be approximately 3 to 8%, with global annual mortality of about 167,000 and affecting the elderly and males.¹

An annual mortality rate of 0.7 per 100,000 in Nigeria has been reported.⁷ Ogunleye *et al* reported an association with hypertension, smoking and connective tissue disorders such as Marfan's syndrome.⁸ The data on age at presentation and aetiology in Africa is not well defined. Presentation is often incidental in most of the cases, and often asymptomatic or with insidious signs such as abdominal pain or pulsatile periumbilical swelling or accidental finding at ultrasonography.

The commonly available diagnostic tools include ultrasonography, computed tomographic (CT) angiography, and magnetic resonance angiography (MRI) to confirm aortic diameter more than 3cm or >50% of the diameter.^{9,10} Perioperative risk factors for adverse events have been identified to include prolonged aortic clamp time (>60 minutes), advanced age (>70 years), significant blood loss, large aortic diameter, emergency procedures, comorbidities and need for postoperative ventilation.¹¹

These factors require adequate preoperative optimization, judicious management of fluids and organ-system support for a successful outcome. We present the perioperative management of five elective open abdominal infra renal aortic aneurysm repairs performed in Port Harcourt Nigeria with successful immediate postoperative outcome.

PATIENTS AND METHODS

Consenting adult patients presenting with Infrarenal abdominal aortic aneurysm for open repairs between January 2019 and June 2024 were recruited in this study. Abdominal ultrasonography and CT angiography were commonly used diagnostic tools, while clinical details of patients' demographics, history including drug history and ancillary investigation details were retrieved from patients' and ICU data base of the hospitals. All patients were optimized prior to elective open surgery and haemodynamically stable during the perioperative periods and postoperatively admitted into the intensive care units. The infrarenal abdominal aneurysmal repairs were done at the University of Port Harcourt teaching hospital, Sterling specialist hospital and Goodheart hospital, Port Harcourt, Nigeria.

Case 1. A 60-year-old female, weight 60kg, 'a known hypertensive' which was well controlled, presented with intermittent abdominal pain worse around the umbilicus. Physical examination showed mobile pulsatile swelling which was confirmed with an abdominal ultrasound and CT angiography to be an aortic aneurysm measuring 7.3cm x 7.1cm. Preoperative workup included echocardiography, chest Xray, electrocardiogram (ECG), clotting profile, lipid profile, kidney function test, urinalysis, full blood count which were not significant. Optimization of the blood pressure was satisfactory, and blood was grouped and crossmatched. Antihypertensive medications such as amlodipine and atenolol tablets were continued till morning of surgery. Open transperitoneal approach was used to define, clamp, repaired, and unclamp the aneurysmal sac with replacement with a graft. Effective communication between the vascular surgeon and the anaesthetist ensured smooth haemodynamic state. Post repair, the patient was admitted in the ICU and within forty-six hours, developed reactionary haemorrhage which was significant and re-exploration was initiated but the patient died within ninety-six hours of surgery.



Figure 1. Neck of AAA in Case 1 shown with forceps.

Case 2. A 65-year-old obese (BMI 32kg/m²) man, known hypertensive, diabetic with chronic kidney disease on regular dialysis was incidentally found to have an abdominal mass during routine clinical examination. It was asymptomatic. Abdominal ultrasonography and CT angiography confirmed infra renal abdominal aneurysm measuring 7.8cm x 6.9cm. The initial serum creatinine level was 1500µg/l. Several sessions of haemodialysis were performed to reduce the serum creatinine level to below 200µg/l with optimization of blood pressure and blood glucose levels with routine antihypertensive and oral hypoglycaemic agents. Ancillary investigations included, chest Xray, kidney function test, HBA1c, clotting profile, ECG, complete blood counts, urinalysis. Whole blood and blood products were cross-matched prior to surgery. Aortic cross clamping period in this patient was approximately ninety minutes. No postoperative sequelae were noticed. Serum creatinine levels returned to normal 125ug/l with no regular haemodialysis thirty days after the procedure. The patient spent seventy-two hours in the ICU before being discharged to the ward and later home.



Figure 2. AAA in Case 2 exposed.

Case 3. A 54-year-old male, known hypertensive, diabetic with a two-day history of sudden abdominal pain radiating to the back with associated nausea and vomiting. There was associated nonproductive cough and moderate grade intermittent fever. The blood pressure was found to be elevated above 200mmHg systolic. Urgent abdominal ultrasonography and a CT scan revealed infra renal abdominal aneurysm measuring 6.8cm x 7.7cm which was at the verge of rupture. He was prepared for emergency exploratory repair. All ancillary laboratory investigations were performed and optimized while preparations were made for urgent repair. Blood and blood products were booked. In this patient, during the repair, the aneurysm ruptured, and significant blood loss occurred.

Postoperative spinal ischaemia was noticed following prolonged cross clamping which lasted over one hundred and eighty minutes(180minutes) presenting as paraparesis of both lower limbs with the patient unable to move both lower limbs (power on both legs 0) and persistently elevated serum creatinine levels of 258umol/l (Day one post op), 443umol/l (day 2 post op), 1124umol/l (Day 4 post op) serum potassium 6.69mmol/l, serum chloride 112.2mmol/l. Despite renal replacement interventions with haemodialysis, the postoperative course was eventful with a mortality after 10 days in the intensive care unit. Inadvertent and premature rupture of the aneurysm intraoperatively resulted in massive blood loss and prolonged clamping time. These factors are known to increase mortality and risk of spinal cord ischaemia and AKI. Massive blood transfusion and use of vasopressors for permissive hypertension proximal to the cross clamp were utilized intraoperatively to reduce end organ complications.



Figure 3. Trouser graft for Case 3.

Case 4. A 60-year-old female with no known comorbidity presented to the gynae-oncologist with abdominal swelling. She was being investigated for ovarian malignancy and incidentally found to have infra renal aortic aneurysm measuring 6.3cm x5.9cm. She was worked up for elective open repair along with debulking pelvic surgery. All ancillary radiological and laboratory work up were performed and prevailing anemia was corrected with blood transfusions, blood pressure was well controlled with relevant anti-hypertensive medications. A CT angiography, chest Xray, ECG, complete blood count, kidney function test, clotting profile, lipid profile, cardiac enzymes, HBA1c were performed. Blood products were arranged for the surgery. The perioperative period was uneventful. Patient was discharged to the ward from the ICU having stayed in the ICU for three days.

Case 5. A 46-year-old male, known hypertensive with a history of gunshot to left lower limb 20 years prior, presented with left lower limb swelling, AV fistula with venous ulcer on the same limb. He was being investigated with CT angiography which revealed an extended infra renal abdominal aneurysm with diameter 6.5cmx 5.9cm extending distally to the common iliac artery and the left femoral artery. The following ancillary investigations, complete blood count, kidney function test, cardiac enzymes, urinalysis, ECG, cardiac echocardiography, cardiac enzymes, leg wound swab microscopy, culture and sensitivity. The patient was optimized; blood pressure was controlled with antihypertensives, appropriate antibiotics as defined by sensitivity results from the leg ulcer. Postoperative period was uneventful and although unilateral left lower paresis was noticed following prolonged cross clamping on the left common femoral because of the extension, the patient recovered and he was discharged home, having spent four days in the ICU.

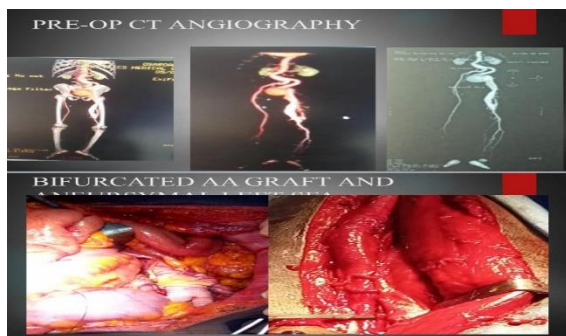


Figure 4. CT PA of Case 5 Showing extension of aneurysm to the common iliac artery and left femoral artery.

DISCUSSION

The open repair of infra renal abdominal aortic aneurysm using the transperitoneal approach is commonly used and it was the same approach that the vascular surgeons involved in this study utilized for the permanent and localized dilatation of infra renal aorta with presenting diameters beyond 5cm which is considered large and at risk of rupture if nothing is done.^{12, 13}

Although AAA is a disease of advanced age with strong predilection for smoking history, the cases presented here had age ranges between the young and the old as depicted in other reports from Nigeria and Malawi.¹⁴⁻¹⁶ In our observation, smoking was not a strong factor for its

aetiogenesis. A common risk factor for the development of AAA amongst all five patients was hypertension¹⁷ and the associated end organ dysfunction in the form of chronic kidney disease, peripheral vascular disease and hypertensive heart diseases.

The presence of comorbidities and advanced ages in these patients with the complexity of open surgical repairs increases the risk of perioperative morbidity and mortality.¹⁸ Although the mortality for elective repairs is about 3.7% and much higher in emergency situations with obvious aneurysmal rupture as it occurred in our third patient who died within 10days post operative following an intraoperative rupture.

In all the reports from Nigeria, none documented the perioperative anaesthetic interventions using available medications to ensure haemodynamic stability following cross clamping and unclamping. It is obvious from applied physiology that the cardiac afterload is usually increased with increased arterial blood pressure proximal to the aortic clamp and the risk of ischaemia to the tissues distal to the clamp. The strategies to ameliorate end organ damage with controlled hypertensive responses after cross clamping are demonstrated in this paper and this requires the combination of epidural instillation of bupivacaine, intravenous propofol and deepening the depth of anaesthesia with isoflurane which all have vasodilatory properties to further reduce cardiac afterload and improve tissue perfusion.¹⁸

The authors have observed that preoperative adequate control of hypertension, and the use of general anaesthesia with propofol and isoflurane, drugs with synergistic effects to reduce systemic vascular resistance attenuated pressure responses during cross clamp. Episodes of hypotension after unclamping were managed with judicious fluid use as indicated by the targeted CVP of 12-15mmH₂O, blood transfusion and use of norepinephrine and phenylephrine. Intraoperative monitoring consisted of intra-arterial blood pressure monitoring, ECG, pulse oximetry, capnography, urinary catheterization, and invasive temperature monitoring. Risk of postoperative death as recorded in this study involved two

patients who had intraoperative aneurysmal rupture with significant intraoperative blood loss and prolonged cross clamping time beyond the recommended 60mins. These adverse events are well documented in literature. The risk of other complications following open repair of AAA were also observed in two of the patients: post repair acute kidney injury (AKI), and hemiparesis following prolonged cross clamping time in case number 3 and 5. These complications were self-limiting and did not require haemodialysis and physiotherapy respectively. To curb these complications, cross clamping time should be reduced to 60minutes, other measures such as spinal cord monitoring and maintaining permissive hypertension proximal to the cross clamp have been reported to improve outcome.¹⁹⁻²³

CONCLUSION

A proper understanding of team communication, adaptive physiology of aortic cross clamping, unclamping, and the need to optimize perioperative risk improve better outcome in the management of these subsets of patients with comorbidities and a complex vascular repair. In Nigeria, there are limited reports to demonstrate the use of readily available anaesthetic agents and techniques to attenuate cross clamping hypertensive responses and vasoactive agents for unclamping hypotensive crisis in resource limited settings with satisfactory perioperative outcome.

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Conflicts of interest

There are no conflicts of interest

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