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CASE REPORT

Repair of Contained Rupture of an Infrarenal Aortic Aneurysm Using Autologous Superficial Femoral Vein

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Introduction: Contained ruptured abdominal aortic aneurysm (CR-AAA) refers to an acute aortic wall disruption leading to expansion of perivascular haematoma that is sealed off by peri-aortic structures. Low and middle income countries have a critical gap in managing abdominal aortic aneurysm (AAA). In Ethiopia, AAA screening is not routine and open surgical repair (OSR) using donated grafts remains the only treatment option. This case shows the first experience at Hawassa University Hospital treating CR-AAA using the superficial femoral vein (SFV) for aortic reconstruction due to lack of prosthetic grafts.

Report: A 40 year old woman presented with three months of abdominal and back pain, vomiting, and a pulsatile abdominal swelling. Imaging showed an 8 cm infrarenal CR-AAA. Due to lack of graft material, a 15 cm SFV was harvested from the left thigh and prepared as a tube graft. OSR via midline laparotomy revealed a 3 cm rupture on the right lateral aortic wall. The reversed SFV graft was anastomosed proximally to the infrarenal aorta, 3 cm below the renal artery, using a 3—0 Prolene suture. Distally, the graft was spatulated for optimal size matching and sewn with a 3—0 Prolene suture at the aortic bifurcation. The procedure lasted 10 hours. Due to the lack of a Cell Saver at the centre, 4 units of whole blood and 4 units of fresh frozen plasma were transfused. Post-operatively, the patient developed bilateral lower extremity swelling, and ultrasound revealed bilateral deep venous thrombosis. Oral anticoagulation was promptly initiated. Follow up imaging confirmed an intact anastomosis with good distal flow. The patient showed clinical improvement in leg swelling at one and three month follow ups. She is scheduled for a six month follow up and will continue regular monitoring.

Discussion: SFV use in ruptured AAA shows promise in resource limited settings. Sub-Saharan Africa's unique AAA patterns highlight specific healthcare needs. Global collaboration is vital to expand vascular care, funding, and research for better AAA treatment.

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INTRODUCTION

A true abdominal aortic aneurysm (AAA) is defined as an aortic diameter 1.5 times larger than the normal proximal segment. Key risk factors include ageing, male gender, smoking, hypertension, and genetic predispositions.[1] Ruptured AAA presents acutely with symptoms such as sudden abdominal or back pain, hypotension, shock, and a pulsatile abdominal mass, posing life threatening outcomes.[1,2] Contained ruptured abdominal aortic aneurysm (CR-AAA) refers to acute aortic wall disruption leading to expansion of perivascular haematoma that is sealed off by peri-aortic structures. The mortality rate associated with CR-AAA is not explicitly mentioned in the literature; however, studies show ruptured AAA having varying mortality rates, ranging from 15% to 94%, with an average exceeding 40%.[2,3]

In low and middle income countries (LMICs), managing complex vascular conditions is hindered by limited resources, which restrict interventions to basic procedures and essential care.[4,5] There is a notable disparity between the demand for specialised items such as grafts and the local capacity to procure them independently. In Ethiopia, patients are not routinely screened for AAA, and open surgical repair (OSR) remains the sole treatment option with donated grafts that are not locally purchasable. This scarcity means patients must wait until donated grafts become available, a situation consistent across the country. At the Hawassa University Hospital vascular unit, newly established with limited resources, innovative strategies are

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needed to optimise the use of donated materials for treating conditions like ruptured aorta.

Aortic bypass using the femoral vein, while uncommon, has shown effectiveness in neo-aorto-iliac reconstruction, especially in cases of aortic graft infections.[6,7] Given the lack of graft materials at the new unit, this approach was successfully employed to reconstruct a neo-aorta for a case of infrarenal CR-AAA using the superficial femoral vein (SFV).

REPORT

A 40 year old woman was referred to Hawassa University Hospital, Ethiopia, with three months of vague abdominal and back pain, vomiting, and a pulsatile right lower quadrant swelling. She had no chronic illnesses, hypertension, diabetes, smoking history, or family history of aneurysms or connective tissue disease. There was also no history of traumatic injury, intra-arterial interventions, or severe infections such as tuberculosis or salmonella.

On examination, she was haemodynamically stable (blood pressure 120/80 mmHg, pulse 105 bpm). Abdominal examination revealed tenderness and an ill defined pulsatile mass in the right lower quadrant. Laboratory results showed haemoglobin 4.6 g/dL, white cell count 14.3 $\times$ 10^9/L, serum creatinine 1.40 mg/dL, with normal liver function, coagulation profile, electrocardiogram, and echocardiogram. Abdominal ultrasound identified an 8 cm right lateral out pouching of the aorta, suggestive of infrarenal CR-AAA. A computed tomography scan (Fig. 1) showed a diffuse enlargement of the aorta, starting 3 cm below the renal arteries and extending 7 cm, with a maximum aneurysm diameter of 8 cm. The common iliac arteries were of normal size. At the centre, the only available option was OSR using an autologous vein, as graft materials were unavailable. Before surgery, ultrasound confirmed a suitable SFV in the left thigh for harvest, with the iliac veins as back up options. An emergency OSR was then planned using the left SFV as aortic tube graft. Here reported the initial success in reconstructing a neo-aorta using the SFV for an infrarenal CR-AAA in a resource limited setting; the patient consented to the case report and accompanying images. Following resuscitation, the operation began under combined spinalepidural anaesthesia. The SFV harvested from the left proximal thigh, for a length of 15 cm. The femoral bifurcation and saphenous junction were preserved proximally. The distal segment, including a branch at 10 cm, was harvested along with a 5 cm branch to enlarge the diameter for the proximal aortic anastomosis. This part of the procedure was completed as the anaesthesia team prepared for the second stage with a midline laparotomy under general anaesthesia (Fig. 2A). Upon opening the abdomen, 200 mL of haemoperitoneum was noted but no active bleeding. Initial proximal control was achieved at the supracoeliac aorta to minimise risk of uncontrolled haemorrhage during proximal neck exposure, given the significant retroperitoneal haematoma (Fig. 2B). The clamp was then repositioned to the infrarenal aorta after exposing the proximal neck of the aneurysm, with distal clamps applied to the common iliac arteries. The ruptured aneurysm was opened, and bleeding lumbar arteries were ligated. A rupture site approximately 3 cm in size was identified on the right lateral aspect of the aortic wall. No signs of

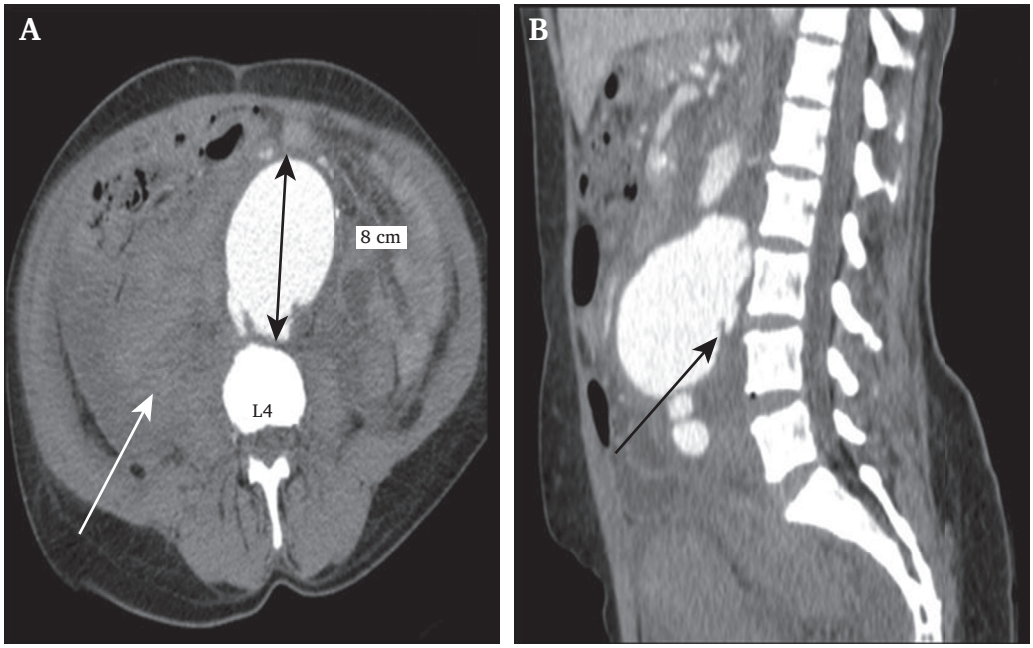

Figure 1. (A) Axial computed tomography scan depicting the aneurysm; note the large retroperitoneal haematoma indicated by the white arrow at the level of fourth lumbar vertebra (L4) and the aneurysm at the maximum diameter of 8 cm. (B) Sagittal computed tomography scan revealing the intra-operative confirmation of site of aneurysm rupture on the right posterior lateral wall of the aorta, pinpointed as the leak point (black arrow).

infection or inflammation were present. The inferior mesenteric artery showed good back bleeding and was subsequently ligated. The SFV graft was reversed and anastomosed to the infrarenal aorta, 3 cm below the renal artery, using a 3—0 Prolene stitch. Distally, the graft was spatulated for optimal size matching and sewn at the aortic bifurcation with the same stitch (Fig. 2C). The bowel was healthy following completion. The entire procedure lasted 10 hours. Due to the lack of a Cell Saver at the centre, 4 units of whole blood and 4 units of fresh frozen plasma were transfused. The patient was subsequently transferred to the intensive care unit.

The patient was extubated the following day and started on statin, aspirin, prophylactic heparin (7 500 IU subcutaneously after 12 hours), and antihypertensive medications. Despite anticoagulation, she developed bilateral lower extremity swelling. Venous ultrasound confirmed bilateral deep venous thrombosis, prompting initiation of oral anticoagulation with warfarin 5 mg. A follow up computed tomography scan confirmed an intact anastomosis with good distal flow (Fig. 2C). After a full recovery, the patient was discharged and showed clinical improvement in leg swelling at the one month follow up and significant improvement at three months. She was scheduled for a six month follow up and will continue regular monitoring.

DISCUSSION

In LMICs, defined by the World Bank as having a gross national income per capita between $1 046 and $12 695, cardiovascular diseases, including aneurysms, cause high morbidity and mortality.[5,8] Strained healthcare systems, resource scarcities, and inadequate infrastructure hinder optimal vascular care.[5,6] Only 10 out of 54 African countries have studied the prevalence of AAA, with six in sub-Saharan Africa.[8,9] Epidemiology in this region shows a female predominance and lower age of onset compared with Western populations. In a Kenyan study by Ogeng'o *et al*.,[9] a male to female ratio of 1:1.9, association with hypertension, a 23.1% presentation with rupture, and a 72.1% overall mortality rate were reported. Genetic, environmental, and infectious factors influence these differences.[9,10] Management of ruptured AAA in LMICs is challenging due to limited resources. Improved healthcare infrastructure and screening programmes are urgently needed for early detection and better outcomes.[5] Future studies are essential for understanding AAA in this region and informing effective health policies.[5]

Additionally, LMICs face severe shortage of vascular surgeons, with only one per 40 million people — 400 times fewer than in the USA.[5] Ethiopia currently has just eight vascular surgeons for over 110 million people. Vascular surgery services are centralised in Addis Abeba at Tikur Anbessa Specialised Hospital, the only centre for subspecialty training with a two year fellowship programme. Open surgical intervention for patients with AAA relies solely on donated grafts. An unpublished study on 35 patients operated on for AAA at Tikur Anbessa Hospital showed women are twice as likely to develop AAA as men, with a mean age of 54. Mortality rates were 3.2% for elective and 75% for ruptured AAA repairs.

Hawassa University Hospital is the first outside the capital to offer vascular services, performing its first aortic surgery. This centre relies heavily on donated surgical items, often needing reprocessing, due to insufficient government funding and an underdeveloped private sector. External

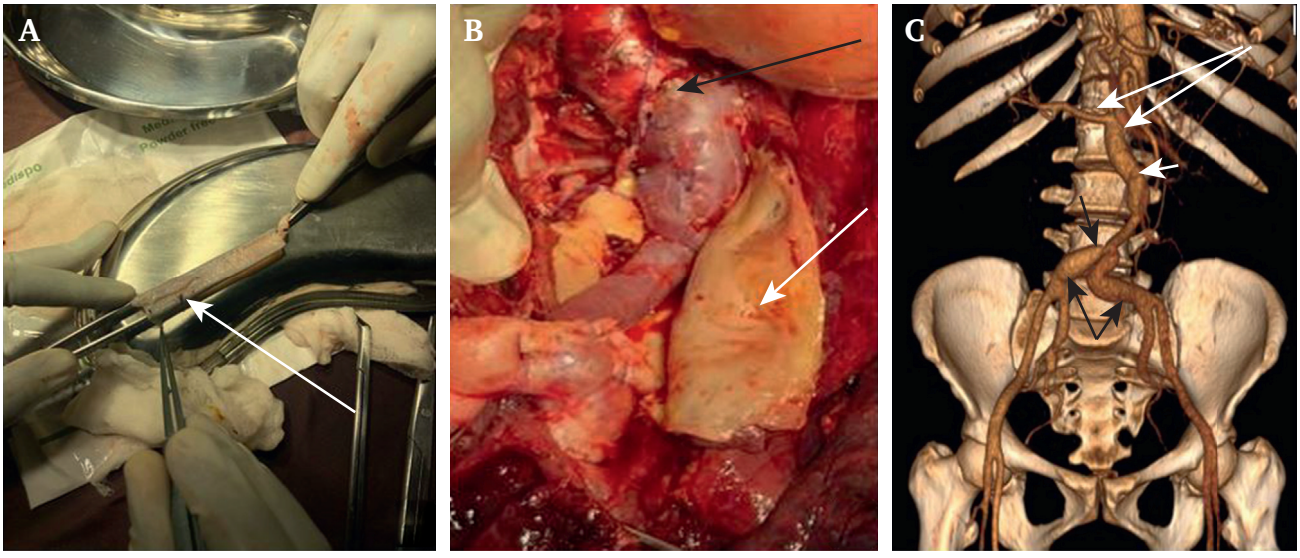

Figure 2. (A) Back table preparation of the harvested femoral vein for a length of 15 cm with the distal part panelled and suture incorporated with the branch (white arrow). (B) Reconstructed aorta using the femoral vein as a tube graft shown by the black arrow at the proximal anastomosis and white arrow showing the aneurysm sac. (C) Volume rendered 3D view of the neo-aorta reconstruction in post-operative evaluation. White double arrow showing the renal arteries and proximal aortic anastomosis (short white arrow) and black arrow pointing at the distal vein anastomosis at the aortic bifurcation and the common iliacs (black double arrow).

support is essential for equipment supplies, training, and research. The vascular unit, with a single vascular surgeon, serves over 20 million people, emphasising the need to match capacity with demand.

The history of AAA surgery has evolved from aneurysm ligation to modern advancements, including the mid-20th century development of synthetic grafts, which revolutionised treatment and outcomes. Neo-aorta and iliac reconstruction with autologous femoral vein, advocated for aortic graft infections, is feasible but time consuming.[6,7] Despite the benefits of a two team approach, it is often unavailable at the centre, where a single vascular surgeon and residents perform most operations, resulting in 10 hours for this procedure. Using the femoral vein for CR-AAA not only saved the patient's life but also shows promise for similar cases in LMICs with limited resources. AAA is usually linked to older age, but younger patients, like this one, can develop them due to genetic, inflammatory, or connective tissue disorders. In this case, none of these causes were identified, and testing is not feasible in this setting, suggesting other mechanisms may be involved. The higher incidence of early onset AAA in sub-Saharan Africa calls for further research.

In conclusion, this case illustrates the challenges of treating ruptured AAA in resource limited settings, showcasing successful SFV use for neo-aorta reconstruction in CR-AAA. Urgent needs in LMICs include enhanced healthcare infrastructure, expanded vascular training, and increased funding for equipment and research. Sub-Saharan Africa's unique AAA epidemiological pattern with higher incidence among females and earlier onset emphasises critical healthcare needs in the region. Global collaboration, research, and policy interventions are crucial to mitigate disparities enhancing AAA early detection and treatment outcomes.[4,5]

FUNDING

None.

ETHICS APPROVAL

Ethics approval was provided by the author's institution.

CONSENT

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

CONFLICT OF INTEREST

None. The corresponding author, Dagim Leykun Berhanu is the guarantor.

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