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SURGICAL OUTCOMES OF INFECTIVE ABDOMINAL AORTIC ANEURYSM WITH EXTRA-ANATOMIC BYPASS AND IN-SITU RECONSTRUCTION: A SINGLE-CENTER CASE SERIES

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ABSTRACT

Background: Infective (mycotic) abdominal aortic aneurysm (IAAA) is a rare but life-threatening condition with mortality rates of 20–40% even with treatment. In South-east Asia, Salmonella spp. accounts for a disproportionate share of causative organisms compared to Western cohorts. Optimal revascularization strategy — extra-anatomic bypass (EAB) versus in-situ reconstruction (ISR) — remains debated.

Methods: We conducted a retrospective review of all patients diagnosed with IAAA and treated surgically at the Department of Thoracic and Vascular Surgery, University Medical Center Ho Chi Minh City (UMC-HCMC), between January 2022 and January 2025. Patient demographics, clinical presentation, microbiological findings, antibiotic management, operative technique, and short-term outcomes were analyzed.

Results: Four male patients underwent open surgical repair. All aneurysms were infrarenal; three were saccular and one was a pseudoaneurysm. Salmonella spp. (ESBL-negative, AmpC-negative) was identified in one patient by positive blood culture. EAB was performed in three patients using woven polyester (Dacron) grafts. ISR with a rifampicin-soaked Dacron bifurcated prosthesis was performed in one patient with extensive para-aortic abscess and concomitant duodenal perforation. All patients received targeted antibiotic therapy for 4–6 weeks postoperatively; the confirmed Salmonella case received an additional 3-month course of oral ciprofloxacin. Technical success was achieved in all four cases. There was no 30-day mortality.

Conclusions: Open surgical repair of IAAA is feasible and effective in a tertiary centre. EAB remains the preferred strategy when anatomy allows complete exclusion of the infected field. ISR may be necessary in anatomically complex cases with extensive retroperitoneal involvement. Prolonged antibiotic therapy tailored to microbiological findings is essential for both early outcomes and long-term graft preservation. A multidisciplinary approach is essential for cases with multi-organ extension.

Keywords: *Infective aortic aneurysm; Mycotic aneurysm; Extra-anatomic bypass; In-situ reconstruction; Salmonella infection; Abdominal aortic aneurysm.*

1. INTRODUCTION

Infective abdominal aortic aneurysm (IAAA), historically termed mycotic aneurysm, results from microbial infection of the aortic wall leading to progressive weakening, dilatation, and high risk of rupture. IAAA accounts for approximately 0.65–2% of all abdominal aortic aneurysms (AAAs) and carries an overall operative mortality of 20–40%, underscoring its severity[1,2].

The epidemiology of IAAA in Southeast Asia differs markedly from Western series. In countries such as Vietnam, Thailand, and Taiwan, Salmonella spp. — including both typhoidal and non-typhoidal strains — has been reported as the leading causative pathogen, accounting for 20–30% of cases in some series, compared with approximately 1–3% in Europe and North America, where Staphylococcus aureus and Streptococcus spp. predominate[3,4]. This regional microbiological difference has direct implications for antibiotic selection and surgical planning.

The cornerstone of treatment is aggressive surgical debridement combined with arterial reconstruction to maintain lower-limb perfusion. Two broad strategies exist: EAB, which routes the prosthetic conduit entirely away from the infected field, and ISR, which places a graft in situ after radical débridement. Both carry distinct advantages and limitations regarding hemodynamic performance, long-term patency, and the risk of graft re-infection[5,6]. The optimal choice remains individualized and contested in the literature.

Given the paucity of IAAA data from Vietnam and Southeast Asia, we report a case series of four consecutive patients surgically treated for IAAA at a single tertiary vascular center in Ho Chi Minh City, focusing on operative strategy, prosthesis selection, antibiotic management, technical outcomes, and the challenges of complex multi-organ involvement.

2. METHODS

2.1. Study design and setting

This is a retrospective case series of patients diagnosed with IAAA and treated with open surgical repair at the Department of Thoracic and Vascular Surgery, University Medical Center Ho Chi Minh City (UMC-HCMC), between January 2022 and January 2025.

2.2. Diagnostic criteria

Diagnosis of IAAA was established when at least one of the following criteria was met: (1) computed tomography angiography (CTA) demonstrating a saccular, rapidly expanding, or irregular aneurysm with periaortic gas, fluid, or soft-tissue stranding; (2) positive blood culture or intraoperative tissue culture for a pathogenic organism; (3) histopathological evidence of infective arteritis; or (4) compatible clinical syndrome — fever, back or abdominal pain, elevated C-reactive protein and leukocyte count — in conjunction with suggestive imaging findings.

2.3. Data collection and outcome definitions

Data extracted from medical records included: patient demographics, comorbidities, presenting symptoms, laboratory and microbiological results, preoperative imaging findings, antibiotic regimen (empirical and definitive), operative technique, intraoperative findings, and postoperative course. Technical

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success was defined as complete aneurysm exclusion with successful arterial reconstruction confirmed by clinical assessment of distal pulses or postoperative imaging. 30-day mortality was defined as death within 30 days of surgery, regardless of cause.

Institutional ethics approval for retrospective case series review was obtained from the Institutional Review Board of UMC-HCMC (376/HĐĐĐ-ĐHYD; 20-March-2023). Written informed consent for publication of clinical data and images was obtained from each patient or their legal representative.

3. RESULTS

3.1. Overview of the case series

Between January 2022 and January 2025, four male patients (mean age 57.5 years, range 47–68) underwent open surgical repair for IAAA at UMC-HCMC. All aneurysms were infrarenal; three were saccular and one was a pseudoaneurysm. Salmonella spp. was the confirmed pathogen in one patient (Case 1). The remaining three patients had no microbiologically confirmed causative agent. Three patients underwent elective or semi-elective repair; one presented as a surgical emergency. Patient characteristics are summarized in Table 1. Operative details and outcomes are presented in Table 2.

Antibiotic management: All patients received empirical broad-spectrum antibiotic therapy upon admission. Case 1 (Salmonella spp., ESBL-negative): targeted therapy with ceftriaxone (2 g IV once daily) was initiated upon blood culture identification and continued for a total of 6 weeks postoperatively, followed by transition to oral ciprofloxacin for an additional 3 months based on susceptibility testing. Cases 2, 3, and 4 (culture-negative): empirical coverage with ampicillin-sulbactam combined with metronidazole was administered perioperatively and continued for 4–6 weeks postoperatively. Antibiotic therapy was supervised by the infectious diseases team in all cases. No patient required antibiotic modification for drug-resistant organisms. No signs of graft infection or recurrent bacteremia were documented at the most recent follow-up available for each patient.

Table 1. Baseline characteristics of four patients with infective abdominal aortic aneurysm

Case	Age (yr)	Sex	Aneurysm morphology	Principal diagnosis	Microbiological findings	Surgical priority
1	53	M	Pseudoaneurysm, infrarenal	Infrarenal AAA, mycotic; Septicemia, Salmonella spp. ESBL (−)	Salmonella spp., ESBL (−), AmpC (−); blood culture positive	Elective
2	62	M	Saccular, infrarenal (aorto-iliac)	Infrarenal saccular AAA, infective	No growth on blood culture	Semi-elective
3	47	M	Saccular, infrarenal, dmax 52 mm, intact	Infrarenal saccular AAA, infective	No growth on blood culture	Elective
4	68	M	Saccular (lateral wall), just above aortic bifurcation	Para-aortic abscess; spondylodiscitis; IVC/ureter compression; duodenal perforation; T2DM	No growth; abscess culture pending	Elective (complex)

3.2. Individual case descriptions

Case 1. Salmonella-related pseudoaneurysm with descending thoracic aorta–bifemoral bypass.

A 53-year-old man presented with an infrarenal aortic pseudoaneurysm and concomitant Salmonella spp. bacteremia (ESBL-negative, AmpC-negative). After microbiological control with targeted antibiotic therapy (ceftriaxone 2 g IV once daily), elective repair was performed. Through a midline laparotomy, the pseudoaneurysm sac was excised and the surrounding infected periaortic tissue was débrided. The infrarenal aorta was oversewn. To avoid placement of prosthetic material within the infected field, arterial continuity to both lower limbs was restored via a descending thoracic aorta–bifemoral extra-anatomic bypass routed through a retroperitoneal tunnel, using a woven polyester (Dacron) graft selected for its availability and suture retention in a contaminated field. The operation was performed under general endotracheal anesthesia. No intraoperative complications were encountered.

Case 2. Culture-negative saccular aneurysm — semi-elective axillo-bifemoral and femorofemoral bypass.

A 62-year-old man was admitted with a saccular infrarenal AAA extending to the aortic bifurcation, clinically consistent with an infective etiology despite negative blood cultures. After haemodynamic optimization over 24–48 hours, semi-elective surgical intervention was undertaken. The aneurysm sac was resected; the infrarenal aorta and both common iliac arteries were ligated. Revascularization was accomplished via an axillo-femoral bypass (right side) combined with a femorofemoral crossover bypass, using Dacron grafts, routing all prosthetic conduits through uninfected tissue planes. No intraoperative complications were noted.

Case 3. Intact saccular aneurysm (dmax 52 mm) — elective axillo-bifemoral bypass.

A 47-year-old man was referred with an asymptomatic infrarenal saccular aneurysm (maximum diameter 52 mm) on a background of clinical and radiological features consistent with infection. The operation was performed electively. Exploratory laparotomy confirmed an infected aneurysm; the sac was ligated and excised. Bilateral lower-limb perfusion was restored with an axillo-right-femoral bypass and a right-to-left femorofemoral bypass using Dacron prosthetic grafts. The postoperative course was uneventful.

Case 4. Complex multi-organ IAAA — in-situ reconstruction with combined vascular, urological, and gastrointestinal repair.

A 68-year-old man with type 2 diabetes mellitus presented with a lateral-wall saccular aneurysm immediately above the aortic bifurcation, complicated by an extensive right-sided para-aortic and iliopsoas abscess causing extrinsic compression of the inferior vena cava and right ureter, hydronephrosis (grade 2, purulent), and spondylodiscitis. A multidisciplinary team comprising thoracic-vascular surgery, urology, and gastrointestinal surgery planned a combined single-stage procedure.

The operation comprised four components performed sequentially: (1) right ureterorenoscopy, retrograde pyelography, and double-J ureteral stent placement; (2) exploratory laparotomy with en-bloc resection of the infected aneurysm sac and surrounding abscess cavity, followed by ISR of the infrarenal aorta and both iliac arteries with a Dacron graft soaked in rifampicin solution (60 mg/mL in saline, 15-minute immersion) prior to implantation — ISR was chosen over EAB because the extensive iliopsoas abscess precluded safe creation of a retroperitoneal EAB tunnel; (3) management of an intraoperatively discovered duodenal perforation attributable to abscess erosion, addressed by segmental duodenectomy with side-to-side duodenojejunostomy; and (4) feeding jejunostomy to ensure adequate postoperative nutritional support. Technical success was achieved; the patient survived to the postoperative period.

3.3. Operative outcomes

Table 2. Operative strategy, prosthesis selection, and short-term outcomes

Case	Revascularization strategy	Prosthesis type	Operative procedure	Intraoperative / early postoperative events
1	Extra-anatomic bypass (descending thoracic aorta → bifemoral)	Dacron; standard (non-rifampicin-soaked)	Pseudoaneurysm excision + aortic oversewing + descending thoracic aorta–bifemoral bypass	None
2	Extra-anatomic bypass (axillo-femoral + femorofemoral)	Dacron; standard	Aneurysm resection + aorto-iliac ligation + axillo-right-femoral + right-to-left femorofemoral bypass	None
3	Extra-anatomic bypass (axillo-femoral + femorofemoral)	Dacron; standard	Aneurysm ligation/excision + axillo-right-femoral + right-to-left femorofemoral bypass	None
4	In-situ reconstruction (multidisciplinary)	Dacron, rifampicin-soaked (60 mg/mL, 15 min)	Abscess + aneurysm excision + aorto-bilateral-iliac ISR + double-J ureteral stenting + segmental duodenectomy + duodenojejunostomy + feeding jejunostomy	Intraoperative detection of duodenal perforation — managed definitively in same operative setting

4. DISCUSSION

4.1. Regional epidemiology: The role of Salmonella

Salmonella spp. predominance as a causative agent of IAAA in Southeast Asia is well established.3,4 Our series captures this phenomenon: Case 1 was confirmed Salmonella-related bacteremia, and the remaining culture-negative cases are consistent with the known difficulty in microbiological confirmation of IAAA.

The high rate of culture-negative results (3 of 4 cases, 75%) in our series reflects a well-recognized diagnostic challenge. Several mechanisms likely contributed. First, all three culture-negative patients had received empirical antibiotic therapy — including beta-lactams and fluoroquinolones — at referring hospitals prior to blood cultures being drawn at our centre, substantially reducing culture sensitivity. Second, standard aerobic and anaerobic blood culture sets (BACTEC™ FX system, Becton Dickinson) used consistently at UMC-HCMC may fail to detect fastidious organisms or Salmonella serovars with low bacteraemic burden. Third, intraoperative tissue cultures from aortic wall specimens were not collected in all cases due to logistical constraints in emergency settings. The diagnostic yield of blood cultures in IAAA ranges from 53–85% in published series, with lower rates consistently reported when antibiotics are initiated before sampling.1 We strongly advocate for blood cultures drawn before empirical antibiotic initiation wherever clinically feasible, and for routine intraoperative submission of aortic wall tissue for culture and histopathology.

The propensity of Salmonella to seed endovascular structures during bacteremia — particularly in aortas with pre-existing atherosclerosis — results in rapidly forming, thin-walled saccular aneurysms with high rupture potential, often presenting with a shorter prodrome than staphylococcal IAAA.4 This has direct implications for the urgency of surgical intervention.

4.2. Extra-anatomic bypass versus in-situ reconstruction

The ongoing debate between EAB and ISR reflects the fundamental tension between infection control and hemodynamic adequacy[5,6]. EAB eliminates prosthetic material from the infected bed, reducing the risk of graft infection. However, EAB is hemodynamically inferior, with 5-year primary patency rates of 60–80% compared with >90% for anatomic reconstruction[6,7]. ISR using rifampicin-soaked prosthetic grafts, or increasingly biologic conduits (cryopreserved allograft, bovine pericardium), offers superior long-term patency and is increasingly supported by data from high-volume Western centers, provided radical débridement and prolonged antibiotic therapy are ensured[5].

In our series, EAB was preferred in three cases where the infected field was localized and retroperitoneal tunneling was feasible. In Case 4, the extensive bilateral iliopsoas involvement precluded a safe EAB tunnel; ISR with a rifampicin-soaked Dacron prosthesis was therefore necessary. Biologic conduits were not available at our institution at the time of surgery; their use should be considered where available, particularly for ISR in heavily contaminated fields. This individualized decision-making aligns with the 2024 European Society for Vascular Surgery (ESVS) guidelines, which recommend tailoring the approach to the anatomical extent of infection rather than adopting a universal strategy[9].

4.3. Antibiotic management

Antibiotic therapy is an essential adjunct to surgical intervention in IAAA and directly impacts both early survival and long-term graft outcomes. In our centre, empirical broad-spectrum coverage was initiated at admission and subsequently de-escalated based on microbiological results. For the confirmed Salmonella case, ceftriaxone was used intravenously for 6 postoperative weeks, followed by oral ciprofloxacin for 3 months, consistent with published recommendations for Salmonella-related IAAA.4 For culture-negative patients, a minimum of 4–6 weeks of intravenous antibiotic therapy was administered. Regular follow-up for signs of graft infection or recurrent bacteremia is planned at 3, 6, and 12 months postoperatively. These practices are consistent with the ESVS 2024 guidelines, which recommend a minimum of 6 weeks of antibiotic therapy for IAAA[9].

4.4. Multidisciplinary management of complex IAAA

Case 4 illustrates the potential for catastrophic local extension of IAAA. Para-aortic abscess progression to the iliopsoas, inferior vena cava, ureter, and duodenum transformed a vascular emergency into a multi-organ surgical problem. Psoas abscess complicating IAAA has been specifically associated with Salmonella spp. infection and carries significantly higher mortality and rates of emergency operation[8]. The intraoperative detection and immediate repair of duodenal perforation in the same anesthetic episode — rather than relegating it to a planned second-stage procedure — likely avoided ongoing fecal contamination of the prosthetic graft and the morbidity of reoperation.

4.5. Vietnamese context and comparison with regional data

IAAA data from Vietnam remain limited. A report from Hanoi Medical University Hospital described a mycotic iliac aneurysm complicated by arterio-colonic fistula — a presentation analogous to the local extension seen in Case 4

of our series.10 The largest published Vietnamese surgical series relevant to aortic infection is that of Doan Quoc Hung et al. from Viet Duc University Hospital (Hanoi), who reported 41 patients with abdominal aortic and iliac aneurysms — including infective cases — treated with silver-coated polyester (Silver Graft) prostheses via in-situ revascularization between 2010 and 2014.11 In that series, microbiological confirmation was achieved in 39% of patients, with identified organisms including E. coli, Citrobacter freundii, Salmonella spp., and Pseudomonas aeruginosa — a spectrum broadly consistent with the infective aetiology in our cohort. Notably, all patients in the Viet Duc series underwent ISR with silver-coated grafts, whereas our series highlights the role of EAB in three of four cases, reflecting differences in institutional experience and patient anatomy. Multi-centre collaboration across Vietnamese tertiary vascular units is needed to generate sufficient sample sizes for meaningful comparative analysis.

4.6. Limitations

This study has several limitations. The sample size is small (n = 4), precluding statistical comparison or multivariable analysis. The retrospective design limits completeness of some variables, including operative duration, aortic clamp time, and long-term follow-up data. Microbiological confirmation was achieved in only one patient, reflecting the recognized diagnostic challenge of culture-negative IAAA — compounded by pre-admission antibiotic exposure in the culture-negative cases. Biologic conduits were unavailable, limiting graft options. Prospective registries with longer follow-up are needed to establish definitive management guidelines for IAAA in Southeast Asia.

CONCLUSIONS

Open surgical repair of infective abdominal aortic aneurysm is feasible and effective at a tertiary vascular center. EAB is the preferred strategy when the infected field can be completely excluded; ISR with rifampicin-soaked prosthetic graft is a necessary alternative when extensive retroperitoneal involvement forecloses safe extra-anatomic tunneling. Cases with multi-organ extension require coordinated multidisciplinary surgery in a single operative setting. In the Southeast Asian context, Salmonella spp. should be considered early in diagnostic and antibiotic planning. Prolonged antibiotic therapy — a minimum of 6 weeks parenterally, with oral continuation for confirmed Salmonella cases — is integral to successful outcomes and graft preservation. Continued prospective case collection with long-term follow-up and multicentre collaboration is essential to define optimal management strategies for this high-mortality condition.

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