

Addressing Critical Challenges: Aortoiliac Occlusive Disease Management In Ethiopia

ABSTRACT: Introduction: Aortoiliac occlusive disease (AIOD), a type of peripheral artery disease (PAD), occurs due to atherosclerotic blockage of the lower abdominal aorta and iliac arteries, resulting in reduced blood flow to the pelvic region and lower extremities. Management options include endovascular interventions and open surgical reconstruction, with the latter being the gold standard in advanced cases. In low- and middle-income countries (LMICs) like Ethiopia, open surgery remains the primary treatment due to limited access to endovascular techniques. This study aims to evaluate the safety and effectiveness of open aortoiliac surgery for AIOD in Ethiopia, providing insights into the feasibility of these procedures in similar resource-limited settings. **Methodology:** This retrospective case series was conducted at a single major referral center in Ethiopia, evaluating 36 consecutive patients with chronic atherosclerotic aortoiliac occlusive disease (AIOD) who underwent open surgery between January 2018 and May 2023. Data were collected from medical records, operation logbooks, and follow-up interviews. Key variables, including demographics, clinical profiles, diagnostic tests, operative records, and postoperative outcomes, were analysed using SPSS version 25.0, with categorical and continuous variables summarized using appropriate statistical methods. **Result:** A total of 36 patients underwent open surgical reconstruction for aortoiliac occlusive disease (AIOD) between January 2018 and May 2023. The majority were male (63.9%), with a mean age of 61.1 years. Ischemic tissue loss was the most common presentation (69.4%), and 63.9% of patients had TASC D lesions. Post-operatively, 91.7% of patients experienced symptom resolution. Early complications occurred in 41.7% of cases, including surgical site infections (25%) and pneumonia (11.1%). The early mortality rate was 2.8%, and 11.1% of patients required limb amputation. Late graft occlusion occurred in five patients, and three patients died during follow-up. **Discussion:** Open surgical reconstruction proves effective for AIOD management in resource-limited settings like Ethiopia, where endovascular options are scarce. Symptomatic relief in 91.7% of patients shows the feasibility of open surgery, despite severe disease and high comorbidities. However, the high incidence of early postoperative complications, such as surgical site infections and limb amputations, points to the severe disease at presentation and the challenges of managing such patients in a resource-limited environment. The study also emphasizes the importance of improvements in surgical training, access to materials, and the formal establishment of vascular surgery programs, which have contributed to an increased number of successful surgeries over time. **Conclusion & Recommendation:** Open surgical reconstruction for AIOD in Ethiopia shows promise in symptom relief and limb salvage, even with limited resources and no established endovascular alternatives. Despite progress, high early complications like infections and graft occlusion highlight the challenges of managing advanced cases in this setting. Early diagnosis using ABI and duplex ultrasound, better pre-op care for comorbid patients, and public health efforts to reduce risk factors like hypertension and smoking are essential. Expanding training, introducing endovascular techniques, and structured long-term follow-up are key to improving outcomes. Further research is needed to refine AIOD management in similar contexts.

AUTHORS: Dagim Leykun Berhanu, Nebyou Seyoum Abebe, Henok Teklesilase Zeleke

INSTITUTIONS:

1. Hawassa University
2. Addis Ababa University

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Introduction

Aortoiliac occlusive disease (AIOD), also known as Leriche syndrome, is a form of peripheral arterial disease (PAD) caused by atherosclerotic blockages in

the lower abdominal aorta and iliac arteries, leading to reduced blood flow to the pelvis and lower limbs [1–3]. Though AIOD is often underreported due to many asymptomatic cases, progression can result in leg

pain, erectile dysfunction, and severe complications like tissue loss or gangrene, significantly increasing the risk of limb loss [4,5]. PAD globally affects 3-10% of the population, rising to 15-20% in those over 70 years [3,6-8]. Several studies indicate that AIOD shares risk factors with other forms of PAD, such as smoking and dyslipidemia, but it is more prevalent among younger smokers. In contrast, distal PAD is more often linked to diabetes and chronic kidney disease [7,9,10]. One study found critical stenosis in the aortoiliac region in over half of lower extremity occlusive disease cases [11]. These distinctions in risk factors and disease patterns significantly impact AIOD treatment and prognosis [4]. Low- and middle-income countries (LMICs) bear a large portion of this burden due to aging populations, smoking, and diabetes [9,12-15].

Management of AIOD typically involves two main strategies: endovascular repair and open surgical reconstruction. The disease's classification by the Trans-Atlantic Inter-Society Consensus (TASC II) guides treatment options, endovascular approaches for less complex lesions (Type A) and open surgery for more extensive disease (Type D) [6]. While endovascular techniques have gained popularity in high-resource settings due to their minimally invasive nature, open surgical repair still remains the gold standard for patients with diffuse disease with significant symptoms who risks limb loss without timely intervention [6,11,16-19]. Aortobifemoral bypass (AFB), the most common open surgical procedure for AIOD, provides excellent long-term patency of over 90% at five years but is associated with higher morbidity compared to endovascular alternatives (2.6% vs. 0.7%) [16,17,20]. Other open options include iliofemoral bypass and endarterectomy [11,18,19]. Extra-anatomic bypasses, such as axillo-femoral or femoro-femoral bypasses, are reserved for patients with more complex presentations or contraindications to intra-abdominal surgery [11,21]. Patient selection is critical, as systemic morbidity remains a concern in open surgery, although mortality rates have decreased in recent studies [20,22,23]. In addition, simultaneous profundaplasty or femoropopliteal bypass may be necessary to enhance patency rates in patients with diffuse disease with infra-inguinal involvement [20-22,24].

The growing burden of non-communicable diseases (NCDs) in sub-Saharan Africa has increased the

demand for vascular surgical interventions, particularly as risk factors like smoking, diabetes, and hypertension become more common [12,13,25,26]. However, the field remains underdeveloped due to inadequate infrastructure, a shortage of skilled professionals, and limited resources. These results in many cases, including aortoiliac occlusive disease (AIOD), going untreated or receiving suboptimal care. Additionally, the lack of comprehensive data on surgical practices and outcomes hinders efforts to fully address the region's healthcare needs [12,27].

In Ethiopia and other low- and middle-income countries (LMICs), vascular diseases are rising due to urbanization, aging, and lifestyle changes [12,13]. However, access to specialized vascular care is severely limited, with few centers offering surgery and many struggling with inadequate infrastructure, staffing shortages, and a lack of graft supplies [9,14,28,29]. Essential materials like grafts and sutures are often obtained through irregular donations from charitable organizations, still not enough to meet the increasing burden of vascular diseases. While endovascular techniques are the standard treatment for aortoiliac occlusive disease (AIOD) in high-income countries due to their minimally invasive nature and quicker recovery times [6,20], open surgery remains the only option in Ethiopia, despite its higher risks and longer recovery periods. Working in this challenging environment necessitates innovative approaches and a concerted capacity-building effort to optimize local resources for more sustainable solutions [12,28]. Improved resource allocation, government investment, and private sector involvement are essential to create a more self-sufficient vascular care infrastructure and meet the growing burden of vascular disease in low- and middle-income countries (LMICs).

Our study aims to evaluate the safety and effectiveness of open aortoiliac surgery in a resource-limited setting, specifically in a major referral center in Ethiopia, where it is the only available option. As the first study to examine AIOD surgery outcomes in Ethiopia, our work is especially pertinent as it is one of the few studies examining open aortoiliac surgery outcomes in sub-Saharan Africa and will provide critical data on the feasibility of performing these procedures in challenging conditions, helping to guide future efforts to expand and improve vascular care in

Ethiopia and other LMICs. By analyzing surgical outcomes in this context, the study will shed light on the feasibility of managing AIOD through open surgery in LMICs. Comparing these outcomes with data from high-income settings will show both the challenges and potential successes in delivering vascular care in resource limited environments. The study will also contribute to the development of evidence based practices for managing AIOD in Ethiopia and other LMICs, while also guiding future resource planning and healthcare strategies to address the growing burden of vascular diseases in resource-limited settings.

Methodology

This retrospective case series was conducted at a single major referral center Ethiopia, to assess the safety and effectiveness of open aortoiliac surgery in patients with aortoiliac occlusive disease (AIOD) between January 1, 2018, and May 30, 2023. Clinical outcomes were evaluated by reviewing the medical records of 36 patients who underwent open aortoiliac reconstructions during this period with the aim of describing the experience and outcomes of these surgeries in Ethiopia.

Sampling Process

A total of 36 consecutive patients who underwent open aortoiliac surgery were included in the study. All patients met the inclusion criteria, which required a diagnosis of chronic atherosclerotic aortoiliac occlusive disease (AIOD) and at least one month of postoperative follow-up. Patients presenting with acute aortoiliac occlusion or non-atherosclerotic conditions were excluded. No patients were lost to follow-up, as postoperative data were successfully collected either directly from the patients or through their next of kin. This process ensured comprehensive data collection and representation of all eligible cases during the study period.

Data Collection and Analysis

Data for 36 patients who underwent open aortoiliac reconstructions during the study period was collected from medical records, with patients identified through vascular surgery operation logbooks. Data collectors,

trained over a two-day period, utilized pre-coded questionnaires and protocols to ensure completeness and consistency. Follow-up data collection involved structured telephone interviews with patients or their next of kin, asking standardized questions to minimize bias. Missing information was supplemented through these interviews, which were conducted by data collectors blinded to surgical outcomes to reduce recall bias. The pre-tested and pre-coded questionnaire captured key variables, including demographics, clinical profiles, diagnostic tests, operative records, and post-operative outcomes. Data was cross-referenced with multiple sources, such as operation logbooks, electronic medical records, and outpatient follow-up logs, ensuring accuracy and minimizing potential biases. Data cleaning, coding, and analysis were conducted using SPSS version 25.0. Categorical variables were summarized using frequencies and percentages, while continuous variables were analyzed using means, medians, ranges, and standard deviations.

Ethical Considerations

Ethical approval for this study was granted by the Institutional Review Board (IRB). Given the retrospective design, a waiver of consent for medical record review was obtained. However, verbal consent was secured from patients or their next of kin for follow-up interviews. To ensure confidentiality, all patient data was anonymized, with identifying information removed prior to analysis. Data was securely stored on password-protected systems, and patient privacy was maintained throughout the research process.

Limitations

This study's retrospective case series design and single-center nature limit the generalizability of its findings, as outcomes may not reflect broader populations. The small sample size restricted regression analysis, limiting the identification of predictors of surgical success. Additionally, the descriptive nature of the study makes it hypothesis-generating rather than definitive. These limitations stem from the resource-constrained environment, where prospective studies are difficult to conduct due to financial and logistical challenges.

Results

Between January 2018 and May 2023, a total of 36 patients underwent open surgical reconstruction for chronic atherosclerotic aortoiliac occlusive disease (AIOD) at a major referral center in Ethiopia. The trend of surgeries varied over the years, with the lowest number in 2020 and the highest in 2022, when 10 procedures were performed (Fig. 1). Of the 36 patients, 63.9% (n=23) were male, and 36.1% (n=13) were female, with a mean age of 61.1 ± 12.3 years. The majority (61.1%) were aged between 50 and 70 years, while 13.9% were younger than 50 years and 25% were over 70 years old. Hypertension was the most common comorbidity, present in 50% of patients, followed by diabetes and smoking history (30.6% each), hyperlipidemia (13.9%), and coronary artery disease (27.8%). (Table 1)

At presentation, 69.4% of patients had ischemic tissue loss or gangrene, 19.4% had rest pain, and 11.1%

experienced severe claudication. CT angiography was performed for all patients, revealing that 63.9% had TASC D lesions and 91.7% had additional infra-inguinal disease involvement (Table 2). Revascularization procedures were performed on 44 limbs, including both anatomic (63.9%) and extra-anatomic (36.1%) reconstructions. Dacron grafts were used in 58.3% of cases, with PTFE used in 25% and autogenous vein grafts in 11.1%. (Table 3)

Post-operatively, 91.7% of patients achieved symptom resolution. Early complications occurred in 41.7% of patients, including surgical site infections (25%), pneumonia (11.1%), and acute limb ischemia (11.1%). Re-intervention was necessary for 11.1% of patients, and the early mortality rate was 2.8%. Limb amputation was required in 11.1% of cases. Late graft occlusion occurred in 5 patients, and 3 patients died during follow-up due to cardiac and renal complications (Table 4).

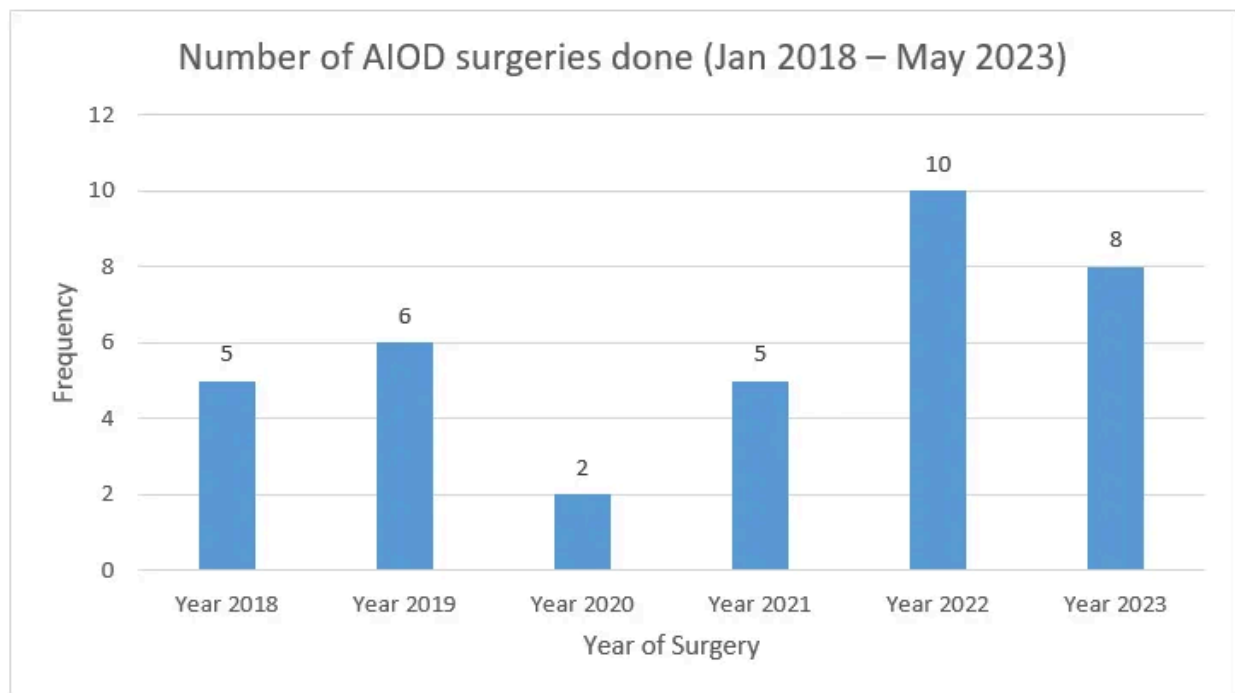


Figure 1: Number of AIOD Operations Performed

Table 1: Demographic characteristics of study participants in results of open surgery for aortoiliac occlusive disease

Demographic Characteristics	Frequency (n = 36)	Percent
Age		
Less than 50 year	5	13.9%
50 - 70 year	22	61.1%
Greater than 70 year	9	25.0%
Average	61.1 ± 12.3-years-old	
Median	60-years-old	
Sex		
Male	23	63.9%
Female	13	36.1%
Risk Factors		
Smoking History	11	30.6%
Diabetes	11	30.6%
Hypertension	18	50.0%
Hyperlipidemia	5	13.9%
Comorbidities		
Coronary artery disease	10	27.8%
Cerebrovascular disease	3	8.3%
Chronic renal insufficiency (Cr > 1.5mg/dl)	3	8.3%
Congestive heart failure	3	8.3%
Prior Surgery		
Vascular procedure	4	11.1%
Major and Minor Amputations	4	11.1%
Drugs		
Aspirin	34	94.4%
Statins	34	94.4%
Anticoagulant	8	22.2%
Beta-blockers	9	25.0%
Antihypertensive	21	58.3%

Table 2: Clinical characteristics of study participants in results of open surgery for aortoiliac occlusive disease

Clinical characteristics	Frequency (n = 36)	Percent
Symptoms		
Bilateral lower extremity symptoms	7	19.4%
Claudication (calf/thigh/buttock)	4	11.1%
Rest Pain	7	19.4%
ED/Sexual Dysfunction		
Yes	1	2.8%
No	8	22.2%
No documentation about ED/Sexual dysfunctions	27	75.0%
Other additional Symptoms: (tingling, coldness, color change, numbness, weakness)	12	33.3%
Exam findings		
Ulceration/Gangrene	25	69.4%
Involving <= 2 toes	17	47.2%
Involving > 3 toes	2	5.6%
Beyond forefoot	6	16.7%
Femoral pulse not palpable bilaterally	8	22.2%
Pre-Operative ABI done	7	19.4%
Imaging Findings		
TASC B	6	16.7%
TASC C	7	19.4%
TASC D	23	63.9%
Infra-Inguinal involvement on imaging	33	91.7%

Table 3: The distribution of intra-operative and technical factors in study participants in results of open surgery for aortoiliac occlusive disease

Intra-operative and technical factors	Frequency (n = 36)	Percent
Anesthesia		
General Anesthesia	23	63.9%
Spinal/Epidural Anesthesia	13	36.1%
Approach		
Trans-Abdominal approach	20	55.6%
Retroperitoneal approach	3	8.3%
Extra-Anatomic	13	36.1%
Surgical Reconstruction		
Bilateral Reconstruction	8	22.2%
Anatomic	23	63.9%
Endarterectomy	8	22.2%
Aorto-bifemoral bypass	3	8.3%
Aorto-biiliac bypass	1	2.8%
Aorto-uniliac bypass	1	2.8%
Aorto-uniliac and Aorto-unifemoral bypass	4	11.1%
Aorto-unifemoral bypass	2	5.6%
Ilio-femoral bypass	4	11.1%
Extra-anatomic bypass		
Femoro-femoral bypass	13	36.1%
Graft Type used for the bypass		
Dacron	21	58.3%
PTFE	9	25.0%
Silver Impregnated	1	2.8%
Vein	4	11.1%
No graft required	1	2.8%
Estimated blood loss		
Greater than 500	3	8.3%
Transfusion required	2	5.6%
Concurrent Procedure done		
Aortic endarterectomy	2	5.6%
Femoral endarterectomy	8	22.2%
Infra-inguinal bypass	4	11.1%
Profundoplasty	3	8.3%
Major and minor amputation	3	8.3%

Table 4: Post-operative outcome of study participants in results of open surgery for aortoiliac occlusive disease

Post-operative outcome	Frequency (n = 36)	Percent
Post-operative hospital stay		
Less than 7 days	10	27.8%
7 – 14 days	22	61.1
Greater than 14 days	4	11.1%
Mean duration of post-operation	740.2 days	
Maximum Days Post-operation	1,904 days	
Minimum Days Post-operation	28 days	
Post-operative improvement		
No improvement	3	8.3%
Subjective improvement (Relief of pain)	33	91.7%
Early post-operative complication (<= 30 days)		
Pneumonia	4	11.1%
Surgical site infection	9	25.0%)
Early graft occlusion	2	5.6%
Acute limb ischemia	4	11.1%)
Renal insufficiency	2	5.6%
Re-intervention	4	11.1%
Death < 30 day	1	2.8%
No 30 day complication	21	58.3%
Limb loss (<= 30 days)	4	11.1%
Progression of acute limb ischemia	3	8.3%
Progression of infection	1	2.8%
Refused amputation	1	2.8%
Late Outcome		
Death	3	8.3%
Alive patients	29	
Lost from follow-up / Unknown status	3	8.3%
Late graft occlusion	5	13.9%
Late re-intervention (Infra-inguinal revascularization)	1	2.8%
Late end-stage renal disease	1	2.8%

Discussion

The current management of aortoiliac occlusive disease (AIOD) has increasingly shifted towards less

invasive endovascular techniques [21]. However, open surgical treatment remains the gold standard, particularly for extensive and complex cases, as seen in our context where limited vascular services are still in early stages of development. There is a significant lack of research data on the management of AIOD in Africa, with existing data on peripheral arterial disease (PAD) often not reflecting the broader scope of the condition across the continent. Most published outcomes of open surgery for AIOD are from high-income countries, creating a gap in understanding the disease burden and surgical outcome in resource-limited settings. This study addresses this gap by presenting outcomes of open vascular reconstructions for AIOD in Ethiopia, showing both the challenges and successes with in resource limited context. These findings can inform the development of targeted strategies to improve vascular care in similar contexts in the region.

One of the key findings is the fluctuation in the number of surgeries over the years, with a notable decline in 2020, likely influenced by the global COVID-19 pandemic and its impact on both patient flow and disruptions in the supply of graft materials directly affected the number of surgeries performed. However, surgical interventions increased significantly from 2021 onward, potentially due to enhanced surgical skills, increased vascular graft access through donations, and the establishment of a formal vascular surgery training program (Fig. 1). The data suggests that these improvements have facilitated a growing number of successful interventions and the critical role that external support plays in addressing the challenges faced in resource-limited settings. Furthermore, the establishment of multidisciplinary specialized care centers shows promise in improving outcomes for patients suffering from complex vascular diseases, a potential pathway for enhancing the efficacy of vascular surgical care in the region.

In terms of patient demographics, this study identifies older male patients (61.1%) as the primary population affected by AIOD, with hypertension, diabetes, and smoking being the major known risk factors. The relatively high prevalence of hypertension (50%) aligns with global findings that hypertension, particularly in Black populations, is a leading modifiable risk factor for cardiovascular disease [7,25]. These findings emphasize the importance of

prevention strategies particularly on hypertension management to reduce the burden of AIOD in our setting.

The study also identified a high rate of advanced disease presentation, with 69.4% of patients presenting with tissue loss with ulceration or gangrene, indicating a potential delay in early diagnosis and treatment of the disease. This late presentation necessitates urgent revascularization to prevent limb loss, as reflected in the study's finding that 11.1% of patients experienced limb amputation within 30 days post-surgery. These complications emphasize the importance of timely diagnosis and intervention to avoid severe ischemic complications ultimately leading to limb loss.

Another key aspect of this study is the high rate of concurrent procedures needed for our patients, including femoro-femoral bypass and aortic endarterectomy. The frequent need for such concurrent procedures emphasizes the advanced stage of disease in many patients and the necessity for a multifaceted surgical approach in these patients. The choice of reconstruction techniques varied depending on disease severity and patient condition and resource availability, with Dacron grafts being the most commonly used material (58.3%).

Despite the severity of disease and the complexity of interventions, 91.7% of patients reported symptomatic improvement with relief of pain after revascularization, demonstrating the effectiveness of open surgery in this setting. The high rate of advanced disease presentation and associated complications highlights the critical need for earlier diagnosis, improved access to preventive care, and enhanced perioperative care to optimize outcomes for open surgery. The study also showed a relatively high rates of early complications, including surgical site infections (25%) and pneumonia (11.1%), as well as a significant rate of limb loss (11.1%) compared to other studies [17,20,30]. The higher rate of surgical site infections, which is significantly elevated compared to other studies in high-income settings is likely influenced by resource limitations in perioperative care commonly faced in low-resource settings like Ethiopia, may have contribute to suboptimal infection control. Additionally, the frequent off-label use of graft materials, though necessary, may further increase infection risk due to possible

compromised sterility. To address these high infection rates, several interventions could be considered. Strengthening perioperative infection control practices and improving postoperative monitoring for early signs of infection are critical steps. Enhanced training for surgical teams on infection prevention protocols, better access to antibiotics and securing more consistent donations of essential graft supplies could play a role in reducing these complications.

Late outcomes were generally positive, with 80.6% of patients alive at the time of follow-up, although 13.9% experienced graft occlusion (Table 4), which is within the reported range of 5% to 30% in the literature [16,20]. These findings suggest the need for on-going follow-up and potential secondary interventions may prolong and maintain long-term graft patency for patients who have undergone surgery.

This retrospective case series study is subject to several limitations. Firstly, the retrospective nature of the study may limit the ability to control for confounding variables, which could affect the generalizability of the findings. Additionally, the reliance on historical data may result in incomplete or inconsistent documentation of clinical parameters. The study's findings are also constrained by the limited availability of preoperative diagnostic tests like the ankle-brachial index (ABI), potentially leading to missed opportunities to document the extent of disease severity and objectively document the revascularization outcome. The small sample size, fluctuating number of surgeries performed and the

variability in surgical techniques utilized in our case series limit the robustness of the conclusions.

Conclusion

Open surgery for AIOD shows promise in Ethiopia, but continued advancements in diagnostics, training, and preventive care are needed for better long-term outcomes. This study shows the growing capacity for open surgical management of aortoiliac occlusive disease (AIOD) in Ethiopia, a resource-limited setting. Despite the lack of endovascular alternatives, improvements in surgical skills and access to graft materials have shown positive outcomes, including symptom relief and limb salvage. However, early post-operative complications such as infections and graft occlusions remain significant challenges. To address these issues, we recommend strategic investments in health systems that focus on integrating and coordinating care between policymakers, researchers, and vascular surgeons. Establishing dedicated regional vascular centers and strengthening existing institutions through collaborations with high-income academic centers will be critical. Additionally, enhancing local research capacities and fostering partnerships are essential steps to tackle disparities in vascular care. These recommendations aim to improve diagnostic capabilities, surgical training, and preventive strategies, ultimately reducing early post-operative complications and improving long-term outcomes in the management of aortoiliac occlusive disease in Ethiopia (Table 5).

Table 5: Recommendation for Addressing Challenges in AIOD management in Ethiopia

Challenge	Stakeholder	Recommendations
Diagnosis and Prevention		
Delayed recognition of AIOD	Healthcare Providers	Implement widespread use of non-invasive diagnostic tools (ABI, Duplex ultrasound)
Rising prevalence of cardiovascular disease	Public health authorities	Launch targeted public health campaigns for prevention and early diagnosis
Lack of preventive strategies	Policy makers	Develop and integrate vascular care into broader healthcare services
Treatment and Care		
Limited access to vascular care services	Policy makers	Allocate resources for expanding local capacity and gradually introduce endovascular procedure
Increased rate of post-operative complications	Healthcare providers	Strengthen preoperative evaluation and optimize comorbidity management.
Reliance on open surgery	Medical institutions	Invest in training for less invasive procedures as resources allow.
Follow-up and Long-term Outcomes		
Poor long-term follow-up	Healthcare providers	Implement structured long-term follow up programs
Insufficient data on long-term outcomes	Researchers and academic institutions	Conduct prospective studies to assess long-term outcomes in AIOD management.
Infrastructure and Resources		
Inadequate infrastructure and equipment	Medical institutions	Invest in facilities for early diagnosis, surgery and long-term patient care
Limited resources for advanced procedures	International organizations and donors	Provide funding and technical assistance for healthcare initiatives
Capacity Building		
Lack of specialized vascular care	Policy makers	Invest in training programs and partnership with high-income countries
Limited local research capacity	Researchers and academic institutions	Foster collaboration with international vascular societies and research centers
Patient Engagement		
High prevalence of comorbidities	Patients and patient advocacy groups	Participate in education programs focusing on modifiable risk factors
Poor adherence to follow-up care		Engage in long-term follow-up care

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