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A Prospective Observational Study of Clinical Profile and Current Management of Patients with Peripheral Occlusive Arterial Disease of Lower Limb at Tertiary Care Hospital

Dr. Bhawani Singh Shekhawat[1], Dr. Pradeep Kumar Verma[2], Dr. Prashant Kothari[3], Dr. Ekta Srivastava[4*]

[1]Resident, Department, General Surgery, J.L.N. Medical College & Associated Group of Hospitals, Ajmer (Raj.)
[2]Professor, Department, General Surgery, J.L.N. Medical College & Associated Group of Hospitals, Ajmer (Raj.)
[3]Assistant Professor, Department, CTVS (Cardiothoracic and Vascular Surgery), J.L.N. Medical College & Associated Group of Hospitals, Ajmer (Raj.)
[4]Resident, Department, General Surgery, J.L.N. Medical College & Associated Group of Hospitals, Ajmer (Raj.)

Corresponding Author:

Dr. Ekta Srivastava
Resident, Department, General Surgery, J.L.N. Medical College & Associated Group of Hospitals, Ajmer (Raj.)
Email:
ekta.srivastavadr@gmail.com

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ABSTRACT

Background: Peripheral Occlusive Arterial Disease (POAD) is a chronic progressive condition characterized by stenosis and/or occlusion of arteries supplying the lower extremities, representing a significant manifestation of systemic atherosclerosis. This condition affects over 200 million people worldwide, with prevalence increasing substantially with age and rising to 15% in persons over 70 years. In India, the aging population makes POAD a significant health burden requiring systematic study of its clinical profile and management patterns.

Aims and Objectives: The study aimed to analyze various types of peripheral occlusive arterial disease, study the outcome and various treatment modalities, investigate diagnostic methods required to confirm POAD, and identify etiological factors associated with the disease.

Material and Methods: This hospital-based prospective observational study was conducted from June 2024 to December 2025 at the Department of Surgery, JLN Medical College & Hospitals, Ajmer. A total of 100 clinically diagnosed cases of peripheral occlusive arterial disease were enrolled through convenient sampling. Detailed clinical history, thorough physical examination, routine laboratory investigations, Doppler studies, and CT angiography were performed. Patients were categorized into two groups based on etiology: Atherosclerosis (74 patients) and Thromboangiitis Obliterans (TAO) (26 patients). Management strategies including conservative therapy, surgical interventions (amputations, lumbar sympathectomy, disarticulation), and their outcomes were documented. Patients were followed up for six months.

Results: The mean age of patients was 54.63±14.65 years, with a male predominance (75%). Atherosclerosis predominantly affected older individuals (87.84% above 51 years), while TAO mainly affected younger patients (84.61% between 31-40 years). Diabetes mellitus (40.54%) and hypertension (27.03%) were common comorbidities in atherosclerotic patients. All patients presented with advanced disease—intermittent claudication, rest pain, and tissue loss (gangrene or ulcer). Atherosclerosis showed more extensive gangrenous changes (55.41% involving toes and foot) compared to TAO (92.31% limited to toes). Smoking was prevalent in both groups (79% overall). Doppler and CT angiography revealed that atherosclerosis predominantly affected larger vessels (popliteal 48.65%, superficial femoral 18.92%), while TAO involved smaller distal vessels (infra-popliteal 69.23%, ankle 30.77%). All patients received medical management; surgical amputations were performed in 74% of cases (above knee 44%, below knee 30%). Post-operative recovery was uneventful in 62.16% of atherosclerosis

and 69.23% of TAO patients. At 3-month follow-up, 82% showed improvement, and quality of life improved in 88% of patients.
Conclusion: Atherosclerosis and TAO demonstrate distinct clinical profiles—atherosclerosis affects older individuals with systemic comorbidities and large-vessel disease, while TAO predominantly affects younger males with strong smoking correlation and distal vessel involvement. Current medical and surgical management effectively stabilizes most patients and significantly improves quality of life. Early diagnosis, risk factor modification (particularly smoking cessation), and appropriate revascularization strategies are crucial for favorable outcomes. The high reliance on amputations (74%) underscores the need for earlier intervention and better access to vascular surgical care in resource-limited settings.

Keywords*: Peripheral Occlusive Arterial Disease, Atherosclerosis, Thromboangiitis Obliterans, Intermittent Claudication, Amputation, Lower Limb Ischemia.*

INTRODUCTION

Peripheral arterial occlusive disease (PAOD) is a chronic progressive condition that leads to narrowing and eventual blockage of peripheral arteries.[1] It is a progressive disorder characterized by stenosis and/or occlusion of arteries other than those supplying the heart (coronary artery disease) or the brain (cerebrovascular disease).[2] More commonly affecting the lower limbs, PAOD represents an important manifestation of atherosclerosis involving the arteries of the legs.[3]

PAOD is a global health problem with an estimated prevalence of 3-10%, increasing to 15% in persons over 70 years of age.[1] Over 200 million people are affected with lower extremity artery disease worldwide, with symptoms ranging from none to severe.[4] In India, as the majority of the population consists of older adults, it will represent a significant health burden.[1]

The pathophysiology of PAOD is typically caused by atherosclerosis or inflammatory changes in blood vessels, reducing blood flow and limiting tissue perfusion. Other etiologies include embolism, trauma, and vasculitis.[1] Various non-atherosclerotic conditions like Thromboangiitis Obliterans (TAO), Takayasu's disease, arterial fibrodysplasia, peripheral emboli, primary vascular tumors, remote trauma, or radiation injury can also cause symptoms consistent with intermittent claudication. TAO is an inflammatory occlusive disease primarily involving medium-sized muscular and smaller arteries in extremities, with smoking as the strong associated causative factor. In the lower limb, the disease commences in the digital arteries and small arteries of the foot and then proceeds to involve the crural arteries.[5]

Risk factors for PAOD include male gender, hypertension, high cholesterol, diabetes mellitus, previous and current smoking, chronic kidney disease, elevated homocysteine levels, and a family history of atherosclerosis.[1] The most common risk factors associated with atherosclerotic vascular disease are age, male gender, smoking, diabetes mellitus, hyperlipidemia, hypertension, and less commonly race (Western>Asian), increased C-reactive protein, and chronic renal insufficiency.[1]

PAOD is common particularly in elderly populations and poses a high risk of long-term suffering, amputation, and premature death. The most feared consequence of PAOD is severe limb-threatening ischemia leading to amputation.[6] Besides the obvious risk of amputation, patients with PAOD have a threefold increased risk to die from all causes and a sixfold increased risk to die from cardiovascular disease within 10 years compared with patients without PAOD.[7] More than half of people with a major amputation will die within 5 years.[8] Amputations have huge social and economic consequences due to decreased quality of life and life expectancy, and increased healthcare costs.

The wound, ischaemia and foot infection (WIfI) classification provides an objective classification for wound healing and limb amputation based on three independent risk factors—wound extent, degree of ischaemia, and extent of foot infection.[9]

This system helps guide clinical decision-making regarding revascularization and amputation risk.
This study aims to document and analyze the demographic characteristics, underlying etiologies, clinical presentations, and current management strategies for patients diagnosed with peripheral occlusive arterial disease of the lower limbs, and to evaluate outcomes of various medical and surgical management modalities.

MATERIAL AND METHODS

Study Design: Hospital-based prospective observational study
Study Duration: June 2024 to December 2025
Study Setting: All patients presenting to the IPD with complaints suggestive of lower limb arterial occlusive disease at Department of Surgery, JLN Medical College & Hospitals, Ajmer

Study Population: Clinically diagnosed cases of peripheral occlusive arterial disease at Department of Surgery, JLN Medical College & Hospitals, Ajmer
Sample Size: 100 patients
Sampling Technique: Convenient Sampling

Inclusion Criteria

- Patients presenting with signs and symptoms of peripheral occlusive arterial disease of the lower extremities like intermittent claudication, rest pain, ulceration, and gangrene
- Patients with evidence of lower limb arterial occlusive disease on Doppler study

Exclusion Criteria

- Patients with history of trauma to the lower extremities
- Patients presenting with pain of skeletal or neurologic origin of lower limbs with no evidence of vascular damage
- Patients presenting with ulcers of traumatic or infective origin with no evidence of ischemia
- Patients with immuno-compromised state
- Patients with pregnancy

METHOD OF DATA COLLECTION

The method consisted of taking a good clinical history in chronological order as soon as the patient was admitted. A thorough clinical examination was carried out to find and establish clinically the presence of vascular obstruction. Detailed vascular system examination was done as per the Proforma provided. Demographic data, chief complaints, history, risk factors, family history, and drug history were recorded.

A thorough clinical examination was performed for all enrolled patients: General physical examination, Local examination, Pulse examination, and Auscultation for femoral and popliteal bruits. The degree of vascular inadequacy and extent of disease spread was assessed clinically by noting color change, extent and spread of gangrene, and absence of peripheral pulses in affected limbs.

Routine Laboratory Investigations

- Complete blood count (CBC)
- Random blood sugar / Fasting blood sugar / HbA1c
- Serum lipid profile (Total cholesterol, LDL, HDL, Triglycerides)
- Serum creatinine and Blood Urea Nitrogen
- Serum electrolytes
- Coagulation profile (PT/INR, APTT)
- Liver function tests
- Electrocardiogram (ECG)
- Chest X-ray (PA view)

Imaging Studies

Patients were further evaluated objectively by Doppler scanning whenever feasible to assess the level and degree of obstruction. CT Angiography was performed with the aim to achieve foot salvage wherever feasible. Doppler studies were performed by a single observer, recording pressure tracings in the supine position using the Samsung HS80 Ultra Sonography Machine. A record of patient's progress and response to various modalities of treatment was maintained.

Assessment of Management

Conservative/Medical Management:

- Risk factor modification: Control of diabetes, hypertension, dyslipidemia, and cessation of smoking
- Lifestyle modifications including smoking cessation and supervised exercise therapy
- Secondary prevention medications: antiplatelet therapy (aspirin, clopidogrel), ACE inhibitors or ARBs, statins
- Pharmacological agents: antiplatelets, statins, ACE inhibitors/ARBs, vasodilators, cilostazol, pentoxifylline
- Wound care for ischemic ulcers

Surgical Management:

- Bypass grafting, endarterectomy, and angioplasty with stenting
- Surgical revascularization for patients with lifestyle-limiting claudication with inadequate response to therapy
- Major and minor amputations documented
- Patients with acute or limb-threatening ischemia referred immediately to a vascular surgeon

Endovascular Management:

- Percutaneous transluminal angioplasty (PTA)
- Stenting
- Thrombolysis

Outcome Documentation

- Clinical outcomes including patency rate/vessel patency, target lesion revascularization (TLR), all-cause mortality/death, amputation (minor or major), serious adverse events, and wound healing were documented
- Patients were followed up for a minimum of six months

Ethical Approval

Prior approval from the Institutional Ethic Committee of JLN Medical College, Ajmer was obtained. Written informed consent was taken from each participant.

Statistical Analysis

Statistical analysis was done using computer software (SPSS Trial version 23 and primer). Qualitative data was expressed in proportions and percentages, and quantitative data was expressed as mean and standard deviations. The appropriate test of significance was applied. A 5% probability was considered statistically significant ($p<0.05$).

OBSERVATIONS AND RESULTS

Table 1: Age Distribution:

Age Range (years)	Atherosclerosis (n=74)	TAO (n=26)	Total (n=100)
20-30	0 (0.0%)	4 (15.38%)	4 (4.00%)
31-40	0 (0.00%)	18 (69.23%)	18 (18.00%)
41-50	9 (12.16%)	4 (15.38%)	13 (13.00%)
51-60	29 (39.19%)	0 (0.00%)	29 (29.00%)
>61	36 (48.65%)	0 (0.00%)	36 (36.00%)
Total	**74 (100%)**	**26 (100%)**	**100 (100%)**

Atherosclerosis predominantly affected older individuals (87.84% above 51 years), while TAO mainly affected younger patients (84.61% between 31-40 years). The mean age was 54.63±14.65 years.

Table 2: Sex Distribution:

Sex	Atherosclerosis	TAO	Total	p-value
Male	49 (66.22%)	26 (100%)	75 (75%)	0.0007 (S)
Female	25 (33.78%)	0 (0%)	25 (25%)	
Total	**74 (100%)**	**26 (100%)**	**100 (100%)**	

Males predominated in both groups (75% overall). The difference in sex distribution was statistically significant ($p=0.0007$), with TAO exclusively affecting males.

Table 3: Etiology:

Etiology	No. of Patients	Percentage	p-value
Atherosclerosis	74	74%	<0.001 (S)

Etiology	No. of Patients	Percentage	p-value
TAO	26	26%	
Total	**100**	**100%**	

Atherosclerosis (74%) was significantly more common than TAO (26%) ($p<0.001$).

Table 4: Associated Diseases

Associated Disease	Atherosclerosis (n=74)	TAO (n=26)
Diabetes Mellitus	30 (40.54%)	0 (0.00%)
Hypertension	20 (27.03%)	0 (0.00%)
Ischemic Heart Disease	9 (12.16%)	0 (0.00%)
Hypercholesterolemia	4 (5.41%)	0 (0.00%)
None	11 (14.86%)	0 (0.00%)

Atherosclerosis patients exhibited multiple comorbidities, with diabetes mellitus being most common (40.54%), followed by hypertension (27.03%) and ischemic heart disease (12.16%). No comorbidities were observed in TAO patients.

Table 5: Clinical Presentation

Clinical Presentation	Atherosclerosis (n=74)	TAO (n=26)
IC Only	0 (0.00%)	0 (0.00%)
IC + Rest Pain	0 (0.00%)	0 (0.00%)
IC + Rest Pain + Gangrene	60 (81.08%)	22 (84.62%)
IC + Rest Pain + Ulcer	14 (18.92%)	4 (15.38%)

All patients presented with advanced disease—intermittent claudication, rest pain, and tissue loss. Gangrene was more common than ulceration in both groups.

Table 6: Extent of Gangrenous Changes

Site of Gangrene	Atherosclerosis (n=74)	TAO (n=26)
Toes only	15 (20.27%)	24 (92.31%)
Toes + Foot	41 (55.41%)	2 (7.69%)
Toes + Foot + Leg	16 (21.62%)	0 (0.00%)
Upto Thigh	2 (2.70%)	0 (0.00%)

Atherosclerosis showed more extensive gangrenous changes, with majority (55.41%) involving toes and foot. TAO was predominantly limited to toes (92.31%).

Table 7: Habits Associated

Habits	Atherosclerosis (n=74)	TAO (n=26)
Chronic Smoking Habit	32 (43.24%)	18 (69.23%)
Chronic Smoking + Alcohol	15 (20.27%)	6 (23.08%)
Chronic Smoking + Tobacco	6 (8.11%)	2 (7.69%)
Alcohol	9 (12.16%)	0 (0.00%)
None	12 (16.22%)	0 (0.00%)

Overall, 79% had smoking habits, 30% consumed alcohol, and 8% used tobacco. TAO showed higher association with smoking (69.23%) compared to atherosclerosis (43.24%).

Table 8: Doppler Findings

Site of Obstruction	Atherosclerosis (n=74)	TAO (n=26)
Ankle	0 (0.00%)	8 (30.77%)
Infra Popliteal	24 (32.43%)	18 (69.23%)
Popliteal	36 (48.65%)	0 (0.00%)
Superficial Femoral	14 (18.92%)	0 (0.00%)

Atherosclerosis predominantly affected larger vessels: popliteal (48.65%), infra-popliteal (32.43%), and superficial femoral (18.92%). TAO primarily involved smaller distal vessels: infra-popliteal (69.23%) and ankle (30.77%).

Table 9: CT Angiography Findings

Segment Involved	Frequency	Percentage
Aorto-iliac	21	21.00%
Femoro-popliteal	28	28.00%
Crural	23	23.00%
Aorto-iliac + Femoro-popliteal	15	15.00%
Femoro-popliteal + Crural	3	3.00%
Aorto-iliac + Femoro-popliteal + Crural	10	10.00%
Total	**100**	**100%**

Femoro-popliteal segment (28%) was most commonly involved, followed by crural (23%) and aorto-iliac (21%). Single-segment involvement was seen in 72% of cases, while multilevel disease was present in 28%.

Table 10: Modalities of Treatment

Treatment Modality	No. of Patients	Percentage

Medical/Conservative	100	100.00%
Lumbar Sympathectomy (LS Only)	3	3.00%
Amputation (Above Knee)	44	44.00%
Amputation (Below Knee)	30	30.00%
Disarticulation + LS	10	10.00%
Disarticulation Only	13	13.00%

All patients received medical treatment. Surgical amputations were performed in 74% of cases (above knee 44%, below knee 30%). Lumbar sympathectomy was performed in 3% of cases, while 13% underwent disarticulation only, and 10% had disarticulation combined with lumbar sympathectomy.

Table 11: Results of Lumbar Sympathectomy

Sign/Symptom	Number of Patients	Relieved	Not Relieved
Rest Pain	10	6 (60%)	4 (40%)
Ulcer	3	2 (66.67%)	1 (33.33%)

Rest pain was relieved in 60% of patients, while ulcer showed relief in 66.67% of cases.

Table 12: Post-Operative Recovery

Post-Operative Recovery	Atherosclerosis (n=74)	TAO (n=26)
Uneventful recovery	46 (62.16%)	18 (69.23%)
Revision Amputation	4 (5.41%)	2 (7.69%)
Secondary suturing	24 (32.43%)	6 (23.08%)
Death	0 (0.00%)	0 (0.00%)

Post-operative recovery was generally favorable, with 62.16% of atherosclerosis and 69.23% of TAO patients having uneventful recoveries. No deaths were recorded.

Table 13: Follow-Up

Follow-Up	1 Month	3 Months	6 Months
Improved	74 (74%)	82 (82%)	0 (0%)
Unchanged	20 (20%)	16 (16%)	0 (0%)
Deteriorated	6 (6%)	2 (2%)	0 (0%)

Improvement was seen in 74% at 1 month, increasing to 82% at 3 months. No data was recorded at 6 months, suggesting patients were lost to follow-up.

Table 14: Quality of Life

Quality of Life	Number	Percentage

Improved	88	88%
Unchanged	8	8%
Deteriorated	4	4%
Total	**100**	**100%**

Quality of life improved in 88% of patients, indicating significant positive impact of treatment.

DISCUSSION

This hospital-based prospective observational study evaluated 100 patients with lower limb arterial occlusive disease, divided into atherosclerosis (74 patients) and Thromboangiitis Obliterans (26 patients). The study provides comprehensive insights into the demographic characteristics, clinical presentation, diagnostic findings, and management outcomes in a tertiary care setting.

The mean age of patients was 54.63±14.65 years, consistent with findings from Reddy DS et al. (2020)[10] (53.55±13.12 years) but slightly lower than studies by Sharma M et al. (2024)[11] (58.49±4.66 years) and Mohan B et al. (2023)[12] (61.4±10.00 years). The age distribution showed a clear dichotomy: atherosclerosis predominantly affected older individuals (87.84% above 51 years), while TAO mainly affected younger patients (84.61% between 31-40 years). This age-related pattern reflects the different pathophysiological mechanisms, with atherosclerosis being an age-related degenerative process and TAO being an inflammatory condition affecting younger individuals.

The male predominance (75%) observed in this study aligns with multiple studies: Manoj KV et al. (2025)[13] reported 92.9% male, Bardooli et al. (2023)[14] observed 85.8%, Sharma M et al. (2024)[11] reported 78%, and Mohan B et al. (2023)[12] documented 73.7%. The consistent male preponderance across studies is attributed to higher prevalence of primary risk factors such as smoking and certain lifestyle-related habits among males.[15] Interestingly, TAO exclusively affected males in our study, which is consistent with the known epidemiology of this condition.[7]

Atherosclerosis accounted for 74% of cases, while TAO comprised 26%. This distribution is remarkably consistent with previous studies: Manoj KV et al. (2025)[13] reported 72.6% atherosclerosis and 27.4% TAO, and Jaykar R et al. (2023)[16] observed 73.33% and 26.67% respectively. The predominance of atherosclerosis reflects the increasing burden of age-related and lifestyle-associated vascular disease in the population.[1] TAO continues to be a significant cause of peripheral arterial disease in younger patients, particularly in the Indian subcontinent, which has a high prevalence of smoking.

Atherosclerosis patients exhibited multiple comorbidities: diabetes mellitus (40.54%), hypertension (27.03%), ischemic heart disease (12.16%), and hypercholesterolemia (5.41%). These findings are consistent with the systemic nature of atherosclerosis.[17] Mohan B et al. (2023)[12] reported even higher rates (diabetes 63.50%, hypertension 62.00%, IHD 39.20%), while Vyas K et al. (2022)[18] observed lower rates (diabetes 24%, hypertension 20%). The variability across studies may reflect differences in patient populations and diagnostic criteria. Notably, no comorbidities were observed in TAO patients, which is characteristic of this disease entity.

Smoking was the most significant lifestyle risk factor in both groups. Overall, 79% of patients had smoking habits, with higher prevalence in TAO (69.23%) compared to atherosclerosis (43.24%). This finding strongly supports smoking as the primary etiological factor in TAO.[5] Vyas K et al. (2022)[18] reported even higher smoking prevalence (90%), while Reddy DS et al. (2020)[10] documented 59.2%. The association between smoking and TAO is well-established, and cessation remains the cornerstone of management.

All patients presented with advanced disease characterized by intermittent claudication, rest pain, and tissue loss (gangrene or ulcer). In atherosclerosis, 81.08% had IC, rest pain, and gangrene, while 18.92% had IC, rest pain, and ulcer. Similarly, TAO patients presented with gangrene (84.62%) and ulcer (15.38%). These findings reflect the delayed presentation in resource-limited settings, where patients often seek medical attention only when symptoms become severe. Previous studies by Prasad C et al. (2018)[19] and Clement SH et al. (2017)[20] reported similar patterns with 81% and 79% presenting with gangrene.

The extent of gangrenous changes differed significantly between the two groups. Atherosclerosis showed more extensive involvement (toes and foot 55.41%, toes+foot+leg 21.62%), while TAO was predominantly limited to toes (92.31%). This anatomical distribution correlates with the pattern of arterial involvement, as atherosclerosis affects larger proximal vessels leading to more extensive tissue loss, while TAO affects distal small vessels resulting in localized toe gangrene.[5]

Doppler and CT angiography findings demonstrated distinct anatomical patterns. Atherosclerosis predominantly affected larger vessels: popliteal (48.65%), infra-popliteal (32.43%), and superficial femoral (18.92%). TAO primarily involved smaller distal vessels: infra-popliteal (69.23%) and ankle (30.77%). These findings are consistent with the known pathophysiology of both conditions.[21] CT angiography revealed that femoro-popliteal segment (28%) was most commonly involved, followed by crural (23%) and aorto-iliac (21%). Single-segment involvement (72%) was more common than multilevel disease (28%).

All patients received medical/conservative management, including risk factor modification, antiplatelet therapy, statins, and wound care. Surgical interventions were common, with amputations performed in 74% of cases (above knee 44%, below knee 30%). The high amputation rate reflects the advanced stage of disease at presentation. Lumbar sympathectomy was performed in 13% of patients (3% alone, 10% combined with disarticulation), providing symptom relief in 60% for rest pain and 66.67% for ulcer.

Post-operative recovery was generally favorable, with uneventful recovery in 62.16% of atherosclerosis and 69.23% of TAO patients. Revision amputation was needed in 5.41% and 7.69% respectively, while secondary suturing was required in 32.43% and 23.08%. No deaths occurred in either group, indicating acceptable surgical outcomes. However, the mortality rate in our study (0%) is lower than reported in some literature, possibly due to the relatively small sample size and short follow-up period.

Follow-up outcomes showed improvement in 74% at 1 month, increasing to 82% at 3 months. Quality of life improved in 88% of patients, demonstrating the significant positive impact of current management strategies. The plateau in improvement and loss to follow-up at 6 months highlights the need for better long-term patient engagement and monitoring.

CONCLUSION

This study underscores the distinct clinical profiles and risk factors associated with atherosclerosis and Thromboangiitis Obliterans (TAO), emphasizing the need for targeted diagnostic and therapeutic approaches. Atherosclerosis primarily affects older individuals and is frequently complicated by systemic comorbidities like diabetes and hypertension, often manifesting as large-vessel disease. In contrast, TAO exhibits a clear predilection for younger, male populations, with a stronger correlation to smoking and a pathophysiology that predominantly targets smaller, distal vessels. These differences in patient demographics, disease progression, and anatomical involvement highlight the necessity of early identification and tailored management strategies for each condition.

Overall, the findings demonstrate that current medical and surgical interventions—including conservative management and necessary amputations—effectively stabilize the majority of patients and significantly improve their quality of life. High rates of favorable post-operative recovery and sustained improvement at follow-up suggest that therapeutic protocols are largely successful, with most patients experiencing maximum benefits within the first three months. While the data indicates a plateau in long-term follow-up and a high reliance on surgical amputation to manage advanced disease, the overwhelming positive impact on patient outcomes validates the current standard of care for peripheral vascular disease.

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