Endovascular treatment versus bypass in long SFA atherosclerotic lesions: a non-randomized comparative study

Marwan Yousry, Khaled Tarek Fathy, A. Gamal Afify, Ahmed Mohsen Hafez,Ahmed.A. Taha

Department of Vascular Surgery, Faculty of Medicine, Cairo University, Cairo, Egypt

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Background: The TransAtlantic Inter-Society Consensus (TASC II) classification categorizes superficial femoral artery (SFA) lesions. This study compares endovascular therapy and bypass surgery for treating challenging TASC II C and D SFA lesions, which are typically complex and involve severe disease.
Purpose: the aim is to compare the outcome of endovascular interventions versus surgical bypass in treatment of superficial femoral artery atherosclerotic TASC II C&D lesions in patients with critical limb ischemia in terms of patency and limb salvage within one year follow up.
Patients and methods: our study included 41 patients in bypass group (groub A) and 74 patients in endovascular group (groub B) with atherosclerotic TASC II C&D SFA lesion. Patients with non-salvageable limbs, acute ischemia, trauma, aneurysms, connective tissue disorders and arteritis were excluded. All patients had Rutherford 4 to 6. Saphenous vein and synthetic grafts were used in bypass group. POBA, DCB and stents were used in endovascular group. The patients were followed up for 1 year.
Results: mean Patients' age was 63.15 years in endo group and 58.76 years in bypass group, male 78.4% in endo group and 85.4% in bypass group. Patients' presentation was incapacitating claudications, rest pain, minor tissue loss, and major tissue loss. Technical success achieved in 100% in bypass cases and 95.9%in endo group. 1ry patency rate was 71.4% in the bypass group versus 57.6% in the endo group, still not significant statistically (p-value 0.171). The assisted 1ry patency was 77.1% in bypass group and 83.3% in the endo group,.(p.value 0.449) 2ry patency rates was 82.9% and 89.4% in bypass and endo groups respectively. Our 1-year limb salvage rates were 85% in the bypass group versus 91.7%, the rate was better in the endo group but with statistically insignificant p.value between them (p: 0.343). The rate of reintervention was higher in endo group (31.8%) than bypass group (11.4%) which was statistically significant, (p.value 0.024). Overall mortality during follow up was only 1 patient in the bypass group (2.4%). the bypass group had higher complication rate (41.5%) than the endovascular group (12.2%) with statistically significant (p.value <0.001).
Conclusion: Bypass surgery and endovascular management have comparable short terms outcomes in terms of patency and limb salvage in treating long SFA atherosclerotic lesion TASC II C&D. Rate of reintervention is higher with endovascular strategy. However, with lower morbidity and mortality compared with surgery.

Background

Atherosclerotic peripheral arterial disease (PAD) affects approximately 3% to 10% of the general population, with prevalence increasing to 15% to 20% among individuals over 70 years old. The condition is especially common in smokers and those with diabetes. A subset of PAD patients develops critical limb ischemia (CLI), characterized by persistent foot pain at rest, ischemic ulcers, or tissue necrosis, or a combination of these symptoms[1].

There is ongoing debate among vascular specialists regarding the benefits of endovascular therapy compared to surgical bypass in managing CLI. While many agree that both approaches are often complementary, determining the most effective treatment strategy for each patient remains

challenging. Randomized controlled trials (RCT) addressing this question, had limited real-world applicability due to its restrictive inclusion/exclusion criteria and limited treatment options[2].

Historically, femoropopliteal disease has been managed surgically through femoropopliteal bypass, yielding favorable 5-year patency rates when saphenous vein grafts are utilized. Meta-analyses and multicenter trials indicate that 50% to 70% of patients undergoing saphenous vein grafting to tibial or pedal targets remain free of CLI symptoms for up to 5 years. These procedures also demonstrate limb salvage rates exceeding 80% and perioperative mortality rates around 3%[2].

Despite these advantages, surgical bypass is associated with limitations, including postoperative complications in 10% to 20% of cases, prolonged hospitalization, and extended outpatient care requirements. Studies analyzing endovascular therapy outcomes in CLI patients are largely retrospective, with notable heterogeneity, or limited to single-center experiences. Few RCTs have compared surgical and endovascular therapies. The BASIL trial, for example, reported no significant difference in amputation-free or overall survival at one year, although long-term results favored surgical intervention[2].

We aimed at this work to compare between endovascular management and surgical bypass in treating TASC II C&D SFA atherosclerotic lesions in terms of patency and limb salvage within 1 year.

Methods

This study was a prospective, non-randomized comparative analysis of endovascular management versus surgical bypass in patients presenting with TASC II C&D SFA lesions. It was conducted between March 2020 and March 2021, with a follow-up period of one year. The primary objective was to compare patency and limb salvage rates within one year among these patients.

Inclusion and Exclusion Criteria

Inclusion criteria included patients with lower limb ischemia (Rutherford's clinical classification type 4-6), multiple SFA stenosis or occlusions greater than 15 cm (with or without calcification), or chronic total occlusion of the SFA exceeding 20 cm. Eligible patients had a patent popliteal artery with at least one patent tibial runoff vessel and atherosclerotic etiology. Only patients committed to follow-up were included.

Exclusion criteria encompassed patients with diseased popliteal arteries, significant CFA stenosis (>50%), or multilevel lesions (aorto-iliac or tibial disease). Other exclusions included arteritic patients, those with aneurysmal disease, non-disabling claudications, and any condition preventing compliance with the study. Vulnerable populations, such as mentally impaired individuals, prisoners, and pregnant women, were also excluded.

Methodology

Clinical Assessment

Patient history included age, gender, and major atherosclerotic risk factors such as diabetes mellitus, smoking, hypertension, cardiac diseases, chest diseases, renal dysfunction, and previous stroke. A history of prior angioplasty or bypass procedures and presenting symptoms (claudication, rest pain, or tissue loss) were recorded.

Clinical examinations included blood pressure measurements in both upper limbs, assessment of peripheral , carotid pulses and Ankle brachial index. Groin evaluations for scars, hematoma, infection, thrills, or aneurysms. Foot examinations assessed pulse, temperature, capillary circulation, sensations, motor power, interdigital infections, ulcers, and gangrene.

Preprocedural Assessment

Routine laboratory investigations included a complete blood picture, kidney and liver function tests, blood glucose levels, and coagulation profiles. Imaging studies, including duplex scanning and/or CTA, were performed to evaluate the anatomical site, occlusions or stenosis, distal runoff status, and any new lesions. Informed consent was obtained from all patients after they were fully briefed on the benefits, risks, alternative interventions, and potential complications of the procedure.

Procedures

Surgical Bypass

Patients were admitted 1-2 days before surgery. Preoperative assessments included cardiopulmonary reserve evaluations and saphenous vein mapping. If needed, synthetic Dacron or PTFE grafts were prepared, and prophylactic antibiotics were administered preoperatively.

During the procedure, antiseptic draping extended from the umbilicus to both feet. The CFA and upper popliteal artery were exposed, and the saphenous vein was harvested if available. Tunneling was performed, and heparin (5000 units intravenously) was administered before clamping, followed by 1000 units/hour until declamping. Distal and proximal anastomoses were completed, and closure was performed in layers. Debridement of gangrenous or ischemic tissue was carried out if distal pulsations were restored intraoperatively.

Postoperatively, LMWH was administered for one week. Patients who received bypass with a saphenous vein graft were prescribed single antiplatelet therapy alongside long-term anticoagulation. Those with synthetic grafts received dual antiplatelet therapy. Statins, antibiotics, regular wound dressings, and VAC therapy for wound management were implemented. Lifestyle modifications, including smoking cessation and control of diabetes, hypertension, and cardiac conditions, were emphasized.

Endovascular Management

Patients were admitted one day before the procedure. A loading dose of 300 mg clopidogrel was administered the night before, along with N-acetylcysteine and hydration with normal saline.

The procedure began with local anesthesia (2% lidocaine) and antiseptic groin preparation. Retrograde femoral access was used in most cases unless antegrade access was deemed appropriate. Fluoroscopic or duplex guidance was employed to localize the CFA accurately. Heparin (80-100 units/kg) was administered, and diagnostic angiography was performed.

Lesions were crossed using hydrophilic wires (0.035" or 0.018") with angled-tip catheters. Balloon angioplasty was performed with appropriate balloon sizing and inflation times of 3-5 minutes. If significant residual stenosis, recoil, or dissection persisted, stent deployment was carried out. Digital compression was applied post-procedure, and arterial sheaths were removed immediately. Wound debridement or minor amputations, if required, were performed within 48 hours. Patients were discharged after two days with instructions on risk factor control and medications, including acetylsalicylic acid, clopidogrel, statins, and cilostazol.

Complications

Bypass complications included acute graft occlusion, infection, hemorrhage, and wound complications. Endovascular complications encompassed contrast-induced nephropathy, thrombosis, peripheral embolism, vessel perforation, recoil, dye allergies, and access site complications.

Follow-Up

Distal pulses were assessed on days 1 and 2 post-procedure. Follow-up assessments, including clinical examination and duplex scanning, were conducted at 3, 6, and 12 months. Surveillance focused on wound healing, pain resolution, claudication assessment, and Rutherford's classification.

Study Outcomes

Primary outcomes included technical success, defined by successful revascularization and restoration of pulsatile flow. Clinical success was determined by improvements in claudication, rest pain, wound healing, and limb salvage. Patency outcomes were categorized into primary, assisted primary, and secondary patency.

One-year limb salvage was defined as the absence of major limb amputation in surviving patients.

Secondary outcomes included morbidity, mortality, and completion of one-year follow-up.

Statistical Methods

Data were analyzed using SPSS version 28 (IBM Corp., Armonk, NY, USA). Quantitative data were summarized as means and standard deviations, while categorical variables were expressed as frequencies and percentages. Group comparisons were performed using unpaired t-tests and Chi-square tests, with exact tests applied for expected frequencies below five. Kaplan-Meier survival curves were used for survival analysis, with comparisons made using log-rank tests. A p-value of less than 0.05 was considered statistically significant.

Results

Patient Characteristics

Our study included 41 cases in the bypass group (Group A) and 74 cases in the endovascular group (Group B). Both groups were followed for one year.

In Group A, the mean age was 58.76 years (SD: 6.02), with a range of 48 to 73 years. In Group B, the mean age was 63.15 years (SD: 7.69), with a range of 27 to 73 years.

Table 1: Mean age in both groups

Group	Mean Age	Standard Deviation
Bypass	58.76	6.02
Endo	63.15	7.69

Risk Factors and Comorbidities

The characteristics of the patients were well balanced between the groups, except for elevated serum creatinine which was higher in the endovascular group

Presentation and run off:

In bypass group: all patients presented with chronic limb threating ischemia with Rutherford's category IV, V and VI. Most of cases had dual run off (63.4%).

In endo group: all patients presented with chronic limb threating ischemia with Rutherford's category IV, V and VI. All patients presented with CLTI .NO of runoff to be added to patient characteristics.

Table 2 : Risk factors and comorbidities

		group A (bypass group)		group B (endo group)		P value
		Count	%	Count	%	
gender	Male	35	85.4%	58	78.4%	0.362
	Female	6	14.6%	16	21.6%	
diabetes		36	87.8%	67	90.5%	0.752
hypertension		23	56.1%	53	71.6%	0.092
smoking		29	70.7%	48	64.9%	0.296
hyperlipidemia		21	51.2%	28	37.8%	0.165
cardiac		14	34.1%	30	40.5%	0.499
cardiac details	(PCI)	14	34.1%	20	27.0%	0.092
	(CABG)	0	0.0%	8	10.8%	
	(medical ttt)	0	0.0%	2	2.7%	
other risk factors	stroke	1	2.4%	2	2.7%	0.152
	HCV	1	2.4%	1	1.4%	
	elevated S.creat (CO2)	1	2.4%	7	9.5%	

Technical success:

100% technical success was achieved in bypass group (41 cases) while 95.9% technical success was achieved in endo cases with 3 cases (4.1%) of technical failure (will be excluded from patency follow up). In endo group, there were 2 cases of failure of wire reentry (failed CAART, reversed CAART and SAFARI) and they underwent bypass surgery. There was 1 case of acute stent thrombosis immediately after stent deployment and underwent femoro-lower popliteal bypass

Clinical success:

In bypass group: 85.3% clinical success (35 cases) and 5 cases had worsened Rutherford's classification and underwent major limb amputation. In endo group: 93% clinical success (66 cases) and 5 cases had major limb amputations.

Table 3: Rutherford's category, runoff, technical success and clinical success in both groups

		group A (bypass group)		group B (endo group)		P value
		Count	%	Count	%	
	4	12	29.3%	14	19%	
	5	23	56.1%	54	73.0%	
	6	6	14.6%	6	8.1%	
run off	single	5	12.2%	17	23.0%	0.349
	dual	26	63.4%	43	58.1%	
	triple	10	24.4%	14	18.9%	
technical success		41	100.0%	71	95.9%	0.551
clinical success		35	85.4%	66	93.0%	0.493

Procedures:

1. Bypass group:

Synthetic grafts were used in 21 cases and GSV was used in 20 cases. All of them underwent femoro-upper popliteal bypass and restored pulse.

Table 4: Conduits used in bypass group

		group A (bypass group)	
		Count	**%**
conduit	**synthetic**	21	51.2%
	GSV	20	48.8%
Rutherford's category improvement	**worsened**	6	14.6%
	improved	35	85.4%

2. Endo group:

Access: crossover was used is 93.2% of patients (69 cases), transbrachial access was used is 4.1% of cases (3 cases), antegrade femoral access in 2.7% of cases (only 2 cases) and retrograde pedal access was used in 16.2% of cases (12 cases).

Wire crossing: 80.6% of cases were crossed subintimally (58 cases) while 19.7% were crossed intraluminally (14 cases). Wire crossing was achieved in used either teraumo 0.035" wire of command 0.018" wire.

Stents: stents were used in 81.9% of cases (59 cases). All stents ranged from 5 to 6 mm in diameters and 15 to 25 cm in length. Supera stents were used in 8 cases, 2 of them were inserted using PRESTO technique. 1 supera stent extended to P2 segment and 2 supera stents covered P1 segment. Metal jacket stenting were done in 13 cases. **DCB**: DCBs were used in 12.5% of cases (9 cases).

Reentry: reentry was at distal SFA in 41.7% of cases (25 cases), p1 30% of cases (18 cases), p2 5% of cases (3 cases) and 20% of cases at proximal SFA using retrograde crossing (12 cases). No reentry devices were used in the study. 2 cases had failed reentry and underwent bypass.

Table 5: Access, wire crossing, stenting, DCB and reentry in endo group

		group B (endo group)	
		Count	**%**
Access	**transbrachial**	3	4.1%
	crossover	69	93.2%
	antegrade	2	2.7%
	Retrograde	12	16.2%
wire crossing	**subintimal**	58	80.6%
	intraluminal	14	19.4%
Stenting	**stent**	59	81.9%
	metal jacket	13	22.0%
	Focal stenting	46	78.0%
DCB		9	12.5%
Reentry	**proximal SFA**	12	20.0%
	distal SFA	25	41.7%
	p1	18	30.0%
	p2	3	5.0%
	failed reentry	2	3.3%

Complications:

Bypass group: complications were found in 41.5% of cases (17 cases). 1 case of mortality. 2 cases suffered from groin 2ry hemorrhage and had triple ligation and above knee amputation. 1 case of groin hematoma and evacuated surgically. 2 cases of groin lymphorrhea, 1 of them treated with

debridement and sartorius flap. 1 case of GSV wound dehiscence treated with debridement and 2ry sutures. 1 case of tunnel hematoma treated conservatively. 8 cases of graft thrombosis.

Endo group: complications occurred in 12.2% of cases (9 cases). 1 case of contrast induced nephropathy and treated with fluids and follow up without dialysis. 2 cases of groin hematoma treated conservatively. 1 case of intraoperative plaque shift to prodfunda femoris artery and treated with kissing balloon angioplasty with no flow limiting residual dissection. 2 cases of acute stent thrombosis at 1st and 8th month and treated with Rotarex. 2 cases of acute stent thrombosis day 2 and 4 post-operative , both of them treated with bypass but unfortunately failed and progressed to above knee amputation. 1 case of acute stent thrombosis on table and treated with femoro-lower popliteal bypass.

Follow up:

In both groups, all cases were followed up at 3,6,9 and 12 months postoperatively. Follow up included pulse check, wound healing and duplex or CTA.

At 3rd month: in bypass group, 97.4% of cases were patent (35 cases) and in endo group 92.4% of cases were patent (61 cases).

At 6th month: in bypass group 85.7% of cases were patent (30 cases) and in endo group 77.2% of cases were patent (51 cases).

At 9th month: in bypass group 77.1% of cases were patent (27 cases) and in endo group 63.6% of cases were patent (42 cases).

At 1 year: in bypass group 71.4% of cases were patent (25 cases) and in endo group 57.6% of cases were patent (38 cases).

Table 6: Fellow up in both groups within 1 year

1ry patency		**groups**			
		group A (bypass group)		**group B (endo group)**	
		Count	**%**	**Count**	**%**
follow up 3 months	**Patent**	35	97.2%	61	92.4%
	Occluded/ stenosis	1	2.8%	5	7.6%
follow up 6 months	**Patent**	30	85.7%	51	77.2%
	Occluded/ stenosis	5	14.3%	15	22.8%
follow up 9 months	**Patent**	27	77.1%	42	63.6%
	Occluded/ stenosis	8	22.9%	24	36.4%
follow up 1 year	**Patent**	25	71.4%	38	57.6%
	Occluded/ stenosis	10	28.6%	28	42.4%

Patency and limb salvage:

After 1 year, in bypass group 1ry patency was 71.4% (25 cases), assisted 1ry patency was 77.1% (27 cases) and 2ry patency was 82.9% of cases (29 cases). In endo group 1ry patency was 57.6% (38 cases), assisted 1ry patency was 83.3% (55cases) and 2ry patency was 89.4% (59 cases).

In bypass group, 85% of cases had 1-year amputation free survival (35 cases) and in endo group 91.7% of cases had 1-year amputation free survival (66 cases).

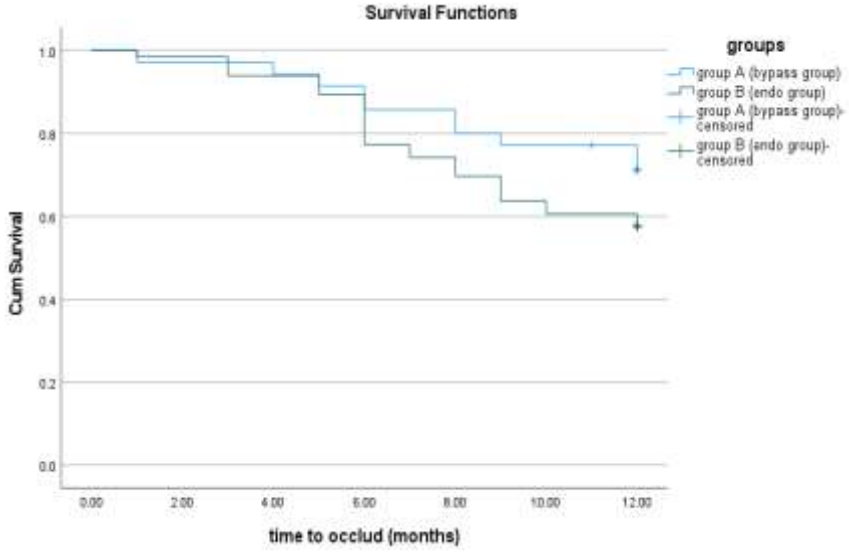
In bypass group, reintervention occurred in 4 cases (11.4%). 1 case had EIA angioplasty after 1 year and 1 case had distal anastomotic stenosis angioplasty after 8 months. 1 case had graft

thrombectomy at 4th month and metal jacket at 10th month. 1 case had graft thrombectomy at 1st month with revision of the distal anastomosis and jump graft on P3.

In endo group, reintervention occurred in 21 cases (31.8%). 13 cases had critical instent stenosis and treated with DCB and stent was inserted in 3 of them. 2 cases had SFA recoil and treated with angioplasty and stent.2 cases had instent stenosis and treated with POBA. 1 case had total SFA occlusion (no stented before) and treated with metal jacket. 1 case had instent occlusion and treated with DCB. 2 cases had acute ischemia and acute instent thrombosis and treated with Rotarex and DCB.

Table 7: Patency, reintervention, mortality, amputation free survival and complications after 1 year

After 1 year	group A (bypass group)		group B (endo group)		P value
	Count	%	Count	%	
1ry patency	25	71.4%	38	57.6%	0.171
assisted 1ry patency	27	77.1%	55	83.3%	0.449
2ry patency	29	82.9%	59	89.4%	0.365
Reintervention	4	11.4%	21	31.8%	0.024
mortality	1	2.4%	0	0.0%	0.357
amputation free survival	35	85.3 %	68	91.89%	0.343
complications	17	41.5%	9	12.2%	< 0.001



groups	Mean survival time			
	Estimate	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
group A (bypass group)	10.600	0.503	9.615	11.585
group B (endo group)	9.803	0.385	9.049	10.558
Overall	10.079	0.304	9.484	10.674

	P value
Log Rank (Mantel-Cox)	0.180

Fig. 1: Kaplan-Meier curve for 1ry patency in both group within 1 year

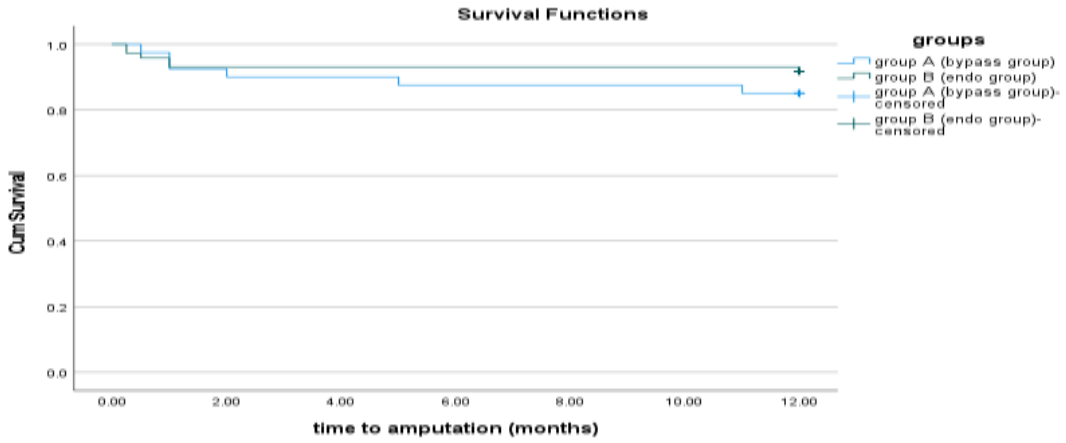


Fig. 2: Kaplan-Meier curve for limb salvage in both group within 1 year

groups	Mean survival time			
	Estimate	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
group A (bypass group)	10.713	0.535	9.664	11.761
group B (endo group)	11.208	0.374	10.475	11.942
Overall	11.031	0.305	10.433	11.629

	P value
Log Rank (Mantel-Cox)	0.294

Correlations in each group:

In bypass group between GSV and synthetic graft:

Reintervention rates were none in GSV group while all cases of reintervention were in synthetic group (4 cases). In GSV group all cases had 1-year amputation free survival while in synthetic group 5 cases underwent major limb amputation within 1 year (30%). Complications occurred in 25% of GSV group (5 cases) while in synthetic group it was 57.1% (12 cases). Patency rates were not statistically significant in both group during the 1 year follow up.

Table 8: Synthetic vs. GSV outcomes

	conduit				
	synthetic		GSV		P value
	Count	%	Count	%	
1ry patency	8	53.3%	17	85.0%	0.062
assisted 1ry patency	10	66.7%	17	85.0%	0.246
2ry patency	12	80.0%	17	85.0%	1
Reintervention	4	26.7%	0	0.0%	0.026
amputation free survival	15	71.4%	20	100.0%	0.020
complications	12	57.1%	5	25.0%	0.037

In group B between DCB and no DCB:

Cases treated with DCB showed better patency rates and higher chances of 1-year limb salvage but it was not statistically significant. DCB cases had lower rates of reintervention but it was not statistically significant

Table 9: DCB vs. no DCB outcomes after 1 year

After 1 year	DCB				
	yes		no		P value
	Count	%	Count	%	
1ry patency	8	88.9%	30	52.6%	0.067
assisted 1ry patency	9	100.0%	46	80.7%	0.337
2ry patency	9	100.0%	50	87.7%	0.581
Reintervention	1	11.1%	20	35.1%	0.252
amputation free survival	9	100.0%	57	91.9%	1

In group B between cases treated with metal jacket stents and cases with no total SFA stent coverage:

Cases treated with focal SFA stents without total SFA coverage had better 1ry and 2ry patency rates than cases with metal jacket stents. 30.8% of metal jacket group cases had major limb amputation with 69.2% of cases had 1-year amputation free survival while in focal stent group 70.5% of cases had 1-year amputation free survival and 1 case had major limb amputation (2.2%)

Table 9: metal jacket vs. Focal stent outcomes after 1 year

After 1 year	metal jacket		Focal stent		P value
	Count	%	Count	%	
1ry patency	1	11.1%	29	65.9%	0.007
assisted 1ry patency	6	66.7%	39	88.6%	0.124
2ry patency	6	66.7%	42	95.5%	0.030
Reintervention	5	55.6%	13	29.5%	0.245
amputation free survival	9	69.2%	44	97.8%	0.007

In both groups the number of run off:

As expected patients with better runoff (patent tibial vessels) had better patency and limb salvage rates in both groups.

The more the number of run off tibial vessels the more the 1ry, assisted 1ry and 2ry patency rates and the less the rates of reinterventions but all of them were statistically not significant.

Table 10: Run off outcomes in bypass group

group A (bypass group)	run off						
	single		dual		triple		P value
	Count	%	Count	%	Count	%	
1ry patency	1	25.0%	15	71.4%	9	90.0%	0.068
Assisted 1ry patency	1	25.0%	17	81.0%	9	90.0%	0.052
2ry patency	3	75.0%	17	81.0%	9	90.0%	0.834
Reintervention	2	50.0%	2	9.5%	0	0.0%	0.069
amputation free survival	5	100.0%	20	76.9%	10	100.0%	0.226

Table 11: Run off outcomes in endo group

group B (endo group)	run off						P value
	single		dual		triple		
	Count	%	Count	%	Count	%	
1ry patency	7	46.7%	19	51.4%	12	85.7%	0.054
assisted 1ry patency	11	73.3%	30	81.1%	14	100.0%	0.154
2ry patency	13	86.7%	32	86.5%	14	100.0%	0.483
Reintervention	6	40.0%	13	35.1%	2	14.3%	0.289
amputation free survival	15	93.8%	37	88.1%	14	100.0%	0.609

In group A, Rutherford's category and limb salvage correlation:

There was no significant difference statistically between all Rutherford's category presentations. In bypass group, 12% of cases had worsened Rutherford's category and progressed to major limb amputation while the ratio was 7% in endo group with the same fate. In both groups, the less the Rutherford's category presentation the more the amputation free survival at 1year (pvalue: 0.001 & 0.027 for endo and bypass respectively). All other cases had improved Rutherford's category at least 1 category during the 1st month follow up.

Table 12: Rutherford's Category outcomes in bypass group

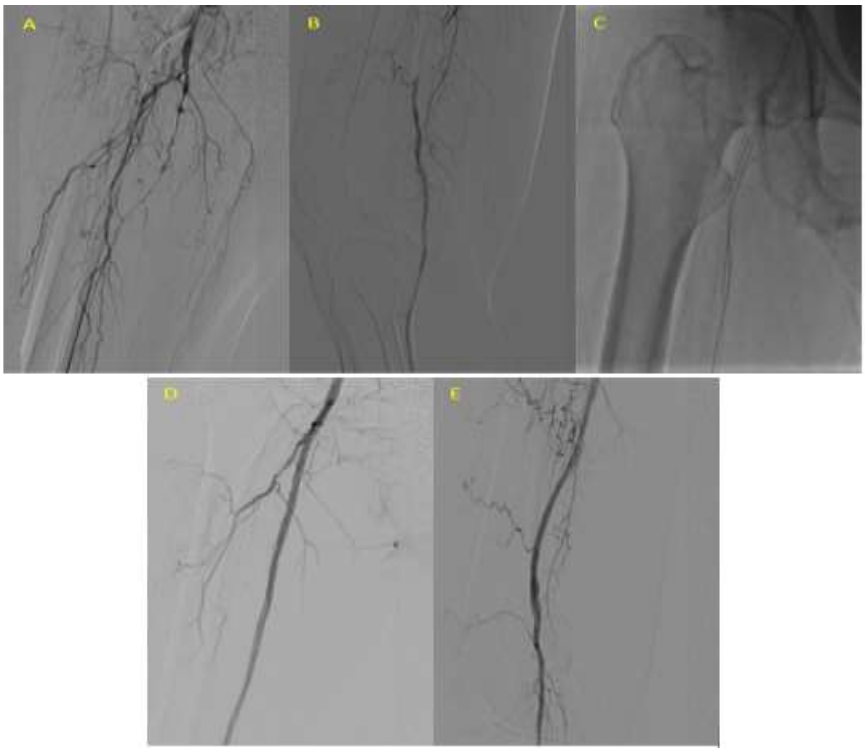
group A (bypass group)	Rutherford's category						P value
	4		5		6		
	Count	%	Count	%	Count	%	
1ry patency	7	58.3%	15	78.9%	3	75.0%	0.515
assisted 1ry patency	9	75.0%	15	78.9%	3	75.0%	1
2ry patency	11	91.7%	15	78.9%	3	75.0%	0.553
Reintervention	4	33.3%	0	0.0%	0	0.0%	0.019
amputation free survival	13	100.0%	19	86.4%	3	50.0%	0.029
complications	4	33.3%	8	34.8%	5	83.3%	0.121

In group B, Rutherford's category and limb salvage correlation:

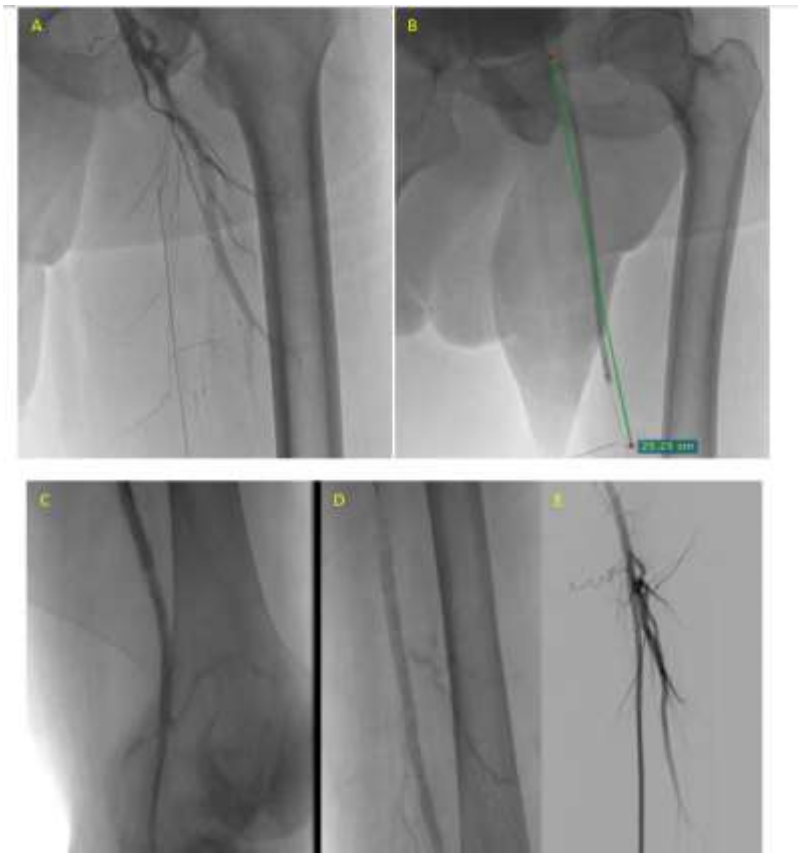
The less Rutherford's category the more amputations free survival rates during 1 year.

Table 13: Rutherford's category outcomes in endo group

group B (endo group)	Rutherford's category								P value
	3		4		5		6		
	Count	%	Count	%	Count	%	Count	%	
1ry patency	1	100.0%	6	46.2%	29	58.0%	2	100.0%	0.552
assisted 1ry patency	1	100.0%	10	76.9%	42	84.0%	2	100.0%	0.818
2ry patency	1	100.0%	12	92.3%	44	88.0%	2	100.0%	1
Reintervention	0	0.0%	6	46.2%	15	30.0%	0	0.0%	0.584
amputation free survival	1	100.0%	13	100.0%	50	96.2%	2	33.3%	0.001
complications	0	0.0%	1	7.7%	7	13.0%	1	16.7%	1



Case 1 (A&B: total SFA occlusion, C: wire crossing, D&E: Completion angiography)



Case 2 (A: Retrograde wire crossing, B: Balloon angioplasty, C: Supra stenting, D&E: completion angiography

Discussion

Peripheral arterial disease (PAD) affects 3–10% of the general population, with prevalence rising to 15–20% in individuals over 70, particularly among smokers and diabetics[4]. A subset of these patients develops critical limb ischemia (CLI), characterized by rest pain, ischemic ulcers, or necrosis[5]. Historically, surgical bypass has been the standard treatment for extensive superficial femoral artery (SFA) lesions classified as TASC D. However, advances in endovascular tools and techniques have made an "endovascular-first" strategy increasingly viable, even for complex lesions, due to lower morbidity and mortality rates[5,6].

Saphenous vein grafts in bypass procedures show limb salvage rates exceeding 80% but are associated with prolonged hospital stays and a 10–20% incidence of wound complications[6]. Comparisons between surgical and endovascular interventions, such as the BASIL trial, revealed no significant difference in amputation-free or overall survival at one year, though long-term outcomes slightly favored surgery[7].

The study presented here compared outcomes between surgical bypass and endovascular interventions for TASC D lesions. The mean age was younger in this cohort compared to previous studies like ZILVERPASS and others[9,10]. Gender distribution was predominantly male (85.4% in bypass vs. 78.4% in endo), consistent with prior research findings[10–12]. Diabetic prevalence was significantly higher in this study (87.8% bypass, 90.5% endo) than in other cohorts, yet limb salvage rates remained comparable (85% bypass vs. 91% endo)[10,13].

Smoking remains a major risk factor for PAD, with active smoking rates of 70.7% in bypass and 64.9% in endo groups, mirroring results from Bosiers and Veraldi[10,13]. Cardiovascular comorbidities, including coronary artery disease, were prevalent (40.5% endo vs. 34% bypass) but had limited direct procedural impact on mortality rates, aligning with prior findings[14].

Technical success was achieved in 100% of bypass cases and 95.9% of endo cases, comparable to previous trials like ZILVERPASS and Veraldi[10,15]. Rutherford's category outcomes demonstrated a higher improvement rate in the endovascular group, although the one-year primary patency rate favored bypass (71.4% vs. 57.6%)[10,15]. Assisted primary and secondary patency rates were statistically similar between the groups, with minor variations across studies[10,15,16].

One-year limb salvage rates (85% bypass vs. 91.7% endo) aligned with other studies, indicating no significant superiority of one method over the other in short-term outcomes[10,13,17]. However, reintervention rates were higher in the endovascular group (31.8%) compared to bypass (11.4%), reinforcing the durability of surgical bypass[10,16,18].

Subgroup analysis highlighted the benefits of drug-coated balloons (DCBs) in improving primary patency and reducing reintervention rates, aligning with findings from Hayakawa et al.[19]. Metal jacket stenting demonstrated poorer outcomes compared to focal stenting, supporting recommendations for limited stent placement[20].

Comparison between patients who had bypass surgery using GSV with those who had synthetic graft as a conduit reveled better patency rates fewer complications and reinterventions rates in the GSV group this was supported by data from BEST-CLI trial published in November 2022 which concluded that patients with CLTI who had an adequate single segment of GSV for conduit initial bypass surgery was associated with a lower incidence of major adverse limb events or death than initial endovascular intervention. In patients without a suitable GSV, results associated with initial endovascular intervention not were significantly different from those associated with initial bypass surgery. [21]

Complication rates were significantly higher in bypass procedures (41.5%) compared to endovascular approaches (12.2%), consistent with data from Kluckner and Zlatanovic[10,22]. Long-term follow-up and larger cohort studies are needed to further validate these findings.

Conclusion

In conclusion, bypass surgery and endovascular management has comparable results in short term follow up regarding patency and limb salvage. However, higher reintervention rate in the endovascular management but still with lower rates of morbidity and mortality

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