Great saphenous vein versus expanded polytetrafluoroethylene graft in patients undergoing elective treatment of popliteal artery aneurysm with a posterior approach

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ABSTRACT

Background: The aim of this study was to compare 30-day and 5-year outcomes of great saphenous vein (GSV) vs expanded polytetrafluoroethylene (ePTFE) graft in patients undergoing elective treatment of popliteal artery aneurysm (PAA) using a posterior approach.

Methods: Between January 2010 and December 2023, a retrospectively maintained dataset of all consecutive asymptomatic PAAs who underwent open repair with posterior approach or endovascular repair in 40 centers was investigated. Of 971 cases, 525 patients were included in the present analysis. These were further divided into posterior approach with GSV graft (252; GSV group), and posterior approach with ePTFE graft (273; ePTFE group). Thirty-day outcomes were assessed and compared. During follow-up, survival, primary patency, secondary patency, freedom from reintervention(s), and amputation-free survival rates were compared between the two groups using log-rank tests. Univariate and multivariate Cox regression analyses were performed in the ePTFE group to find predictive factors of poor outcomes.

Results: Two groups were homogeneous in terms of preoperative risk factors and morphological data. Median follow-up duration was similar (24 months [interquartile range [IQR], 10-36 months] GSV group vs 21 months [IQR, 7-47 months] ePTFE group; $P = .123$). At 5 years, there were no differences between the two groups in terms of survival (84.7% GSV group vs 86.1% ePTFE group; $P = .097$, log-rank = 2.756), secondary patency (94.9% GSV group vs 89.4% ePTFE group; $P = .068$, log-rank = 3.336), or amputation-free survival (99.1% GSV group vs 99.6% ePTFE group; $P = .567$, log-rank = .328). Five-year primary patency (89.5% GSV group vs 76.2% ePTFE group; $P = .007$, log-rank = 7.239) and freedom from reintervention(s) (92.8% GSV group vs 80.6% ePTFE group; $P = .011$, log-rank = 6.449) were significantly higher in the GSV group. Using multivariate analysis in the ePTFE group, factors compromising primary patency were patients on dialysis ($P = .054$; odds ratio, 3.641), and patients who were not on any preoperative antiplatelet therapy or anticoagulation ($P = .019$; odds ratio, 5.532), whereas none of the perioperative factors affected freedom from reintervention(s).

Conclusions: GSV as graft guaranteed better primary patency with lower reinterventions rates at midterm follow-up after treatment of PAAs via a posterior approach. Patients on dialysis and who were not on any preoperative antiplatelet therapy or anticoagulation had lower patency rates. (J Vasc Surg 2025;82:845-53.)

Keywords: Popliteal artery aneurysm; Posterior approach; Great saphenous vein; Expanded polytetrafluoroethylene

As reported by the Society for Vascular Surgery guidelines, treatment for asymptomatic popliteal artery aneurysms (PAAs) is recommended for >20 mm in diameter or <20 mm with associated thrombus to decrease the risk of acute limb ischemia.[1,2]

Although outcomes after elective treatment for PAAs ≤60 mm in length via an open posterior approach vs endovascular repair with covered stents seem to be comparable, and surgical treatment seems to be a better option in young and fit patients, especially considering its durability and limb savage rates.[3-6] A posterior approach offers satisfactory overall patency rates, although being burdened by a higher risk of nerve injuries.[7]

Several studies in the current literature compare the medial and posterior approaches, with conflicting results.[8,9] Indeed, some authors demonstrate the superiority of venous conduit over prosthetic graft in terms of

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PARADE Study Collaborative Group present in the Appendix section

Additional material for this article may be found online at www.jvascsurg.org.

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primary patency, irrespective of the surgical approach used.[10]

In contrast, recent studies demonstrate that conventional open repair with prosthetic conduit yields comparable results to those with vein conduit with respect to primary and secondary patency and major adverse limb events (MALEs) at 2 years for targets to the popliteal artery, whereas when the distal target was infrapopliteal, worse outcomes were observed with a prosthetic conduit.[7,11,12] Moreover, it has been shown that 1-year primary patency does not differ between conduit types, although prosthetic conduits are associated with significantly higher risk of amputation and death compared with great saphenous vein (GSV) among symptomatic patients. Although non-GSV autologous veins are less often used for open repair, they produce similar acceptable outcomes as GSV.[13]

Despite this wide evidence comparing different types of conduits for open PAA repair, there remains a lack of consistent data with respect to a single surgical approach. Therefore, the aim of this study was to evaluate and compare 30-day and 5-year outcomes of GSV vs expanded polytetrafluoroethylene (ePTFE) graft in patients undergoing elective treatment of PAA via a posterior approach.

ARTICLE HIGHLIGHTS

- **Type of Research:** Multicenter, retrospective study with the aim to compare 30-day and 5-year outcomes of great saphenous vein (GSV) or expanded polytetrafluoroethylene (ePTFE) as graft for patients with popliteal artery aneurysm undergoing open surgery via a posterior approach
- **Key Findings:** We included 525 patients in the analysis in two homogeneous groups with similar median follow-up duration (24 months; interquartile range [IQR], 10-36 months) GSV group vs 21 months (IQR, 7-47) ePTFE group ($P = .123$). No differences were found at 30 days. During follow-up, no differences in terms of survival, secondary patency, or amputation-free survival were noted. However, the primary patency (89.5% GSV group vs 76.2% ePTFE group; $P = .007$, log-rank = 7.239), and freedom from reintervention(s) (92.8% GSV group vs 80.6% ePTFE group; $P = .011$, log-rank = 6.449) were significantly higher in the GSV group.
- **Take Home Message:** The 30-day and 5-year outcomes after elective repair of popliteal artery aneurysms via a posterior approach seemed to be comparable with either GSV or ePTFE, even if use of GSV guaranteed better primary patency with a lower risk of reinterventions during follow-up.

METHODS

Study population. A multicenter retrospective cohort study was conducted under the auspices of the Research Collaborative in Peripheral Arterial Disease, a pan-European scientific collaboration of vascular specialists.[14] A total of 40 departments (10 countries) participated. Each one of the centers involved had its own registry where patient data were collected at the time of surgery and afterwards collected into PARADE (Elective surgical repair of Popliteal ARtery Aneurysms with posterior approach vs enDovascular Exclusion).[3]

The aim of this study was to compare nonacute elective surgical repair of PAAs via a posterior approach vs endovascular exclusion with covered stenting, analyzing 30-day and 5-year outcomes in a multicenter retrospective study.

Preoperative duplex ultrasound (DUS) and computed tomography angiography (CTA) were required to include patients in the study and this analysis.

Treatment selection was based on the treating clinicians' and local multidisciplinary team's preferences. Given the pragmatic nature of this study, all departments applied their local/regional standardized protocols for perioperative medication, and follow-up examinations and/or imaging. The follow-up protocol included a physical examination combined with a DUS or CTA 1 month after the index procedure, at 6 months, and yearly thereafter.

All patients provided written consent for the procedure and to the fully anonymized processing of data. Institutional review board approval was waived owing to the retrospective nature of the study.

A retrospective review of patients with PAA electively treated in the 40 participating centers between January 2010 and December 2023 was performed; the local collaborator (site lead) identified all consecutive patients with available DUS and CTA imaging preoperatively who met the study inclusion criteria and collected data using medical records retrospectively. During the 14-year studied period, 971 consecutive patients with a PAA were treated in the participating centers via an open surgical posterior approach or using endovascular means (covered stents in all cases).

For the purposes of the study, patients who underwent endovascular treatment were excluded. Therefore, out of a total of 971 cases, 525 patients were included in the present analysis and divided into posterior approach with GSV graft (252, GSV group) and posterior approach with ePTFE graft (273, ePTFE group) (Fig 1).

Preoperative and intraoperative data. All patients underwent preoperative evaluation including clinical examination, DUS, and CTA, to identify the length of the aneurysmal lesion, and the diameters of the popliteal artery 1 cm above and 1 cm below the aneurysmal sac.

Definitions. Chronic limb-threatening ischemia was defined as the presence of peripheral artery disease in combination with rest pain, gangrene, or a lower limb

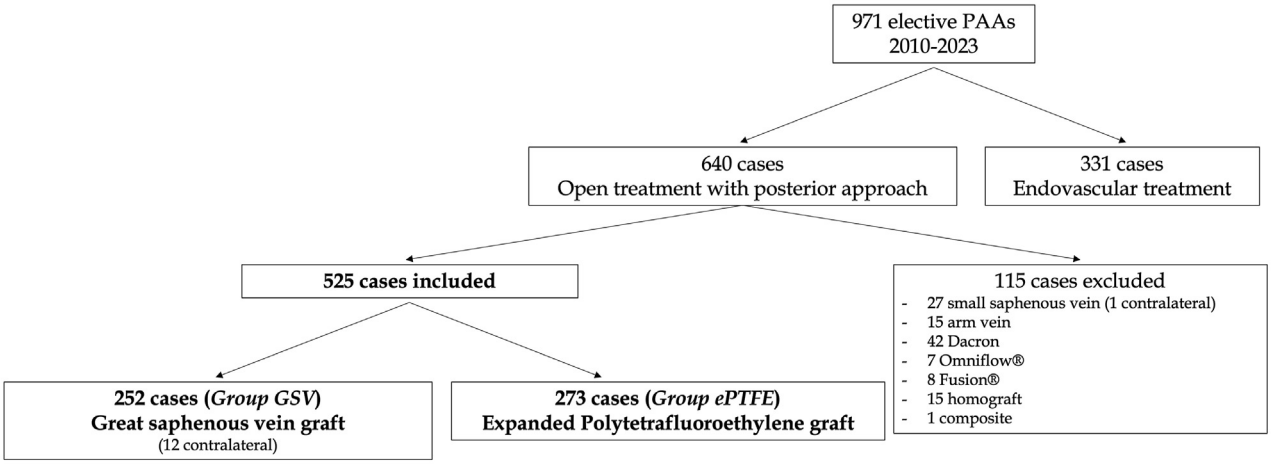

Fig 1. Study population. *ePTFE*, expanded polytetrafluoroethylene; *GSV*, great saphenous vein; *PAA*, popliteal artery aneurysm.

ulceration of ≥2 weeks in duration.[15] Run-off status was defined based on the number of patent tibial vessels, based on the imaging (diagnostic angiogram) obtained during the index procedure and preoperative DUS/CTA. Run-off status was considered poor in case of 0 patent below-the-knee vessels or one patent vessel with indirect flow. Other definitions of clinical events and/or imaging parameters were as per the reporting standards of the Society for Vascular Surgery for peripheral artery disease.[16]

Outcome measures and statistical analysis. All data concerning the procedures were collected retrospectively in a dedicated online database. This included demographics, preoperative risk factors, clinical and diagnostic preoperative assessments, intraoperative features, 30-day data, and follow-up data. All data regarding reinterventions were also recorded in the same database and adjudicated locally by the lead and other site collaborators. All data were anonymized.

Thirty-day outcomes were assessed and compared between both groups in terms of mortality, major adverse cardiovascular events (MACEs), and MALEs including graft occlusion(s), rates of reintervention, and major (above-the-ankle) amputations. Further, the number of identified nerve injuries was assessed via clinical examination during follow-up.

At follow-up, the evaluated primary outcome measures were primary patency, secondary patency, freedom from reintervention(s), and amputation-free survival. Survival and graft infection were considered as secondary outcome measures. Estimated 5-year outcomes were compared using Kaplan-Meier curves. The two groups were compared with the log-rank test. Estimates were given with the 95% confidence intervals (CI).

Univariate analysis with the log-rank test was performed to identify predictive factors affecting primary patency, and freedom from reintervention(s) in the ePTFE group. We included in the Cox regression multivariate analysis any factor with a P value of $<.05$ obtained in the univariate analysis.

Continuous data were expressed as the mean ± standard deviation or median with interquartile range (IQR) values when necessary. Categorical data were expressed as percentages. The Pearson χ^2, mean t test, or analysis of variance were used to compare values between groups, based on the nature of the data and variables. Statistical significance was defined at a P value of $<.05$. Statistical analysis was performed using SPSS software (version 24.0 for Apple; IBM Corporation, Armonk, NY).

RESULTS

Demographics and morphological data. Demographic and preoperative data of both groups are shown in Table I. No differences were found in terms of clinical presentation between the two groups. Overall, in 10 of 525 cases (1.9%), a previous saphenectomy in the index limb was performed (8 [3.2%] GSV group and 2 [0.7%] ePTFE group; $P = .031$). With regard to morphological data, both groups were homogeneous in terms of diameters, lesion lengths, and run-off vessels. Table II summarizes the preoperative morphological data.

Intraprocedural outcomes. With regard to venous conduits, the most often used was the ipsilateral GSV (240, 95.2%), and the contralateral GSV was harvested in the remaining 12 cases (4.8%). Regarding the ePTFE conduit, 247 of 273 patients (90.5%) received a heparin-bonded graft (Gore Propaten; W. L. Gore & Associates, Flagstaff, AZ); in the remaining cases, different standard ePTFE grafts were used, including Gore-tex (W. L. Gore & Associates) in 11 cases (4%), Impra vascular graft (Becton, Dickinson and Company, Franklin Lakes, NJ) in 9 cases

Table I. Demographic and preoperative data

	GSV group (n = 252)	ePTFE group (n = 273)	*P* value
Male sex	241 (95.6)	266 (97.4)	.186
Age, years	68.5	70.1	.087
Age >80 years	38 (15.1)	50 (18.3)	.191
Risk factors			
Smoking	94 (37.3)	100 (36.6)	.472
Hypertension	179 (71)	208 (76.2)	.107
Hypercholesterolemia	151 (59.9)	163 (59.7)	.494
Diabetes mellitus	42 (16.7)	53 (19.4)	.241
Coronary artery disease	71 (28.2)	75 (27.5)	.467
Chronic kidney disease[a]	6 (2.4)	15 (5.5)	.094
Dialysis treatment	1 (0.4)	3 (1.1)	.342
Clinical presentation			.573
Asymptomatic	174 (69)	187 (68.4)	
Intermittent claudication	46 (18.3)	43 (15.8)	
CLTI	32 (12.7)	43 (15.8)	
Preoperative medical therapy			
Aspirin	169 (67.1)	189 (69.2)	.330
Clopidogrel	37 (14.7)	39 (14.3)	.498
Other antiplatelet therapy	3 (1.2)	7 (2.6)	.204
Oral ANTICOAGULANT	21 (8.3)	16 (5.9)	.175
Direct oral anticoagulant	37 (14.7)	26 (9.5)	.078
Statin	145 (57.5)	144 (52.7)	.155

CLTI, Chronic limb-threatening ischemia; *ePTFE,* expanded polytetrafluoroethylene.
Continuous data are presented as the means; categorical data are given as the counts (%).
[a]Glomerular filtration rate <30 mL/min.

Table II. Morphological data

	GSV group (n = 252)	ePTFE group (n = 273)	*P* value
Lesion length, mm	57.3 ± 30.8	62.1 ± 29.9	.072
Aneurysmal sac maximum diameter, mm	30.9 ± 13.6	32.6 ± 11.3	.144
1-cm above aneurysm diameter, mm	8.2 ± 2	8.1 ± 2.2	.134
1-cm below aneurysm diameter, mm	7.6 ± 1.8	7.3 ± 1.7	.103
Patent tibial vessels, mean	2.4 ± 0.7	2.4 ± 0.7	.404
No. of patent tibial vessels			.403
0	0	5 (1.8)	
1	37 (14.7)	23 (8.4)	
2	87 (34.5)	99 (36.3)	
3	128 (50.8)	146 (53.5)	

ePTFE, Expanded polytetrafluoroethylene.
Values are mean ± standard deviation or number (%).

(3.3%), and Lifespan (LeMaitre Vascular, Burlington, MA) in 6 cases (2.2%).

The mean bypass length was similar in both groups (60 mm [IQR, 60-80 mm] in the GSV group vs 60 mm [IQR, 55-70 mm] in the ePTFE group; $P = .093$), whereas the median graft diameter was larger in the ePTFE group (7 mm [IQR, 7-8 mm] vs 4 mm [IQR, 4-5 mm]; $P < .001$).

Intraprocedural diagnostics was performed in 141 of 252 cases (55.9%) in the GSV group, and in 180 of 273 cases (65.9%) in the ePTFE group ($P = .002$). DUS was the most used diagnostic tool (112/141 in the GSV group, and 163/273 in the ePTFE group), whereas a completion angiography was done in 29 of 141 cases in the GSV group and in 17 of 273 cases in the ePTFE group.

Table III. Postoperative medical management

	GSV group (n = 252)	ePTFE group (n = 273)	*P* value
Mono antiplatelet therapy	97 (38.5)	152 (55.7)	<.001
Dual antiplatelet therapy	55 (21.8)	64 (23.4)	.368
Warfarin	55 (21.8)	25 (9.1)	<.001
Direct oral anticoagulants	45 (17.9)	32 (11.7)	.003
Statin	163 (64.7)	154 (56.4)	.003

Values are number (%)

The median operation time was similar in both groups (150 minutes [IQR, 110-180 minutes] in the GSV group vs 140 minutes [IQR, 110-170 minutes] in the ePTFE group; $P = .328$). Acute technical success was obtained in all cases in both groups.

Thirty-day data. The median hospital stay was similar in both groups (6 days [IQR, 4-7 days] in the GSV group vs 5 days [IQR, 4-7 days] in the ePTFE group; $P = .381$). Table III summarizes postoperative medical management for each group. Two patients (0.8%) in the GSV group and one patient (0.4%) in the ePTFE group experienced a postoperative permanent nerve injury ($P = .470$). The lesions involved the sciatic-popliteal nerve, which required a posterior tibial tendon transposition and concomitant rehabilitation.

At 30 days, one patient died in the GSV group with an overall 30-day mortality rate of 0.4% ($P = .480$). The cause of death was cardiovascular but not related to the intervention. In addition, 30-day rates of MACEs (3/252 [1.2%] GSV group vs 3/273 [1.1%] ePTFE group; $P = .621$), graft occlusion (7/252 [2.8%] GSV group vs 2/273 [0.8%] ePTFE group; $P = .081$), procedure-related reinterventions (12/273 [4.4%] GSV group vs 7/273 [2.6%] ePTFE group; $P = .133$), and major amputation (0 [0%] GSV group vs 1/273 [0.4%] ePTFE group; $P = .214$) did not differ between the two groups. Even the overall 30-day rate of MALEs did not differ (19/252 [7.5%] GSV group vs 10/273 [3.7%] ePTFE group; $P = .072$).

LONG-TERM OUTCOMES

Follow-up was available for all patients with an overall median follow-up period of 24 months (IQR, 8.0-42.5 months). The median length of follow-up was similar in both groups (24 months [IQR, 10-36 months] GSV group vs 21 months [IQR, 7-47 months] ePTFE group; $P = .123$).

During the follow-up period in the whole study population another 50 deaths occurred. The cause of death was unknown in 16 cases (32%), malignancy related in 8 cases (16%), acute myocardial infarction in 8 cases (16%), chronic heart failure in 2 cases (4%), sepsis and multiorgan failure 3 cases (6%), COVID-19 infection in 2 cases (4%), ruptured AAA in 1 case (2%), fatal arrhythmia in 2 cases (4%), stroke in 3 cases (6%), trauma in 1 case (2%), pneumonia in 3 case (6%), and end-stage renal disease in 1 case (2%). The estimated 5-year survival rate was similar in both groups (84.7% GSV group [95% CI, 83.5%-90.1%] vs 86.1% ePTFE group [95% CI, 81.3%-91.7%]; $P = .097$, log-rank = 2.756).

In addition, during the follow-up period, 64 additional graft occlusions occurred, and 48 further reinterventions were performed. Two further major amputations were recorded (one in the GSV group and one in the ePTFE group; $P = .279$). Finally, three graft infections in the ePTFE group were recorded with the need for graft removal and new bypass with contralateral GSV or arm veins. No graft infection was reported in the GSV group.

The 5-year estimates with Kaplan-Meier tests demonstrated that there were no differences between the two groups in terms of secondary patency (94.9% GSV group [95% CI, 90.5%-97.4%] vs 89.4% ePTFE group 95% CI, 84.3%%-94.1%; $P = .068$, log-rank = 3.336) and amputation-free survival (99.1% GSV group [95% CI, 97.9%-100%] vs 99.6% ePTFE group [95% CI, 98.3%-100%]; $P = .567$, log-rank = .328). Estimated 5-year primary patency (89.5% GSV group [95% CI, 84.9%-92.3%] vs 76.2% ePTFE group [95% CI, 73.1%-81.2%]; $P = .007$, log-rank = 7.239), and freedom from reintervention(s) (92.8% GSV group [95% CI, 88.7%-96.1%] vs 80.6% ePTFE group [95% CI, 77.1%-84.8%]; $P = .011$, log-rank = 6.449) were better in the GSV group (Fig 2).

Supplementary Tables I and II (online only) show univariate analyses of factors affecting primary patency, and freedom from reintervention(s) in the ePTFE group, respectively. On multivariate analysis in the ePTFE group, factors affecting primary patency were dialysis ($P = .054$; odds ratio, 3.641) and patients who were not on any preoperative antiplatelet therapy or anticoagulation ($P = .019$; odds ratio, 5.532) (Table IV); none of the perioperative factors affected freedom from reintervention(s).

DISCUSSION

This study demonstrates that 30-day and long-term outcomes of elective surgical repair for PAA via a posterior approach using either autologous GSV or ePTFE grafts seem to be comparable, although the GSV should be considered the conduit of choice for bypass surgery owing to higher primary patency and freedom from reinterventions rates.

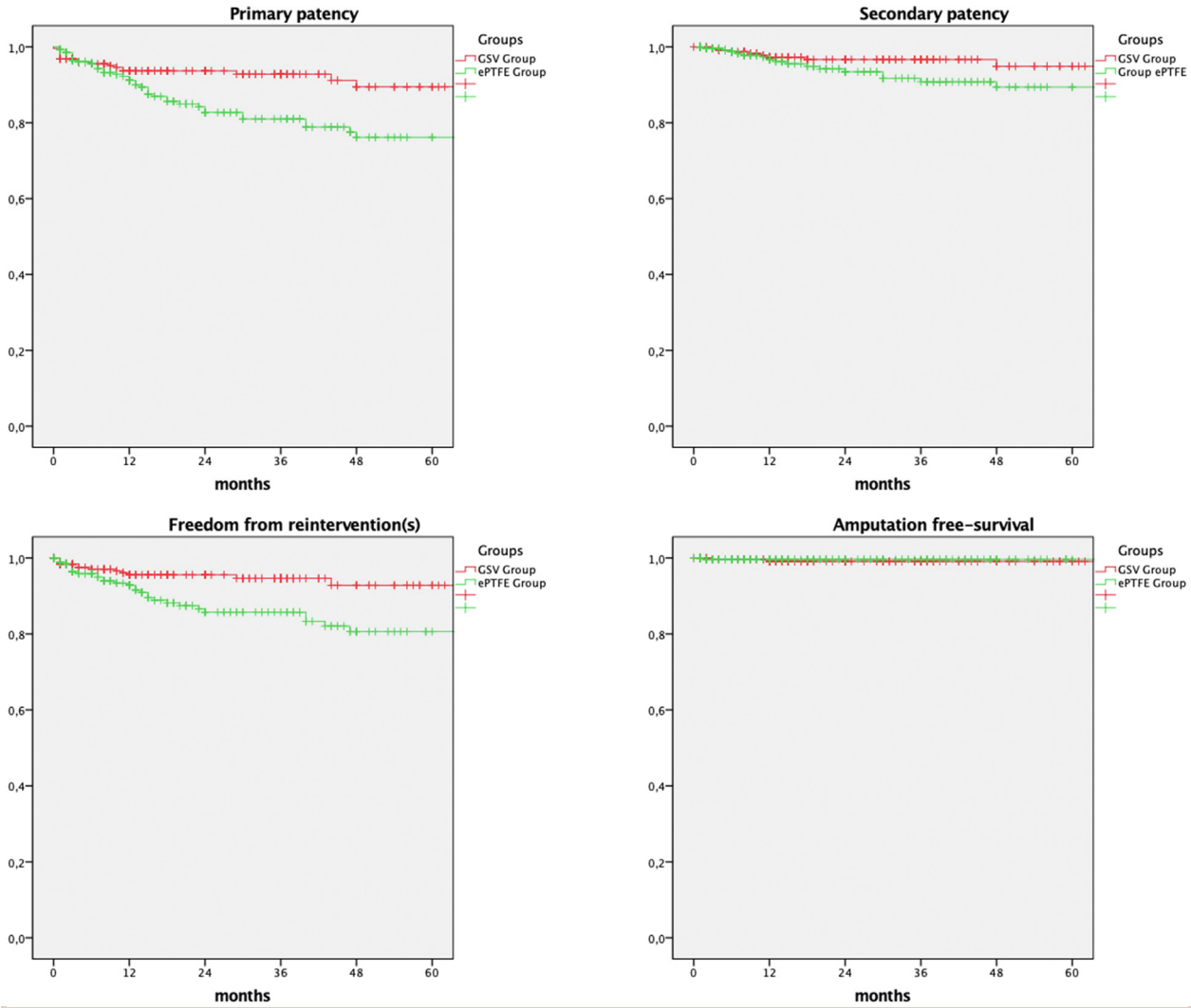

Fig 2. Estimated 5-year primary patency, secondary patency, freedom from reintervention(s), and amputation-free survival (Kaplan-Meier curves). *ePTFE*, expanded polytetrafluoroethylene; *GSV*, great saphenous vein.

The median length of the bypass was similar in both GSV and ePTFE groups considering the characteristics of the treated PAA located in the midportion of the artery.[3] Conversely, patients treated with ePTFE conduits presented with larger bypass diameters than those receiving GSV. This is intuitive if considering that vein quality assessment is usually performed in the preoperative period on DUS examination, and measurements refer to the predilation phase. In any case, this difference between types of graft did not affect primary patency rates, especially considering that GSV used in our cohort remains >3 mm in diameter. Nonetheless, it has been demonstrated that vein diameter of <3 mm, distal anastomosis on tibial or foot vessel, and use of suprafascial tributary collateral as a graft were associated significantly with loss of patency and limb loss during follow-up.[17]

Regarding intraprocedural details, an intraoperative DUS examination seems to be more often performed in the ePTFE group. This factor can be related to specific centers' preferences that may weigh more when analyzing data, above all in the context of a real-world experience. In contrast, especially considering its wide and well-recognized use in preoperative and postoperative surveillance of chronic limb-threatening ischemia patients, DUS imaging remains a first-line diagnostic tool, even in this scenario.[18,19]

In any case, the use of DUS as an easy-to-perform intraprocedural confirmation of bypass patency may be of a certain benefit for ePTFE conduits, considering the potential caliber mismatch between the donor popliteal artery and the prosthetic conduit.

In terms of short-term results, 30-day analysis demonstrated low rates of perioperative complications in both the GSV and ePTFE groups, in terms of MACEs, mortality, and major amputations. These findings are in line with previously reported data, where open surgical repair

Table IV. Multivariate analysis of factors affecting primary patency in the expanded polytetrafluoroethylene (ePTFE) group

Variables	B	Standard error	Odds ratio	*P* value	Exp(B)	95% CI for Exp(B)	
Dialysis	1.972	1.033	3.641	.054	7.182	.948	54.411
No preoperative antiplatelet or anticoagulation	−.726	.309	5.532	.019	.484	.264	.886

provided good results not only in the perioperative period, but also an excellent durability in the long-term.[20] However, a proper surgical technique and expertise is mandatory, because nerve injury still represents a drawback and potential complication of posterior approach.[6,21]

Overall, these results confirm the safety and effectiveness of open repair via posterior approach, regardless of the conduit used in both the 30-day and long-term periods. Nevertheless, GSV bypasses showed a significant advantage compared with ePTFE conduits in terms of 5-year primary patency and freedom from reinterventions. Indeed, it has already been demonstrated that vein bypass is safe and durable.[22-24] Nonetheless, the run-off status plays a pivotal role in affecting patency rates.[25]

This study seems to be the first comparative analysis about the type of conduit used in PAAA open repair with posterior approach. Chang et al[7] demonstrated that conventional open PAA repair with prosthetic conduit performed with medial or posterior approach yields results comparable to those with vein conduit with regard to primary and secondary patency and MALEs at 2 years for targets to the popliteal artery. However, the authors suggested the use of vein conduit preferentially for infrapopliteal targets, because of the influence of run-off status on the outcomes. More recently, Kim et al[11] reported that, in open PAA repair with a medial approach at 2 years, prosthetic bypass is a comparable alternative with an autogenous conduit for below-knee popliteal bypass targets, and the lack of a suitable GSV should not prohibit open surgical repair when indicated. Naazie et al,[13] in a large cohort study including symptomatic and asymptomatic PAAs treated with a medial or posterior approach, reported that 1-year primary patency does not differ between conduit types, even if prosthetic conduits are associated with a significantly greater risk of amputation and death compared with GSV among symptomatic patients. Finally, Baccellieri et al[12] demonstrated that open surgical repair of PAAs with prosthetic grafts (Dacron and ePTFE) via a medial or a posterior approach is safe and feasible, with good midterm results and satisfactory primary and secondary patency at 3 years.

The present study is not only the first comparative analysis between ePTFE and GSV, but also it is the first to report 5-year outcomes. Furthermore, despite the relative homogeneity between the groups in terms of clinical presentation, PAA diameter, lesion length, and run-off vessels, multivariate analysis identified the lack of preoperative antiplatelet therapy or anticoagulation, as well as dialysis as predictors of poor primary patency in the ePTFE group. This finding can be explained by the role of antiplatelet agents in decreasing the risk of thrombogenic events before treatment. As demonstrated in a recent systematic review, antiplatelet therapy has beneficial effects on the primary patency of peripheral bypass compared with placebo, and this effect is more evident in patients with prosthetic grafts.[26] The American Heart Association recommends antiplatelet therapy in patients undergoing surgical lower limb revascularization, although few studies investigated the target preoperative dosage, which can affect bypass primary patency positively.[27]

The loss of patency in the ePTFE group owing to the lack on any preoperative antiplatelet therapy or anticoagulation is supported by Gassman et al,[28] who demonstrated that medications commonly prescribed for atherosclerosis, such as aspirin, are associated with a significant patency benefit when administered preoperatively and postoperatively, especially in a population undergoing infrainguinal bypass with a prosthetic graft.

Other factors that potentially could be associated with poor outcomes after PAA surgical repair have been largely investigated.[29] In this registry, dialysis was found to be a predictor of poor primary patency in the ePTFE group. We can speculate about similar behavior between patients with ePTFE peripheral bypass and patients with ePTFE fistulas. Indeed, this prosthetic conduit seems to be associated with more occlusions in patients on dialysis, because of the different mechanical behavior compared with native vessels.[30,31] Furthermore, it is well-known that patients on dialysis undergoing revascularization experience worse outcomes, especially considering their compromised vascular status.[32]

Despite the undisputable advantages of autologous conduits, our results suggest that ePTFE grafts remain a valid option in patients where GSV is unavailable, such as those with prior saphenectomy or poor quality veins. Therefore, the choice of conduit material should be targeted on patient specific characteristics, and medical therapy with antiplatelet drugs remains crucial for improving outcomes in high-risk patients with synthetic grafts.

This study has some limitations. First, it is a retrospective analysis based on registry data, which is susceptible to

registration errors and the potential bias of patient selection and patterns of referral, although mitigated to an extent by diligent data recording and collection. Second, the relatively small sample size could have affected the generalizability of the results. Eventually, although we tried to account for potential confounders with regression analyses, it is possible that some associations remained undefined and may have influenced the overall findings on multivariate analysis. Finally, the nonrandomized nature of enrolment could have partly affected the generalizability of the results, including also the nonhomogeneous distribution of the cases (ePTFE vs GSV) and the nonhomogeneous postoperative medical management carried out in each participating center.

CONCLUSIONS

The 30-day and long-term outcomes of elective surgical repair for PAA by posterior approach via GSV or ePTFE grafts are comparable, although GSV should be considered the preferred conduit for bypass surgery owing to superior primary patency, and freedom from reinterventions. However, in patients where GSV cannot be used, ePTFE grafts offer a valid alternative with acceptable outcomes, provided they are managed appropriately. A randomized controlled trial with a larger sample size is needed to further clarify the superiority of one treatment over another.

AUTHOR CONTRIBUTIONS

Conception and design: NT, GB, RB
Analysis and interpretation:NT, GB, MA, VS, RB
Data collection: NT, MA, VS
Writing the article: NT, GB, MA, VS
Critical revision of the article: NT, GB, MA, VS, RB
Final approval of the article: NT, GB, MA, VS, RB
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APPENDIX (online only).

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Supplementary Table I (online only). Univariate analysis of factors affecting 5-year primary patency in expanded polytetrafluoroethylene (ePTFE) group

	Log-rank	*P* value
Age >80 years	2.399	.121
Male sex	.029	.866
CLTI	.556	.757
Smoking	.001	.987
Hypertension	.112	.738
Hyperlipidemia	1.468	.226
Diabetes mellitus	.351	.554
Coronary artery disease	.317	.573
CKD	.036	.850
Dialysis	3.916	.048
Preoperative antiplatelet therapy	5.455	.020
Preoperative oral anticoagulant	1.636	.201
Preoperative direct oral anticoagulant	2.321	.143
Preoperative statin	.021	.886
Poor run-off (0-1 tibial vessels)	1.141	.285
Graft diameter 5 or 6 mm	.177	.674
MACE at 30 days	.149	.699
Reintervention at 30 days	.001	.971
Postoperative antiplatelet therapy	2.134	.144
Postoperative oral anticoagulant	.640	.424
Postoperative direct oral anticoagulant	3.121	.094
Postoperative statin	.0337	.561

CI, Confidence interval; *CKD*, chronic kidney disease; *CLTI*, chronic limb-threatening ischemia; *MACE*, major cardiovascular event.

Supplementary Table II (online only). Univariate analysis of factors affecting 5-year freedom from reintervention(s) in the expanded polytetrafluoroethylene (ePTFE) group

	Log-rank	*P* value
Age >80 years	.469	.494
Male sex	.100	.752
CLTI	3.638	.162
Smoking	.007	.933
Hypertension	.133	.716
Hyperlipidemia	.001	.998
Diabetes mellitus	.029	.866
Coronary artery disease	.179	.672
CKD	.130	.719
Dialysis	.155	.694
Preoperative antiplatelet therapy	8.053	.005
Preoperative oral anticoagulant	2.979	.085
Preoperative direct oral anticoagulant	1.568	.211
Preoperative statin	.029	.865
Poor run-off (0-1 tibial vessels)	.381	.537
Graft diameter 5 or 6 mm	.657	.418
MACE at 30 days	.139	.709
Reintervention at 30 days	3.479	.082
Postoperative antiplatelet therapy	1.968	.161
Postoperative oral anticoagulant	.800	.371
Postoperative direct oral anticoagulant	3.970	.061
Postoperative statin	1.089	.297

CKD, Chronic kidney disease; *CLTI*, chronic limb-threatening ischemia; *MACE*, major cardiovascular event.