

ORIGINAL ARTICLE

The outcome of Autogenous Venous Graft Vs Prosthetic Graft in Peripheral Arterial Disease- Study in Bangladesh

MAINUL MAHMUD¹, NUR A AL-AMIN¹, KAMAL HOSSAIN¹, UZZAL AHMED², ASHIK RAHMAN RIFAT¹,
RAKIBUL HASAN¹, MD. SAIF ULLAH KHAN¹

¹Department of vascular surgery , Bangabandhu Sheikh Mujib Medical University (BSMMU), Shahbag, Dhaka, Bangladesh,

²Enam Medical College and Hospital, Savar, Dhaka.

Address of Correspondence : Dr. Mainul Mahmud , Assistant Professor, Department of Vascular Surgery, Room no- 608 , Out Patient Department Building-1 , BSMMU , Shahbag, Dhaka, Email: dr.mainulmahmudsuny@gmail.com.

Abstract:

Graft insertion is a surgical intervention employed to address advanced stages of peripheral artery disease (PAD) or peripheral vascular disease (PVD). Peripheral artery disease (PAD) or peripheral vascular disease (PVD) refers to the narrowing or blockage of blood vessels, typically in the lower extremities resulting from the accumulation of fatty deposits (atherosclerosis). This condition leads to diminished blood flow to the affected regions. These symptoms may include leg pain, cramping, numbness, and, in severe instances, tissue damage and gangrene.

Objective: This study aims to evaluate the surgical outcome of autogenous venous grafts and prosthetic grafts in peripheral arterial disease.

Method: The cross-sectional study was conducted at Department of Vascular Surgery, Bangabandhu Sheikh Mujib Medical University & Enam Medical College Hospital, Savar, Dhaka - over two year from January 2021 to December 2022. This study represented patients who received surgical treatment for peripheral artery disorders using grafts, which could be either autogenous (vein) or prosthetic in nature.

Results: Smoking, hypertension, and dyslipidemia were the main risk factors for PAD. The main indications of revascularization in our investigation were gangrene, critical limb ischemia, and limb salvage. In the case of a prosthetic graft, post-operative infection was higher. The other postoperative problems were thrombosis-related occlusion and hemorrhage.

Conclusion: Autogenous venous and prosthetic grafts can provide a bypass or supply blood flow to the damaged area during peripheral arterial disease (PAD) revascularization. The surgeon's preference and the patient's condition determine which graft type is used. In this study, prosthetic and autogenous venous grafts in PAD are compared.

Keywords: Peripheral arterial disease, Autogenous venous graft, Prosthetic graft, limb salvage, Critical limb ischemia, Claudication, Great saphenous vein, PTCA.

University Heart Journal 2023; 19(2): 55-60

DOI: <https://doi.org/10.3329/uhj.v19i2.73744>

Introduction:

Peripheral arterial disease (PAD) or peripheral vascular disease (PVD) refers to the constriction and blockage of blood flow in major systemic arteries, excluding those in the cerebral and coronary circulations. Various factors can contribute to PAD such as vasculitis, dysplastic syndromes, degenerative diseases, thrombosis, and thromboembolism. However, atherosclerosis is by far the most prevalent

cause. This primarily manifests in the lower extremities and gives rise to various clinical symptoms. The majority of patients do not show symptoms, however even a disease that is clinically quiet indicates a higher risk of vascular morbidity and mortality.¹ This condition predominantly affects older individuals and is believed to arise from a combination of genetic and environmental factors that contribute to the development of atherosclerotic disease.

PAD affects approximately 12% to 14% of the overall population and around 20% of individuals aged 75 years and older. It is becoming a growing concern worldwide, partly due to the increasing prevalence of abdominal fat accumulation and related metabolic issues.² The diagnosis of PAD, even in patients without symptoms, has a substantial clinical impact due to its role as an indicator of systemic atherosclerosis. Individuals diagnosed with peripheral artery disease (PAD) face a similar risk of cardiovascular complications as those who have experienced a previous heart attack (myocardial infarction). To enhance their chances of long-term survival, individuals with PAD need to undergo intensive modification of risk factors. The treatment of PAD is contingent upon the severity of the disease and the status of symptoms. Possible treatments for PAD including lifestyle modifications, elimination of cardiovascular risk factors, medication, endovascular intervention and surgical procedures.^{3,4,5}

Occasionally, a medical intervention to reinstate the circulation of blood in the arteries of the legs may be advised. This process is commonly referred to as revascularization. Surgical revascularization is mostly employed in patients with chronic limb-threatening ischemia (CLTI) when endovascular intervention is considered unsuitable. This is typically recommended for patients with significant atherosclerosis, where an endovascular treatment is considered less effective. These individuals are also assessed to be physically suitable for surgery. When doing lower limb bypass surgery on patients with intermittent claudication, it is crucial to thoroughly address the potential advantages and disadvantages of the procedure with them.⁶ Nevertheless, a considerable percentage of individuals suffering from severe lower extremities ischemia do not have a functional ipsilateral great saphenous vein (GSV).⁷ In some cases, an alternate blood vessel is necessary. There has been much controversy regarding the choice of alternative channels.⁸ Various reports have shown a preference for diverse alternatives, such as autogenous and prosthetic options.⁹ Prosthetic conduit bypass grafts have demonstrated moderate success when used to bypass the popliteal artery, especially when placed above the knee.¹⁰ Prosthetic grafts have been successfully used as an alternative to primary amputation in cases involving the tibial vessels.¹¹ Nevertheless, most investigations indicate that prosthetic grafts below the knee are less successful than all-autogenous conduits. To enhance the durability of prosthetic grafts, several institutions have implemented alterations involving the use of a cuff or patch made from

the patient's own vein or an arteriovenous fistula at the distal connection point.¹² Other autogenous veins that have been utilized for lower extremity bypass grafts include the cephalic and basilic arm veins, the short saphenous vein (SSV) and the remaining portions of the great saphenous vein (GSV). These alternate autogenous conduits have proven effective in various anatomical configurations, including long-length grafts that necessitate spliced vein bypass grafts.^{13,14}

Objective:

- This study will determine the outcome of Autogenous Venous Graft vs. prosthetic Graft in Peripheral Arterial Disease.

Methods:

This cross-sectional study was conducted in Department of Vascular Surgery, Bangabandhu Sheikh Mujib Medical University & Enam Medical College Hospital, Savar, Dhaka - over two year from June 2021 to June 2023. The patients were segregated into two distinct groups. The study included all patients over the age of 18 who underwent surgical treatment for peripheral artery disorders using interposition grafts, which might be either vein or prosthetic. Forty patients met the criteria for inclusion. Group "A" consisted of 20 patients who had arterial repair using a venous graft, whereas Group "B" included 20 patients who received a prosthetic graft. The study excluded patients who underwent primary amputation, had simultaneous arterial damage in the same limb, had the arterial injury treated as the primary treatment, had isolated venous injuries, or had missing medical information.



Before Surgery



After Surgery

Results:

Table 1 displays the demographic characteristics of the patients. 12(60%) of males underwent venous grafting, while 10(50%) of males received prosthetic grafting. Among female patients 8(40%) received venous grafts and 10(50%) received prosthetic grafts.

Among patients who received venous grafts (Group A)- the prevalence of dyslipidemia was 90%, diabetes mellitus was 15(75%), recent smokers accounted for 15(75%), hypertension was present in 13(65%), coronary artery disease was observed in 12(60%), previous coronary artery bypass grafting (CABG) or percutaneous transluminal coronary angioplasty (PTCA) was reported in 8(40%) and end-stage renal disease (ESRD) was found in 2(10%).

Among patients with prosthetic grafts (Group B)- the prevalence of dyslipidemia was 19(95%), diabetes mellitus was 14(70%), recent smokers accounted for 14(70%), hypertension was present in 12(60%), coronary artery disease was observed in 11(55%), previous coronary artery bypass grafting (CABG) or percutaneous transluminal coronary angioplasty (PTCA) was reported in 44% and end-stage renal disease (ESRD) was found in 1(5%).

Group A- consisted of 2 patients (10%) aged 18-27 years, 3 patients (15%) aged 28-37 years, 2 patients (10%) aged 38-47 years, 3 patients (15%) aged 48-57 years, 4 patients (20%) aged 58-67 years, and 6 cases (30%) aged 68-77 years. Within group B, there was 1 patient (5%) between

the ages of 18 and 27, two patients (10%) between the ages of 28 and 37, four patients (20%) between the ages of 38 and 47, six patients (30%) between the ages of 48 and 57, two patients (10%) between the ages of 58 and 67, and five cases (25%) between the ages of 68 and 77.

Figure 1 presents a comprehensive list of indications for revascularization. In group A, the prevalence of critical limb ischemia was 18(90%), limb salvage was observed in 17(85%) of cases, gangrene in 16(80%), ischemic ulcer in 15(75%), and disabling claudication features in 14(60%). In group B, the majority of individuals exhibited critical limb ischemia 17(85%), followed by limb salvage 16(80%), gangrene 14 (70%), ischemic ulcer 14(70%) and disabling claudication 10(50%).

Figure 2 presents the graft characteristics of the procedure. Bypass grafting was performed as the initial procedure in 9(45%) autogenous vein grafting cases and 12(60%) prosthetic cases and as revision bypass graft procedures in 10(50%) autogenous vein grafting cases and 8(40%) prosthetic cases.

Table 2 displays the anatomical arrangement of revascularization in two distinct groups. In group A- the surgical procedure of grafting was performed in the following percentages of patients: Femoro-above-knee-popliteal grafting in 2(10%), Femoro-below-knee-popliteal grafting in 6(30%), Femorotibial grafting in 9(45%), Femoropedal grafting in 2(10%), Popliteo-tibial /pedal grafting in 1(5%).

Table-I
Patients Demographic profile and risk factors.

Characteristics	Vein Graft	Prosthetic Graft
Gender		
Male	12 (60%)	10 (50%)
Female	8 (40%)	10 (50%)
Age(years)		
18-27	2(10%)	1(5%)
28-37	3(15%)	2(10%)
38-47	2(10%)	4(20%)
48-57	3(15%)	6(30%)
58-67	4(20%)	2(10%)
68-77	6(30%)	5(25%)
Diabetes	15(75%)	14(70%)
Dyslipidemia	18(90%)	19(95%)
History of recent smoking	15(75%)	14(70%)
Coronary artery disease	12(60%)	11(55%)
Previous CABG or PTCA	8(40%)	9(45%)
Hypertension	13(65%)	12(60%)
End-stage renal disease	2(10%)	1(5%)

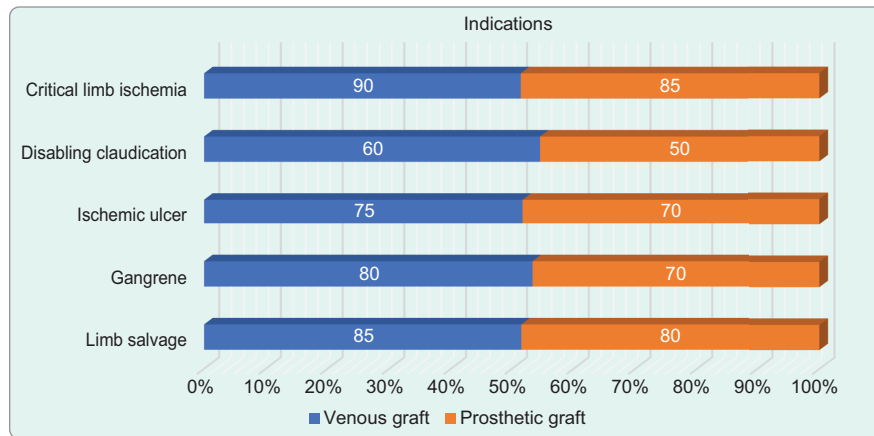


Figure 1: Indication for Revascularization Procedure

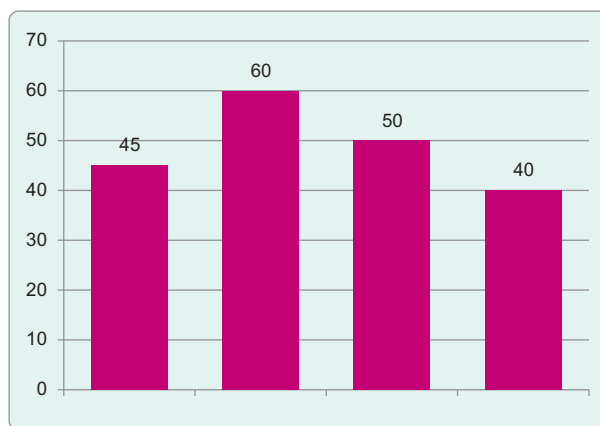


Figure 2: Graft Characteristics of Revascularization Procedure

In group B- the surgical procedure of grafting was performed in different locations for various patients. Specifically, Femoro-above-knee-popliteal grafting was carried out in 9(45%) of the patients, Femoro-below-knee-popliteal grafting was performed in 3(15%) of the patients,

Femorotibial grafting was done in 5(25%) of the patients, Femoropedal grafting was conducted in 1(5%) of the patients, Popliteo-tibial/pedal grafting was performed in 2(10%) of the patients.

Table-II
Anatomic Configuration of Revascularization Procedure

Characteristics	Vein Graft	Prosthetic Graft
Femoro-above-knee-popliteal	2(10%)	9 (45%)
Femoro-below-knee-popliteal	6 (30%)	3(15%)
Femorotibial	9 (45%)	5(25%)
Femoropedal	2(10%)	1(5%)
Popliteo-tibial/pedal	1(5%)	2(10%)

Figure 3 is a list of the different complications observed in the two groups. The majority of patients in group A experienced post-procedure infection, with a prevalence of 13(65%). Additionally, thrombosis was observed in 9(45%) of patients, while bleeding occurred in 7(35%) of cases. In group B, the incidence of infection was greater,

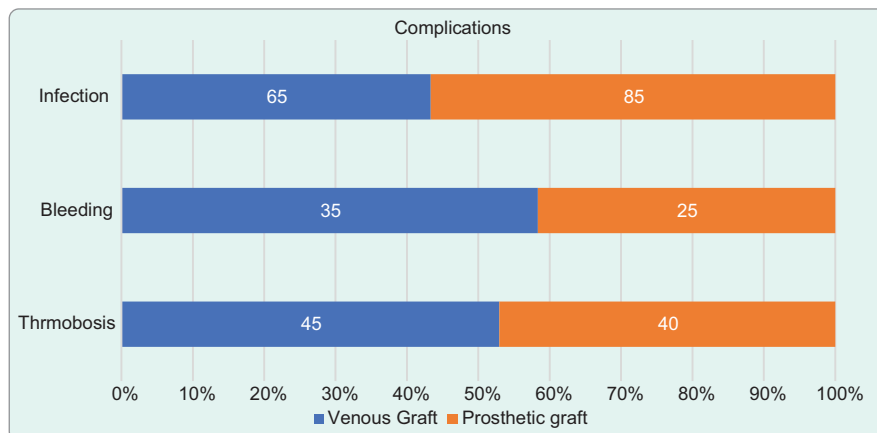


Figure 3: Complications of revascularization.

affecting 17(85%) of patients, compared to group A. Thrombosis occurred in 8(40%) of patients, whereas bleeding occurred in 5(25%) of patients.

Discussion:

The study presents the demographic attributes of the patients. Out of the total number of males, 12 (60%) had venous grafting, whereas 10 (50%) received prosthetic grafting. Out of the female patients, 8 (40%) were given venous grafts and 10 (50%) were given prosthetic grafts.

In Group A, 90% of patients had dyslipidemia, 75% had diabetes mellitus, 75% were recent smokers, 65% had hypertension, 60% had coronary artery disease, 40% had previous coronary artery bypass grafting (CABG) or percutaneous transluminal coronary angioplasty (PTCA), and 10% had end-stage renal disease (ESRD).

In patients with prosthetic grafts (Group B), the occurrence of dyslipidemia was 19 (95%), diabetes mellitus was 14 (70%), recent smokers made up 14 (70%), hypertension was present in 12 (60%), coronary artery disease was observed in 11 (55%), previous coronary artery bypass grafting (CABG) or percutaneous transluminal coronary angioplasty (PTCA) was reported in 44%, and end-stage renal disease (ESRD) was found in 1 (5%).

Peripheral artery disease is primarily influenced by diabetes mellitus, according to another study¹⁵.

Group A comprised 2 patients (10%) in the age range of 18-27 years, 3 patients (15%) in the age range of 28-37 years, 2 patients (10%) in the age range of 38-47 years, 3 patients (15%) in the age range of 48-57 years, 4 patients (20%) in the age range of 58-67 years, and 6 cases (30%) in the age range of 68-77 years. In group B, there was one patient (5%) aged 18 to 27, two patients (10%) aged 28 to 37, four patients (20%) aged 38 to 47, six patients (30%) aged 48 to 57, two patients (10%) aged 58 to 67, and five cases (25%) aged 68 to 77.

Claudication is more common among males in younger age groups, although there is almost no difference in prevalence between genders in later age groups. The GetABI Study found that the incidence of peripheral artery disease (PAD) was higher in women compared to males after the age of 75.¹⁶

Our study presents an exhaustive compilation of indications for revascularization. The occurrence of critical limb ischemia in group A was 18 (90%), with limb salvage observed in 17 (85%) instances, gangrene in 16 (80%), ischemic ulcer in 15 (75%), and debilitating claudication characteristics in 14 (60%). The majority of persons in

group B displayed critical limb ischemia in 85% of cases, followed by limb salvage in 80% of cases, gangrene in 70% of cases, ischemic ulcer in 70% of cases, and debilitating claudication in 50% of cases.

In this study, bypass grafting was initially conducted in 45% of instances using autogenous vein grafts and in 60% of cases using prosthetic grafts. Additionally, revision bypass graft procedures were performed in 50% of cases using autogenous vein grafts and in 40% of cases using prosthetic grafts.

The results of our study demonstrate the anatomical configuration of revascularization in two separate cohorts. The surgical procedure of grafting was conducted in the following proportions of patients in group A: Femoro-above-knee-popliteal grafting was performed in 2 cases (10%), Femoro-below-knee-popliteal grafting in 6 cases (30%), Femorotibial grafting in 9 cases (45%), Femoropedal grafting in 2 cases (10%), Popliteo-tibial/pedal grafting in 1 case (5%).

Within group B, diverse individuals had the surgical process of grafting at varied anatomical sites. The surgical procedure of Femoro-above-knee-popliteal grafting was performed on 9 (45%) of the patients. Femoro-below-knee-popliteal grafting was carried out on 3 (15%) of the patients. Femorotibial grafting was done on 5 (25%) of the patients. Femoropedal grafting was conducted on 1 (5%) of the patients. Popliteo-tibial/pedal grafting was performed on 2 (10%) of the patients.

13 out of 20 patients in group A, accounting for 65% of the group, had post-procedure infection. Furthermore, thrombosis was detected in 9 out of 20 patients, accounting for 45% of the instances, where as bleeding was experienced by 7 individuals, representing 35% of the total. The infection rate was higher in group B, affecting 17 out of 20 patients (85%), compared to group A. Thrombosis manifested in 8 individuals, accounting for 40% of the total, while bleeding occurred in 5 patients, representing 25% of the total.

The study revealed that the most common forms of infections identified were surgical site infection (55.2%), urinary tract infection (16.4%), pneumonia (14.9%), and bacteremia (10.4%).¹⁷

Conclusion:

The selection of autogenous venous grafts or prosthetic grafts for PAD revascularization is primarily determined by patient-specific factors, such as the location and severity of arterial disease, the presence of suitable autogenous

veins, and the surgeon's proficiency. Autogenous venous grafts are often preferred when possible due to their favorable long-term outcomes and reduced risk of complications. Prosthetic grafts are a useful alternative when autogenous options are limited or when patient-specific factors support their use.

References:

1. Conte SM, Vale PR. Peripheral arterial disease. *Heart, Lung, and Circulation*. 2018 Apr 1;27(4):427-32.
2. Song P, Rudan D, Wang M, Chang X, Rudan I. National and subnational estimation of the prevalence of peripheral artery disease (PAD) in China: a systematic review and meta-analysis. *Journal of global health*. 2019 Jun;9(1).
3. Aysert Yýldýz P, Özdil T, Dizbay M, Güzel Tunçcan Ö, Hýzel K. Peripheral arterial disease increases the risk of multidrug-resistant bacteria and amputation in diabetic foot infections. *Turk J Med Sci*. 2018 Aug 16;48(4):845-50.
4. Yuksel A, Velioglu Y, Cayir MC, Kumtepe G, Gurbuz O. Current Status of Arterial Revascularization for the Treatment of Critical Limb Ischemia in Infrainguinal Atherosclerotic Disease. *Int J Angiol*. 2018 Sep;27(3):132-37.
5. Tan MNA, Lo ZJ, Lee SH, Teo RM, Tan WLG, Chandrasekar S. Review of Transmetatarsal Amputations in the Management of Peripheral Arterial Disease in an Asian Population. *Ann Vasc Dis*. 2018 Jun 25;11(2):210-16.
6. Chowdhury MM, Coughlin PA. Peripheral arterial disease. *Surgery (Oxford)*. 2022 Jul 1;40(7):432-37.
7. Taylor LM, Edwards JM, Porter JM. Present status of reversed vein bypass grafting: five-year results of a modern series. *J Vasc Surg* 1990;11:193-206.
8. Calligaro KD, Syrek JR, Dougherty MJ, Rua I, Raviola CA, DeLaurentis DA. Use of arm and lesser saphenous vein compared with prosthetic grafts for infrapopliteal arterial bypass: are they worth the effort? *J Vasc Surg* 1997;26:919-27.
9. Quinones-Baldrich WJ, Prego AA, Ucelay-Gomez R, Freischlag JA, Ahn SS, Baker JD, et al. Long term results of infrainguinal revascularization with polytetrafluoroethylene: a ten-year experience. *J Vasc Surg* 1992;16:209-17.
10. Green RM, Abbott WM, Matsumoto T, Wheeler JR, Miller N, Veith FJ, et al. Prosthetic above-knee femoropopliteal bypass grafting: five-year results of a randomized trial. *J Vasc Surg* 2000;31:417-25.
11. Parsons RE, Suggs WD, Veith FJ, Sanchez LA, Lyon RT, Marin ML, et al. Polytetrafluoroethylene bypasses to in Fra popliteal arteries without cuffs of patches: a better option than amputation in patients without autologous vein. *J Vasc Surg* 1996;23:347-56.
12. Pappas PJ, Hobson RW II, Meyers MG, Jamil Z, Lee BC, Silva MB, et al. Patency of infrainguinal polytetrafluoroethylene bypass grafts with distal interposition vein cuffs. *Cardiovasc Surg* 1998;6:19-26.
13. Londrey GL, Boshier LP, Brown PW, Stoneburner FD Jr, Pancoast JW, Davis RK. Infrainguinal reconstruction with arm vein, lesser saphenous vein and remnants of greater saphenous vein: a report of 257 cases. *J Vasc Surg* 1994;20:451-57.
14. Faries PL, LoGerfo FW, Arora S, Pulling MC, Rohan DI, Akbari CM, et al. Arm vein is superior to prosthetic-autogenous grafts in lower extremity revascularization. *J Vasc Surg* 2000;31:1119-27.
15. Soyoye DO, Abiodun OO, Ikem RT, Kolawole BA, Akintomide AO. Diabetes and peripheral artery disease: A review. *World journal of diabetes*. 2021 Jun 6;12(6):827
16. Diehm C, Schuster A, Allenberg JR, Darius H, Haberl R, Lange S, Pittrow D, Von Stritzky B, Tepohl G, Trampisch HJ. High prevalence of peripheral arterial disease and co-morbidity in 6880 primary care patients: cross-sectional study. *Atherosclerosis*. 2004 Jan 1;172(1):95-105.
17. Flu HC, Ploeg AJ, Marang-van de Mheen PJ, Veen EJ, Lange CP, Breslau PJ, Roukema JA, Hamming JF, Lardenoye JW. Patient and procedure-related risk factors for adverse events after infrainguinal bypass. *Journal of vascular surgery*. 2010 Mar 1;51(3):622-27.