

## Surgical infrainguinal revascularization for peripheral arterial disease: factors affecting patency rate

Ali Jafarian<sup>1</sup>, Fezzeh Elyasinia\*<sup>2</sup>, Mohammad Reza Keramati<sup>3</sup>, Farham Ahmadi<sup>4</sup>  
Reza Parsaei<sup>5</sup>

Received: 18 February 2015

Accepted: 8 June 2015

Published: 12 October 2015

### Abstract

**Background:** Peripheral arterial disease is a source of morbidity and mortality. Surgical vascular reconstruction is a treatment option but probability of failure and complications are important concerns. In this study, we evaluated outcome of surgical infrainguinal reconstruction and factors affecting graft patency for a period of one year.

**Methods:** In this cohort study, 85 consecutive patients with chronic ischemia who underwent lower extremity surgical vascular reconstruction (including 52 femoropopliteal and 25 femorofemoral bypass) from March 2007 to Feb 2009 were recruited. Graft patency was evaluated before discharge from hospital and one year after the surgical operation using duplex ultrasonography. Association between possible risk factors and graft patency were evaluated.

**Results:** In general, 71% (37 patients) of femoropopliteal and 52% (13 patients) of femorofemoral reconstructions were patent during the follow up period. Diabetes mellitus, hypertension, smoking, opium use and ischemic heart disease were significantly associated with decreased rate of patency ( $p < 0.05$ ).

**Conclusion:** Assessing risk factors that predict perioperative mortality and graft patency is essential for selecting patients that would benefit from surgery. Omitting surgical reconstruction and endovascular intervention may be preferable especially when multiple risk factors are present or in the absence of critical limb ischemia.

**Keywords:** Outcome, Surgical reconstruction, Peripheral vascular disease, Infrainguinal bypass.

*Cite this article as:* Jafarian A, Elyasinia F, Keramati MR, Ahmadi F, Parsaei R. Surgical infrainguinal revascularization for peripheral arterial disease: factors affecting patency rate. *Med J Islam Repub Iran* 2015 (12 October). Vol. 29:278.

### Introduction

Peripheral arterial disease (PAD) is a worldwide problem that has significant impact on quality of life and can also lead to mortality (1). As a result of the increased life expectancy and increased elderly population, the prevalence of PAD is growing (2). Patients with PAD may be asymptomatic, or they may present with intermittent claudication or chronic critical limb ischemia. The management of patients with PAD is complex and includes pharmaco-

logical therapy and/or surgery (3).

Surgical reconstruction can be an effective treatment that improves quality of life in case of claudication and save the limb in severe ischemia (4). However, since PAD is encountered usually in elderly patients with comorbidities, post-operative complications are major concerns (2,5). Besides, failure of revascularization and graft patency are seen in a proportion of patients; advent of endovascular intervention has provided alternate method of PAD manage-

<sup>1</sup>. Associate Professor of Surgery, Department of Surgery, Tehran University of Medical Sciences, Tehran, Iran. [jafarian@tums.ac.ir](mailto:jafarian@tums.ac.ir)

<sup>2</sup>. (**Corresponding author**) MD, Assistant Professor of Surgery, Department of Surgery, Tehran University of Medical Sciences, Tehran, Iran. [elyasiniarf@gmail.com](mailto:elyasiniarf@gmail.com)

<sup>3</sup>. Assistant Professor of Surgery, Department of Surgery, Tehran University of Medical Sciences, Tehran, Iran. [dr\\_morezak@yahoo.com](mailto:dr_morezak@yahoo.com)

<sup>4</sup>. Resident of General Surgery, Department of Surgery, Tehran University of Medical Sciences, Tehran, Iran.

<sup>5</sup>. General Surgeon, Department of General Surgery, Tehran University of Medical Sciences, Tehran, Iran. [parsaeir@irimc.org](mailto:parsaeir@irimc.org)

ment (6,7). This necessitates careful patient selection to achieve most beneficial result from surgical revascularization and avoid potential morbidity and complications. This study reviews experience of a referral center in infrainguinal surgical bypass and surveys patency rate and risk factors associated with failing in achievement of a durable vascular reconstruction.

## Methods

### Data

In this analytic prospective cohort study, 85 consecutive patients with chronic ischemia who underwent lower extremity surgical vascular reconstruction (including 52 femoropopliteal bypass and 25 femorofemoral bypass) were recruited. This study was done in a two year period from March 2007 to Feb 2009 at Imam Hospital affiliated to Tehran University of Medical Sciences. In addition to demographic data, patients' comorbidities and risk factors including ischemic heart disease, diabetes mellitus, hypertension, hyperlipidemia, history of preoperative and post-operative smoking and opium use were also obtained. Patency of patients' grafts were evaluated before discharge from hospital and one year after the operation using duplex ultrasonography. Statistical association between possible risk factors and graft patency were analyzed.

### Statistical Analysis

Data were analyzed using SPSS version 18. Relation between patients' characteristics and one year patency was evaluated using independent-sample t-test, Mann-Whitney, Fisher's exact test, and Chi-Square tests. P-values of less than 0.05 were considered as significant.

## Results

A total of 85 patients underwent infrainguinal surgical reconstruction during the study period. Eight patients did not adhere to follow up. Seventy seven patients were evaluated including 52 with femoropopliteal and 25 with femorofemoral vascular reconstruction. In all cases except for one femoropopliteal patient, saphenous vein grafts were used and in all femorofemoral patient synthetic graft was used.

The mean±SD age of the patients was 61.1±10.8 year (range: 39-89 year). Fifty three patients (67.9%) were male and 24 patients (32.1%) were female. The mean±SD creatinine level was 0.99 ± 0.24 mg/dl (range: 0.5-1.6), and mean±SD cardiac ejection fraction (EF) was 45.2 ± 6.8 percent (range: 25-55). Male to female ratio among those who underwent femoropopliteal and femurofemoral grafts were 2.5 to 1 and 1 to 1, respectively. Patient's characteristics and the analyzed correlation between preoperative risk factors and one year patency have been depicted in Table 1.

Three patients (3.8%) died in post-operative period due to myocardial infarction. The mean±SD EF was 45.2 ± 6.8 percent in alive and 32.8 ± 6.4 percent in dead patients (p=0.001). Thirty seven patients among those who underwent femoropopliteal graft (71%) and 13 patients among those who underwent femorofemoral graft (52%) showed a one-year complete vascular patency (p=0.003). Among those with failed reconstruction, two (3.8%) patients in the femoropopliteal group and 3 (12%) patients in the femorofemoral group underwent amputation and other patients with failed reconstructions were managed medically. Age, sex and creatinine level were not statistically different between those

Table 1. Patient's characteristics and relation between them and one year reconstruction patency

| Patient variable       | N (%)  | Patency In presence of variable (%) | Patency in absence of variable (%) | p     |
|------------------------|--------|-------------------------------------|------------------------------------|-------|
| Diabetes mellitus      | 39(50) | 36.5%                               | 63.5%                              | 0.001 |
| Hypertension           | 28(36) | 27%                                 | 73%                                | 0.010 |
| Smoking                | 35(45) | 34.6%                               | 65%                                | 0.010 |
| Opium use              | 32(41) | 32%                                 | 67%                                | 0.030 |
| Ischemic heart disease | 52(67) | 53%                                 | 81%                                | 0.010 |

with and without vascular patency ( $p < 0.05$ ). The mean  $\pm$  SD EF was  $46.2 \pm 7.4$  percent in patent and  $43.07 \pm 4.9$  percent in non-patent group that showed a significant difference ( $p = 0.049$ ). Hypertriglyceridemia was not related to the patency ( $p > 0.05$ ). Patients with claudication, rest pain and ischemic ulcers had not different patency rates; but diabetes mellitus, ischemic heart disease, hypertension, history of preoperative or postoperative smoking, and opium use were associated with failure of one year vascular patency.

### Discussion

Peripheral arterial occlusive disease is a major health problem and one of the most challenging vascular problems facing vascular surgeons. The complexity of the disease has been magnified by its association with other medical comorbidities such as cardiovascular and cerebrovascular disease. Therefore, risk factor modification seems to be essential to improve long-term survival of these patients (3). This study was performed to demonstrate the success and patency rate of infrainguinal vascular reconstruction for peripheral vascular disease and related factors affecting this patency. Generally, we found that 71% of femoropopliteal grafts and 52% of femorofemoral grafts had at least one year of patency. Similar results for femoropopliteal bypasses have been reported in other studies (8,9).

Goodney et al surveyed results of 2036 bypass procedures and reported a one year patency of 79% in patients suffering from claudication and 73% in patient with critical limb ischemia (9). In our study, patency rate was not statistically different in patients with critical ischemia compared to patients with claudication. Some studies have reported a decreased patency rate in older patients. This difference might be due the older mean age of patients in those studies comparing to ours. A cut off age of around 65-75 have been shown as a risk factor for patency failure (7,8). We found no relation between advanced age and patency rate that is consistent with some other

reports (9,10).

Opium use was associated with lower rate of patency in our patients. Association of opium addiction with increased post-operative complications has been investigated and yielded different results (11-13). Adverse effects of opium on cardiovascular system in experimental and clinical settings has been shown (14-16). It may be reasonable to consider opium addiction as a risk factor affecting results of surgical reconstruction. It is particularly true when considering that opium addicts may have less compliance to treatment and follow up.

Diabetes mellitus, hypertension, ischemic heart disease and smoking was associated with decreased patency as are reported in other studies (17,18). Diabetes has been shown to increase risk of PAD, but the effectiveness of tight glycemic control with regard to halting the progression of PAD, relieving symptoms of claudication, or increasing amputation-free survival is unclear (3,4). Hypertension should be treated according to the recommendations of the Eighth Joint National Committee (19). While some controversy exists regarding the effect of smoking cessation on regression of symptoms of claudication, the effects of smoking on progression of symptoms, increased risk of amputation, and failure of surgical therapy have been studied. Therefore, all patients with PAD should be advised to stop smoking (3,20).

While endovascular treatments have appealing advantage of lower morbidity and mortality, bypass surgery still has better long term outcome for femoropopliteal lesions with reported patency rate of up to 70% at 5 years (4). Lower extremity endovascular interventions may also result in some complications such as those related to puncture site, intervention site, distal vessel, and also systemic complications (21). The use of stent grafts has been studied for treatment of long segment femoropopliteal occlusive disease as well. Similar long-term patency has been reported when compared to conventional femoral-popliteal bypass using synthetic conduit (22,23). Neverthe-

less, further studies are required to prove long-term effect and cost-effective benefit of these studies. Mortality rate of surgical bypass should be considered as well. In our study early mortality rate (within 30 days after surgery) was 3.8%. Feinglas et al, in their study of 28128 patients who underwent lower extremity surgical bypass reported 30 mortality of 4.8%. They also showed that 31.4% of patients were alive 5 years after their initial operation without major amputation or subsequent bypass or revision procedures (24).

### Conclusion

Assessing risk factors that predict perioperative mortality and graft patency is essential for selecting patients that would benefit from surgery. Presence of such factors would suggest increased probability of graft occlusion and help surgeons in selecting best candidates for surgery. Omitting surgical reconstruction and endovascular intervention may be preferable especially when multiple risk factors are present or in the absence of critical limb ischemia.

### References

1. McDermott MM. The magnitude of the problem of peripheral arterial disease: epidemiology and clinical significance. *Cleveland Clinic journal of medicine* 2006;73 Suppl 4:S2-7.
2. Go AS, Mozaffarian D, Roger VL, Benjamin EJ, Berry JD, Blaha MJ, et al. Executive summary: heart disease and stroke statistics--2014 update: a report from the American Heart Association. *Circulation* 2014;129(3):399-410.
3. Pennywell DJ, Tan TW, Zhang WW. Optimal management of infrainguinal arterial occlusive disease. *Vascular health and risk management* 2014;10:599-608.
4. Norgren L, Hiatt WR, Dormandy JA, Nehler MR, Harris KA, Fowkes FG, et al. Inter-Society Consensus for the Management of Peripheral Arterial Disease (TASC II). *Journal of vascular surgery* 2007;45 Suppl S:S5-67.
5. Nowygrod R, Egorova N, Greco G, Anderson P, Gelijns A, Moskowitz A, et al. Trends, complications, and mortality in peripheral vascular surgery. *Journal of vascular surgery* 2006; 43(2):205-16.
6. Al-Omran M, Tu JV, Johnston KW, Mamdani MM, Kucey DS. Use of interventional procedures

for peripheral arterial occlusive disease in Ontario between 1991 and 1998: a population-based study. *Journal of vascular surgery* 2003;38(2):289-95.

7. Mingoli A, Sapienza P, Feldhaus RJ, Di Marzo L, Burchi C, Cavallaro A. Femorofemoral bypass grafts: Factors influencing long-term patency rate and outcome. *Surgery* 2001;129(4):451-8.

8. Schanzer A, Mega J, Meadows J, Samson RH, Bandyk DF, Conte MS. Risk stratification in critical limb ischemia: derivation and validation of a model to predict amputation-free survival using multicenter surgical outcomes data. *Journal of vascular surgery* 2008;48(6):1464-71.

9. Goodney PP, Nolan BW, Schanzer A, Eldrup-Jorgensen J, Bertges DJ, Stanley AC, et al. Factors associated with amputation or graft occlusion one year after lower extremity bypass in northern New England. *Annals of vascular surgery* 2010;24(1):57-68.

10. Rossi PJ, Skelly CL, Meyerson SL, Bassiouny HS, Katz D, Schwartz LB, et al. Redo infrainguinal bypass: factors predicting patency and limb salvage. *Annals of vascular surgery* 2003;17(5):492-502.

11. Azarasa M, Azarfarin R, Changizi A, Alizadehasl A. Substance use among Iranian cardiac surgery patients and its effects on short-term outcome. *Anesthesia and analgesia* 2009; 109(5):1553-9.

12. Safaii N, Kazemi B. Effect of opium use on short-term outcome in patients undergoing coronary artery bypass surgery. *General thoracic and cardiovascular surgery* 2010;58(2):62-7.

13. Sadeghian S, Karimi A, Dowlatshahi S, Ahmadi SH, Davoodi S, Marzban M, et al. The association of opium dependence and postoperative complications following coronary artery bypass graft surgery: a propensity-matched study. *Journal of opioid management* 2009;5(6):365-72.

14. Joukar S, Najafipour H, Malekpour-Afshar R, Mirzaeipour F, Nasri HR. The effect of passive opium smoking on cardiovascular indices of rabbits with normal and ischemic hearts. *The open cardiovascular medicine journal* 2010;4:1-6.

15. Najafipour H, Joukar S. Combination of opium smoking and hypercholesterolemia augments susceptibility for lethal cardiac arrhythmia and atherogenesis in rabbit. *Environmental toxicology and pharmacology*. 2012;34(2):154-9.

16. Sadeghian S, Darvish S, Davoodi G, Salarifar M, Mahmoodian M, Fallah N, et al. The association of opium with coronary artery disease. *European journal of cardiovascular prevention and rehabilitation : official journal of the European Society of Cardiology, Working Groups on Epidemiology & Prevention and Cardiac Rehabilitation and Exercise Physiology* 2007; 14(5): 715-7.

17. Biancari F, Alback A, Ihlberg L, Kantonen I, Luther M, Lepantalo M. Angiographic runoff score as a predictor of outcome following femorocrural

bypass surgery. *European journal of vascular and endovascular surgery* : the official journal of the European Society for Vascular Surgery 1999; 17(6):480-5.

18. Hertzner NR, Bena JF, Karafa MT. A personal experience with the influence of diabetes and other factors on the outcome of infrainguinal bypass grafts for occlusive disease. *Journal of vascular surgery* 2007;46(2):271-9.

19. James PA, Oparil S, Carter BL, Cushman WC, Dennison-Himmelfarb C, Handler J, et al. 2014 evidence-based guideline for the management of high blood pressure in adults: report from the panel members appointed to the Eighth Joint National Committee (JNC 8). *Jama* 2014;311(5):507-20.

20. Hankey GJ, Norman PE, Eikelboom JW. Medical treatment of peripheral arterial disease. *Jama* 2006;295(5):547-53.

21. Bradbury AW, Adam DJ, Bell J, Forbes JF, Fowkes FG, Gillespie I, et al. Multicentre randomised controlled trial of the clinical and cost-effectiveness of a bypass-surgery-first versus a balloon-angioplasty-first revascularisation strategy for severe limb ischaemia due to infrainguinal disease. *The Bypass versus Angioplasty in Severe*

*Ischaemia of the Leg (BASIL) trial*. *Health technology assessment* 2010;14(14):1-210, iii-iv.

22. Geraghty PJ, Mewissen MW, Jaff MR, Ansel GM, Investigators V. Three-year results of the VIBRANT trial of VIABAHN endoprosthesis versus bare nitinol stent implantation for complex superficial femoral artery occlusive disease. *Journal of vascular surgery* 2013;58(2):386-95 e4.

23. Lammer J, Zeller T, Hausegger KA, Schaefer PJ, Gschwendtner M, Mueller-Huelsbeck S, et al. Heparin-bonded covered stents versus bare-metal stents for complex femoropopliteal artery lesions: the randomized VIASTAR trial (Viabahn endoprosthesis with PROPATEN bioactive surface [VIA] versus bare nitinol stent in the treatment of long lesions in superficial femoral artery occlusive disease). *Journal of the American College of Cardiology* 2013;62(15):1320-7.

24. Feinglass J, Sohn MW, Rodriguez H, Martin GJ, Pearce WH. Perioperative outcomes and amputation-free survival after lower extremity bypass surgery in California hospitals, 1996-1999, with follow-up through 2004. *Journal of vascular surgery* 2009;50(4):776-83 e1.