Journal of Indonesian Society for Vascular and Endovascular Surgery
Vol. 1, No. 1, January 2020
pISSN 2715-1204 - eISSN 2715-1239

Original Article

Level of Patency for a One Year Period of Infra-inguinal Arterial Bypass in Patients with Peripheral Artery Disease

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JINASVS 2020;1(1):26-29

Introduction: Peripheral arterial disease (PAD) is the most common macroangiopathic complication in type II diabetes mellitus, arising from inadequate blood sugar control. In the presence of PAD, the risk of limb loss will also increase, and arterial bypass is one method to reduce the risk of amputation. In Indonesia, the level of patency for the arterial bypass has not yet been published. On bypass with venous grafts, the patency rates at the location of infrapopliteal reach at 70-80%, while the prosthetic graft is 30-50%.

Method: From 2009 to 2012, patients with arterial bypasses were analyzed. The level of patency was described by ultrasound examination and pulsation on clinical examination in the distal anastomosis, reduced pain, and other examinations that support adequate revascularization. Identification of risk factors that affect patency, particularly protective risk factors, were also taken into account.

Results: From 2009 to 2012, 29 patients with infra-inguinal arterial bypass were collected. The ratio of men to women was 5:1, with a one-year patency rate of 88% in men, and 75% in women, for an overall of 86.2%. The irreversible risk factor affecting patency was male ($p = 0.117$). Modifiable risk factors that decreasing patency level were smoking ($p = 0.042$) and more advanced stage of PAD ($p = 0.067$). Smoking cessation ($p = 0.041$) and the use of drugs after bypass procedure ($p = 0.072$) were known to increase the level of patency.

Conclusion: The one-year patency rate for infra-inguinal artery bypass was 37-89%. Smoking cessation was known to increase the level of patency.

Keywords: patency level, arterial bypass, infra-inguinal, peripheral arterial disease, diabetes
https://doi.org/10.36864/jinasvs.2020.1.007

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INTRODUCTION

Peripheral Arterial Disease (PAD) is a blockage of arterial blood flow out of coronary and intracranial arteries. PAD results from the process of atherosclerosis, embolism, thrombus, and inflammation that leads to arterial stenosis.[1] As many as 3-10% of the world's population suffer asymptomatic PAD and rises to 15-20% in the population above 70 years.[1,2] The presence of revascularization procedures in critical limb ischemia (CLI) significantly reduce amputation rates in PAD. Incidents for major amputation in large populations in several countries ranged from 120 to 500 million per year. The ratio between amputations below the knee and above the knee was about one to one. Approximately 60% of lower amputations were restored primarily, 15% restored secondarily, and another 15% had to be undergo amputations above the knee, and 10% were dead in the perioperative period. Our division in the vascular and endovascular, Department of Surgery FMUI - RSUPN Cipto Mangunkusumo, noted that 18.1-24.7% of diabetic patients with PAD had undergone amputation in the last three years, both for major and minor amputations.[1,2]

The Infra-inguinal bypass is a standard procedure for vascular surgery that has been developed in several decades.[3] In the treatment of symptomatic PAD, the infra-inguinal arterial bypass is an effective procedure.[4] This study aimed to know level of patency of one year in infra-inguinal arterial bypass and the factors that influence it.

METHOD

This was a prospective case-control study for patients in the Vascular and Endovascular Division of the Department of Surgery, Faculty of Medicine, Cipto Mangunkusumo, from January 2009 to December 2012. Data contained patient characteristics, risk factors, comorbid factors, and level of patency after infra-inguinal artery bypass were collected.

The data were colleceted from medical records from all of PAD patients in the Vascular and Endovascular Division of the Department of Surgery FKUI-RSUPN Cipto Mangunkusumo Jakarta. All PAD

patients treated to the Vascular and Endovascular Division of the Department of Surgery, FKUI-RSUPN Cipto Mangunkusumo Jakarta, who underwent surgery for primary and secondary infra-inguinal artery bypass from of January 2009 to December 2012 were included. Exclusion criteria were patients who underwent endovascular revascularization before infra-inguinal arterial bypass surgery. The data were analyzed using SPSS statistical program version 11.5 for Windows®.

RESULTS

A total of 29 patients were included in this study; none of the study subjects dropped out. On the characteristics of respondents, variables such as age, sex, comorbid disease, risk factors, and surgical characteristics were identified (table 1).

On this table were presented the mortality and morbidity levels and the level of patency infra-inguinal artery bypass (table 2).

In this study, the cumulative patency of bypass was examined using the Kaplan-Meier method and a comparison between survival graft using the Wilcoxon sign-rank test ($p< 0.05$, figure 1). At the level of patency infra-inguinal artery bypass were obtained overall survival of 86.2%, male overall survival of 88.0%, and female overall survival of 75% ($p = 0.8615$,log rank test)

DISCUSSION

The prevalence of peripheral arterial disease (PAD) ranges between 3-10% and increases as the life expectancy rate. At the age of 70 years and above, the prevalence of PAD also increases to 15-20%.[1,2,5,6] In this study, the increasing trend in the prevalence paralleled with the age growth. At the age of 40-49 years, the prevalence was 6.8%, after the following decade increased by 27.5%, and the following decade increased again by 44.8%, even though at the age of> 70 years it was only 3.4%. In terms of sex ratio, more men suffer from PAD than women (up to 5:1). Comorbid factors for diabetes mellitus and risk factors for smoking become the first factors for influencing PAD.[1,2,5,6]

Revascularization in peripheral arterial disease (PAD) can be done endovascularly or bypass surgery. Bypass procedure performed at the infra-inguinal level can be done in three places, which are femoropopliteal, femorodistal, and poplitealdistal. At the level of femoropopliteal and femorodistal, the patency was 77% and 67%, respectively.[7] In this study, the patency was 86.2%, which consists of 88% in men, and 75% in women. This result was consistent with the literature, which said that both PTFE graft and great saphenous vein graft had patency ranging from 75-84% for the patency rate of 1-year primary patency. For secondary patency, infra-inguinal femoropopliteal was not stated, but in the below-knee femoropopliteal there was a 68-96% patency rate.[4]

Factors affecting the output of infra-inguinal bypass are the presence of coronary heart disease, diabetes, renal insufficiency, age, smoking, chronic obstructive pulmonary disease, hypercoagulability, and the degree of ischemia.[8,9] In this study, smoking and diabetes became the first risk factors and comorbid affecting the output of the bypass.

In this study, we only got 29 samples, which was considered as a small amount in researching a survival analysis case. However, the results obtained were similar to the large-scale research.

The revascularization process in PAD does not only lead to survival analysis, but also the benefits felt by the patient. It was found that there was a decrease in the intensity of claudication and improvement in the condition of the wound or ulcer, so it can be concluded that revascularization also provides a clinical improvement for patients (table 2).

Several studies stated that there are relationship between risk factors and high amputation rates, including the Finnvasc score, which consists of diabetes, coronary heart disease, leg gangrene, and immediate surgery. This score has an effect on morbidity, which is the rate of amputations. Thus, it can determine the need for revascularization. Other studies mention Prevent III (PIII) risk factors, which are dialysis (4 points), tissue loss (3 points), age >75 years (2 points),

Table 1. Table of characteristics of PAD infra-inguinal artery bypass patients.

	Classification	Number (%)	*p* value
Age	≤30	1 (3,4)	
	30-39	4 (13,7)	
	40-49	2 (6,8)	
	50-59	8 (27,5)	
	60-69	13 (44,8)	
	≥70	1 (3,4)	0,062
Sex	Men	25 (86,2)	
	Women	4 (13,8)	0,117
Comorbid diseases	Diabetes mellitus	27 (93,1)	0,056
	Kidney	3 (10,3)	0,069
	Heart	6 (20,6)	0,198
	Lung	4 (13,7)	0,083
	No comorbid	0 (0)	-
Risk factors	Smoking	15 (51,7)	0,042
	Diabetes mellitus	27 (93,1)	0,096
	Hypercholesterolemia	19 (65,5)	0,106
	Hypertension	23 (79,3)	0,112
Anastomotic site	Femoro-popliteal	14 (48,2)	
	Femoro-distal	12 (41,3)	
	Popliteal-distal	3 (10,3)	0,077
Conduit type	Vein Reversion	10 (34,4)	
	In situ vein	9 (31,0)	
	Synthetic graft	10 (34,4)	0,098

Table 2. Mortality and morbidity rates and patency rates for arterial bypass.

	Item	Number (%)	*p* value
General complications	Airway infection	2 (6,8)	
	Pulmonary embolism	0 (0)	
	Myocardial infarct	2 (6,8)	
	Other heart abnormalities	5 (17,2)	0,078
Complications related to the procedure	Thromboembolism	1 (3,4)	
	Compartment syndrome	3 (10,3)	
	Hematoma	2 (6,8)	
	Seroma	2 (6,8)	
	Surgical wound infection	4 (13,7)	
	Pseudoaneurysm	0 (0)	0,066
Mortality	30 days	0 (0)	-
	1 years	0 (0)	-
Amputation free-survival	30 days	29 (100)	>1,00
	1 years	29 (100)	>1,00
Level of patency	Distal artery pulsation ++	24 (82,7)	
	Doppler flow tri/biphasic	15 (51,7)	0,120
	Decreased intensity of claudication	13 (44,8)	
	Improved wound ulcers	17 (58,6)	
	1-year mortality	0 (0)	0,089
	Fountaine I	3 (10,3)	
	Fountaine IIa	0 (0)	
	Fountaine IIb	5 17,2)	
	Fountaine III	2 (6,9)	
	Fountaine IV	19 (65,5)	0,067

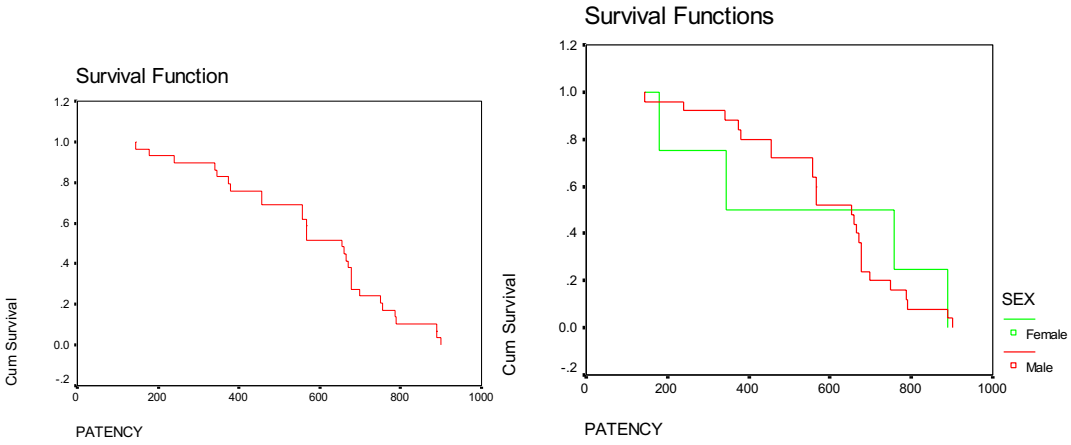

Figure 1. Overall survival chart of patency levels for infra-inguinal artery bypass and each sex.

hematocrit <30 (2 points), and coronary heart disease (1 point).

Revascularization is also affected by the type of conduit used. All studies support autologous reverse vein as the standard for revascularization, but in some studies, it has a similar survival rate with venous and synthetic grafts.

CONCLUSION

As people age more than 40 years are increasing, the prevalence of PAD will also increase, with men are more frequent compared to women (5: 1 ratio). The dominant risk factors and comorbid factors were diabetes and smoking. The patency rate for infra-inguinal artery bypass was 86.2% for overall survival, 88% for men, and 75% for women. There was a significant relationship with smoking cessation with the level of patency.

ACKNOWLEDGMENTS

The author states the original work, and there is no conflict of interest in doing this research.

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REFERENCES

1. Lars Norgen, William R Hiatt (editor). Inter society consensus for the management of peripheral arterial disease (TASC II). TASC II Working Group. 2004.

2. Vivian Ho, Douglas Wirthlin, Huifeng Yun, Jeroan Allison. Physician suplly, treatment, and amputation rates for peripheral arterial disease. J Vasc Surgery 2005; 42:81-7
3. T Lees, T Troeng, I. A Thomson, et al. International variations in infrainguinal bypass surgery – A Vascunet Report. Eur J Vasc Endovasc Surg. 2012 Aug;44(2):185-92. doi: 10.1016/j.ejvs.2012.05.006.
4. Eva Arvela. Editor. High-risk patients and high-risk grafts in infrainguinal bypass for critical limb ischemia. Academic Dissertation. Department of Surgery, Vascular Surgery, Institut of Clinical Medicine. University of Helsinki. 2011.
5. Paul L Allan. The peripheral arteries. In: Paul L Allan, Paul A Dubblins, Myron A Pozniak. W Norman McDicken. Clinical Doppler Ultrasound. Ch 4. Churchill Lkivingstone-Elsevier. London: 2004. p. 65-86
6. R Eugen Zierlier. Ultrasound assessment of lower extremity arteries. In: Zwiebel, Pellerto. Introduction to vascular ultrasonography 5th ed. Ch 18. Elsevier-Saunders. Philadelphia:2005, p. 341-380
7. Pereira et al. Meta-analysis of femoropopliteal bypass grafts for lower extremity arterial insufficiency. J Vasc Surg 2006;44:510-7
8. Sarin S, Shami S, Shields DA, Scurr JH, Smith PD. Selection of amputation level: a review. Eur J Vasc Surg. 1991. Dec;5(6):611-20
9. Patrick D Hallihan, Niamh Ni Choileain, eddie Myers, et al. Predictors Predictors of time to graft failure following infrainguinal arterial reconstruction. Surgical Science, 2011, 2, 166-172.