Original Article ISSN (O):2395-2822; ISSN (P):2395-2814

Redo Lower Limb Bypasses – Factors Affecting Patency And Limb Salvage.

B.Velladuraichi[1], S.Jeyakumar[2], K.Elancheralathan[2], T.Vidyasagaran[2], J.Amalorpavanathan[2], N. Sritharan[2].

[1]Assistant professor, Institute of Vascular Surgery, Madras Medical College, India.
[2]Professor, Institute of Vascular Surgery, Madras Medical College, India.

Received: May 2017
Accepted: June 2017

ABSTRACT

Background: Redo lower limb bypasses are done following early or late graft thrombosis in patients with critical limb ischemia or incapacitating claudication. Objectives: The purpose of our study was to analyze the factors affecting patency and limb salvage following redo lower limb bypasses. **Methods:** This study is a prospective study of 45 patients who underwent redo lower limb bypasses following failed lower limb bypass grafts over a period of three years at Institute of Vascular Surgery, Madras Medical College, Chennai. **Results:** The mean age of patients was 47.06 years. The gender, the site of distal anastomosis, and time of redo were the only three variables that showed significant effect on redo lower limb bypass patency and limb salvage. **Conclusion:** Redo lower limb bypasses provide long-term graft patency and limb salvage rates, with low operative mortality rates.

Keywords: graft failure, redo lower limb bypasses, graft thrombectomy, patch plasty, secondary bypasses.

INTRODUCTION

Postoperative graft thrombosis remains a significant clinical challenge in contemporary vascular surgical practice. Whether early or delayed, graft thrombosis continues to account for significant morbidity, limb loss, and mortality in patients requiring vascular intervention. Specifically, at 1 year after lower limb bypass graft failure, more than 50% of patients will have undergone major amputations.[1,2] Among the remaining patients, ischemic rest pain or ulceration will have developed in 25%, and more than 15% will have died.[3-5] The relatively high incidence of this complication and the major impact it has on our patients mandates an aggressive and effective management regimen.

The causes of graft thrombosis are multifactorial and involve patient demographics, risk factors, and co-morbid conditions, as well as technical issues associated with arterial reconstruction. Such risk factors and technical aspects of reconstruction have an impact on graft patency from the initial operation through the entire follow-up interval. With this in mind, technical precision at initial reconstruction is imperative to achieve an optimal outcome because technical errors account for 4% to 25% of early failure after revascularization.[6-8] Furthermore, optimal long-term graft durability remains in part, predicated on lifetime surveillance, timely re-interventions, and vigilant risk factor modification.[9-12] The purpose of this study is to analyze the factors affecting patency and limb salvage in patients underwent surgery for lower limb bypass graft failures.

Name & Address of Corresponding Author
Dr. B.Velladuraichi
Assistant professor,
Institute of Vascular Surgery,
Madras Medical College,
India

MATERIALS AND METHODS

Patient selection

The study material consists of 45 patients who underwent redo lower limb bypasses for incapacitating claudication, rest pain ,ischemic ulcer, gangrene following failed lower limb bypass grafts over a period of 36 months at Institute of Vascular Surgery, Rajiv Gandhi Government General Hospital & Madras Medical College ,Chennai.

Inclusion criteria

- All thrombosed lower limb bypass graft presenting with incapacitating claudication , ischemic ulcer , gangrene, rest pain.
- Early, intermediate and late graft failure
- Supra inguinal bypass
- Infrainguinal bypass
- Autogenous and prosthetic graft

Exclusion criteria

- Non salvageable limb
- Upper limb bypass

- Lower limb bypass for vascular trauma

Methods

Data acquisition

The studies are based on prospectively recorded patient data from outpatient and inpatient vascular registry maintained by the department and supplemented with data from patient records. The data were retrospectively analysed.

Evaluation

The graft thrombosis was diagnosed clinically by disappearance of previously palpable pulses, recurrence of symptoms, presence of ischemic ulcer and gangrene and by measuring Ankle Brachial Index. Routine baseline blood investigation and cardiac evaluation was done. Duplex scan was done to assess graft patency. Selective angiography or 64 slice angiography of the affected limb was performed if planned for any intervention.

By reviewing the past records, the details regarding the type of surgery, nature of the conduit used, post-operative outcome were obtained. Patients with immediate graft failure were subjected to emergency exploration and proceed after the confirmation of graft thrombosis by Duplex scan. The high chances of risk of limb loss were explained to all patients. The treatment modalities vary with type of procedure, nature of procedure, duration of graft thrombosis.

Surgery

The patients were routinely operated on under combined spinal and epidural anaesthesia. General anaesthesia and epidural anaesthesia was chosen for patients with a concomitant supra inguinal procedure and supra inguinal procedures. Continuous ECG monitoring was maintained during the operation and extended to the postoperative period as necessary. Cefaperazone sulbactum or Cefotaxime was given as an antibiotic for prophylaxis.

1. Graft thrombectomy
   - Alone
   - With graft to graft anastomosis
   -with redoing of distal anastomosis
2. Jump graft
3 .New secondary bypass
4. Patch plasty

RESULTS

45 patients who underwent redo lower limb bypasses for lower limb ischemia were enrolled in this study. In addition to demographic information, results analyzed for this study included (1) Procedure, (2) Graft Material, (3) Site Of distal anastomosis, (4) Surgical Indications (5) Patency of the redo bypass, (6) Limb Salvage, and (7) Patient Survival.

Demographic data and descriptive statistics

The bypasses in this series included 45 first-time reoperations, 6 second time reoperations, and 2 third time reoperations. Forty three of the original bypass procedures were performed by us, whereas the remaining were referred after failure of grafts performed elsewhere.

Ninety five percent of the patients were men and 4.4% were women, with a mean age of 47.06% years. The patients demonstrated the typical distribution of risk factors for peripheral vascular disease including tobacco use (95.56%), diabetes mellitus (11.1%), hypertension (11.1%), coronary artery disease (6.67%) and previous stroke (5.7%).

The conduits employed included autogenous vein in 19 bypasses (42.2%) and prosthetic graft in 6 cases (13.3%). The outflow vessel for the bypass grafts was the popliteal artery in 17 cases (37.8%), including 4 (8.9%) above-knee and 13 (28.9%) below-knee popliteal bypasses. Eighteen bypasses (40%) were to the tibial arteries. Several techniques were used to revise the primary graft, including Graft thrombectomy alone (Figure 1a) (26.67%), Graft thrombectomy with graft to graft anastomosis (Figure 1b) (4.44%), Redoing of distal anastomosis (6.67%), jump graft (28.8%), patch angioplasty (2.2%) (Figure 1c), new secondary procedure (31.1%).

Figure 1: a) Graftotomy for thrombectomy, b) Graft to graft anastomosis, c) Patch plasty.

Patency and Limb Salvage

For the 45 redo lower limb bypass grafts, early patency rate at the time of graft revision was 55.5% and two years patency rate was 40% and early limb salvage rate was 88.8% and two year limb salvage rate was 80%.

Gender Vs Patency

There was a statistically significant difference in the patency and limb salvage between male and female patients (P value- 0.001*). Even though the sample size was very small (female patients n=2), the results were statistically significant. (Patency rate 41.8% Vs 0%, Limb loss 16.2% Vs 50% and mortality rate 0% Vs 50%) .

Outflow vs patency

Grafts with tibial distal anastomosis (two year patency rate, 44.4% vs 22.2% ;Amputation rate- 27.8% vs 14.8%) had lower patency rate and higher amputation rate than grafts with popliteal and distal femoral anastomosis.

Time of first revision vs patency

Grafts that were revised within thirty days of the primary operation (two year primary patency: 30.4% (early) -81.8% (late); Limb salvage: 65.3% (early)-81.8% (late); Amputation rate: 34.7%(early) vs 0% (late)) were at greater risk for failure than were grafts with later revisions.

Techniques Vs Patency

For grafts revised with new secondary procedure (n=14), the patency rate was 100% and limb salvage rate was 100%. For grafts revised with patch angioplasty (n=1), the patency rate was 100%. For grafts revised with a jump graft (n=13), the patency rate was 30.7%, limb salvage rate was 69.23%.For grafts with graft thrombectomy (n=12), the patency rate was 41.6% and limb salvage rate was 66.6%.

Univariate analysis was performed on the aforementioned demographic, medical, and surgical factors with respect to graft patency. The gender (male vs female; (P - 0.04), the site of distal anastomosis (popliteal vs tibial ; (P-0.006) and time of redo (early vs late) were the only three variables that showed significant effect on redo lower limb bypass patency and limb salvage.[Table 1]

Table 1: Factors affecting patency and limb salvage

S.no	Factors			Patency	Limb salvage	Morbidity	P value
1	Gender	Male		18	36	-	<0.001*
		female		-	-	1	<0.001*
2	Risk factor	one		13	25	-	0.080
		two		2	7	1	0.073
		three		4	4	-	0.055
		four		-	-	-	0
3	Number of redos	One		15	32	-	0.041
		two		2	3	1	0.032
		three		1	1	-	0.021
4	Indication for redo	CLI		17	35	1	0.880
		Claudicant		1	1	-	0.780
5	Outflow vessel	CFA		1	1		0.472
		SFA		4	6		0.073
		Proximal popliteal		3	3		0.086
		Distal popliteal		4	13		0.074
		ATA		-	1		0.095
		PTA		5	11		0.006**
		Peroneal		1	1		0.426
6	Type of surgical technique	Graft thrombectomy	alone	5	8	-	0.472
			With graft to graft anastomosis	-	1		0.674
			Redoing of distal anatomosis	1	3		0.543
		Jump graft		4	9	1	0.625
		New secondary procedure		7	14		0.645
		Patch plasty					0.547
7	Conduit	RSV		6	18		0.432
		PTFE		4	4	1	0.635
		Composite		1	3		0.345
8	Duration of graft thrombosis	Early		7	15	-	0.041*
		Late		6	21	1	0.055

*,**-significant.

There were four early graft failures (8.8%, < 30 days after surgery) during the study, with all the four resulting in early amputations. Arteritis (n=9) patients (C - reactive protein positive patients) had higher amputation rate than TAO and ASO patients (Arteritis 44%, TAO- 9%, ASO -7.6%) The single operative death in the series (2.2%) resulted from a myocardial infarction.

DISCUSSION

Failure of an infra inguinal bypass graft presents a major challenge to the vascular surgeon. The correct management in any particular patient varies with a number of fundamental considerations. Most important is the functional status of the patient and the condition of the affected extremity. A significant proportion of patients will appear well compensated after graft thrombosis, with relatively mild disability not warranting intervention.

Outcome of redo lower limb bypass

Past reports of repeat limb bypass after a single graft failure have demonstrated poor patency rates of less than 30% at 5 years and similarly poor limb salvage rates.[13-16]

In our study, the overall results of 55.5% early patency rate, 88.8% early limb salvage rate and 40% 2 year patency, 80% 2 year limb salvage rate from the time of graft revision are similar to the results of other studies. This is quite encouraging, and confirms that durable patency may be achieved through revision of thrombosed grafts. Brewster et al. reported a 31% 5-year patency rate and a 52% limb salvage rate for failed lower limb bypass.[17] Other studies have reported repeat bypass after at least one prior failure to yield a primary patency rate of 37% to 57% at 5 years and the limb salvage rate at 5 years of 59% to 90%.[18,19] The 2-year limb salvage rate of 80% currently observed seems to be a significant improvement and may be the result of an early detection and timely intervention.

Factors affecting patency and Limb salvage

Several studies have identified a variety of factors potentially contributing to graft failure, including patient demographics, risk factors, comorbid diseases, conduit characteristics, adjuvant medical therapy and technical precision.[20-24] Even though the sample size was very small, the patency and limb salvage between male and female patients was statistically significant. (Patency rate 41.8% Vs 0%, Limb loss 16.2% Vs 50% and mortality rate 0% Vs 50%) . This is comparable to a study by Peter J Rossi et al, where they have found female gender was predictive of redo graft failure (2-year patency 73 ± 8% male vs. 39 ± 9% female, p = 0.01).[25] Bypass grafts to the tibial or pedal level had significantly lower 2-year patency rates after redo lower limb bypass than those to the popliteal artery (two year patency rate, 44.4% vs 22.2%; Amputation rate-27.8% vs 14.8%) .This may be simply explained by longer segments of graft at risk for new lesions to develop, poor quality of vein and poor run off. Edwards et al., reported 3 year patency rate 30% for tibial outflow in 202 patients.[26] Nguyen et al., the four year patency rate following early graft thrombosis was only 29.8% and 4-year limb-salvage rate after secondary bypass was only 43.9% .18.[27]

Early (<30 days) thrombosis of vascular reconstructions has been attributed to technical error. In our experience technical failure accounts for 28% of all primary graft failure and 3.4% of all lower limb bypasses. In a review of the Dartmouth-Hitchcock experience, it was found that technical errors accounted for roughly 25% of early graft failures.[7] Routine surveillance of bypass grafts with close clinical follow-up and serial duplex ultrasound scanning of the graft has become the standard of care in lower extremity bypass surgery. It is our practice to perform immediate re-exploration in any patient with perioperative graft failure when at initial surgery all components (including inflow, conduit and outflow vessels) of the revascularization were judged technically optimal. This group of 45 patients with failure of a previous lower limb bypass was treated with an aggressive policy of reoperation. This policy has resulted in acceptable long-term graft patency and limb salvage rates, with low operative mortality rates.

CONCLUSION

1. Redo lower limb bypasses provide excellent results and limb salvage rates and can be performed with low mortality rates and acceptable morbidity rates.
2. The optimal surgical strategy in patients with failed lower limb bypasses depends upon the identification of the underlying etiology and its correction by a new secondary surgical procedure.
3. Bypass graft to tibial level and grafts that required revision for early thrombosis had lower patency rates.
4. Graft surveillance program should be mandatory in all peripheral arterial bypasses as it will enable the identification of failing grafts as compared to failed grafts.

REFERENCES

1. Giswold ME, et al.: Modifiable patient factors are associated with reverse vein graft occlusion in the era of duplex scan surveillance. J Vasc Surg. 37 (1):47-53 2003 12514577
2. Watson HR, et al.: Relationship of femorodistal bypass patency to clinical outcome. Iloprost Bypass International Study Group. Eur J Vasc Endovasc Surg. 17 (1):77-831999 10071622
3. Lancaster RT, et al.: Predictors of early graft failure after infrainguinal bypass surgery: a risk- Adjusted analysis from the NSQIP. Eur J Vasc Endovasc Surg. 43(5):549- 555. 2012 22342690
4. Singh N, et al.: Factors associated with early failure of infrainguinal lower extremity arterial bypass. J Vasc Surg. 47 (3):556-561 2008 18295106.
5. Goodney PP, et al.: Risk Factors for Graft Failure and Amputation After Lower Extremity Bypass in Patients with Critical Limb Ischemia. Vascular Study Group of Northern New England. 2008 ME Portland
6. Stept LL, et al.: Technical defects as a cause of early graft failure after femorodistal bypass. Arch Surg. 122 (5):599-604 1987 3579569
7. Walsh DB, et al.: Intragraft drug infusion as an adjunct to balloon catheter thrombectomy for salvage of thrombosed infragenicular vein grafts: a preliminary report. J Vasc Surg. 11 (6):753-759 1990 2113591
8. Wolfle KD, et al.: [Follow-up of infra-inguinal bypass operations: value of the peak systolic Velocity and arm-ankle index for evaluation of femorodistal reconstructions.]. Vasa. 23 (4):349-356 1994 7817617
9. Mills JL, et al.: The characteristics and anatomic distribution of lesions that cause reversed vein graft failure: a five-year prospective study. J Vasc Surg. 17 (1):195-2041993 8421336
10. O'Mara CS, et al.: Recognition and surgical management of patent but hemodynamically failed arterial grafts. Ann Surg. 193 (4):467-476 1981 7212810
11. Turnipseed WD, et al.: Postoperative surveillance. An effective means of detecting correctable lesions that threaten graft patency. Arch Surg. 120 (3):324-328 1985 3882080
12. Veith FJ, et al.: Diagnosis and management of failing lower extremity arterial reconstructions prior to graft occlusion. J Cardiovasc Surg (Torino). 25 (5):381-384,1984 6238971
13. Silverman SH, Flynn TC, Seeger JM. Secondary femoral-distal bypass. J Cardiovasc Surg. 1991;32:121–126.
14. Painton JF, Avellone JC, Plecha FR. Effectiveness of reoperation after late failure of femoropopliteal reconstruction. Am J Surg. 1978;135:235–237.
15. Tyson RR, Grosh JD, Reichle FA. Redo surgery for graft failure. Am J Surg. 1978;136:165 170.
16. Burnham SJ, Flanigan DP, Goodreau JJ, Yao JST, et al. Nonvein bypass in below-knee reoperation for lower limb ischemia. Surgery. 1978;84:417–424.
17. Brewster DC, LaSalle AJ, Robison JG, et al. Femoropopliteal graft failures: clinical consequences and success of secondary procedures. Arch Surg. 1983;118:1043–1047.
18. Whittemore AD, Clowes AW, Couch NP, Mannick JA. Secondary femoropopliteal reconstruction. Ann Surg. 1981;193:35–42.
19. Edwards JM, Taylor LM, Porter JM. Treatment of failed lower extremity bypass grafts with new autogenous vein bypass grafting. J VASC SURG. 1990;11:136–145.

20. Singh N, et al.: The effects of the type of anesthesia on outcomes of lower extremity infrainguinal bypass. J Vasc Surg. 44 (5):964-968 2006 17000075
21. Gibson KD, et al.: Identification of factors predictive of lower extremity vein graft thrombosis. J Vasc Surg. 33 (1):24-31 2001 11137920
22. Gentile AT, et al.: Identification of predictors for lower extremity vein graft stenosis. Am J Surg. 174 (2):218-221 1997 9293849
23. Schanzer A, et al.: Technical factors affecting autogenous vein graft failure: observations from a large multicenter trial. J Vasc Surg. 46 (6):1180-1190 2007 18154993
24. Schanzer A, et al.: Statins are independently associated with reduced mortality in patients undergoing infrainguinal bypass graft surgery for critical limb ischemia. J Vasc Surg. 47 (4):774-781 2008 18381138
25. PeterJ Rossi MD,Christopher L skelly. Redo infra inguinal bypass-factorspredicting patency and limb salvage. Annals of Vascular Surgery 2001,17,492-502.
26. Edwards JM, Taylor LM, Porter JM. Treatment of failed lower extremity bypass grafts with new autogenous vein bypass grafting. J VASC SURG. 1990;11:136–145.
27. Nguyen et al., Optimal surgical strategy for failed lower limb bypasses-lessons learned from 300 reoperations., (J VAsc SURG 1995;21:282-95.)

How to cite this article: Velladuraichi B, Jeyakumar S, Elancheralathan K, Vidyasagaran T, Amalorpavanathan J, Sritharan N. Redo Lower Limb Bypasses – Factors Affecting Patency And Limb Salvage. Ann. Int. Med. Den. Res. 2017; 3(4): SG31-SG35.

Source of Support: Nil, **Conflict of Interest:** None declared