EJVES Short Reports (2019) 43, 21–23

TECHNICAL NOTE

Spiral Vein Graft Technique for Popliteal Artery Aneurysms

Gustav Pedersen [a,b,*], **Egil Gleditsch** [a,b], **Lydia Johnsen** [a,b], **Espen Gubberud** [a]

[a] Department of Vascular Surgery, Haukeland University Hospital, Bergen, Norway
[b] Department of Clinical Science, University of Bergen, Bergen, Norway

WHAT UNIQUE EDUCATIONAL MESSAGE IS PROVIDED AND WHY IS IT RELEVANT?
The spiral vein graft technique may be used for popliteal artery aneurysm (PAA) in patients lacking vein for bypass when infection risk is increased. It may also be an alternative in cases of graft infection following PAA surgery.

Introduction: In patients with popliteal artery aneurysm lacking a suitable vein for bypass, prosthetic graft, or endovascular stent graft are alternative treatment options. However, durability is limited. Construction of an autologous spiral vein graft has previously been used to replace infected aortic grafts and arteriovenous fistulas.
Technical summary: Five patients underwent surgery for popliteal arterial aneurysm with the spiral vein graft technique. Technical success was 100%. Operative technique and results are reported.
Conclusion: The spiral vein graft technique can be used for popliteal artery aneurysm with good short term results, avoiding use of prosthetic grafts.

Article history: Received 30 October 2018, Revised 24 March 2019, Accepted 7 April 2019,
Keywords: Popliteal artery aneurysm, spiral vein graft, posterior approach

INTRODUCTION

In patients with popliteal artery aneurysm (PAA) lacking a suitable vein for bypass, prosthetic graft or endovascular stent graft are alternative treatment options. However, durability is limited.[1,2]

Construction of an autologous spiral vein graft has previously been described and has been used to replace infected aortic grafts, to create arteriovenous fistulae, and to perform vascular reconstructions in complex cancer surgery.[3,4]

The spiral vein graft technique for PAA was used in five patients lacking a suitable vein for bypass. The technique and results are reported.

SURGICAL TECHNIQUE

Patients

From October 2016 to August 2017, five patients underwent surgery for PAA (Table 1). Mean aneurysm diameter was 3.9 cm (3.2–4.9 cm). None had a suitable vein for bypass, defined as vein diameter >3 mm on duplex scan in the upright position. Patients had to have at least one open tibial artery to the level of the ankle. Consent was obtained from all patients. The study was approved by the Regional Ethics Committee (REK 2017/1727).

Operative technique

The posterior approach to the popliteal artery was used. The great saphenous ($n = 3$), superficial accessory ($n = 2$), and/or small saphenous veins ($n = 1$) were retrieved, and in one patient a combination of the last two. The veins were split longitudinally and sutured around a plastic tube (2.5 mL plastic syringe, 8 mm diameter) in a spiral fashion with continuous polypropylene 6.0 sutures advancing 1 mm at a time, creating a tube graft with diameter and length matching the need. A lazy S incision was performed in the popliteal fossa. The aneurysm sac was incised longitudinally and supra- and/or infragenicular arteries were sutured. An inlay technique and end to end anastomoses with continuous polypropylene 5-0 sutures were performed (Fig. 1). Intra-operatively, duplex ultrasound (18 MHz probe) and transit time flow measurements were performed. Post-operatively, low molecular weight heparin 5000 units daily was administered until discharge (see Fig. 2).

* Corresponding author. Department of Vascular Surgery, Haukeland University Hospital, N-5021, Bergen, Norway.
E-mail address: gustav.pedersen@helse-bergen.no (Gustav Pedersen).

https://doi.org/10.1016/j.ejvssr.2019.04.001

Table 1. Patient characteristics, operative and follow up data of five patients receiving a spiral vein graft for popliteal arterial aneurysm.

Patient no.	Aneurysm size (mm)	BMI	Operative time (min)	Blood loss (mL)	Hospital stay (days)	Follow up (months)	Complication
1	49	27.5	213	1050	3	21	None
2	40	28.7	305	400	4	16	Sural nerve injury
3	40	24.9	257	300	2	13	Wound infection
4	32	24.5	258	600	2	14	Lymph fistula
5	35	31.1	243	100	2	8	None
Mean	39	27.3	255	490	2.6	14	

Aneurysm size is defined as the maximum antero-posterior diameter. BMI = body mass index.

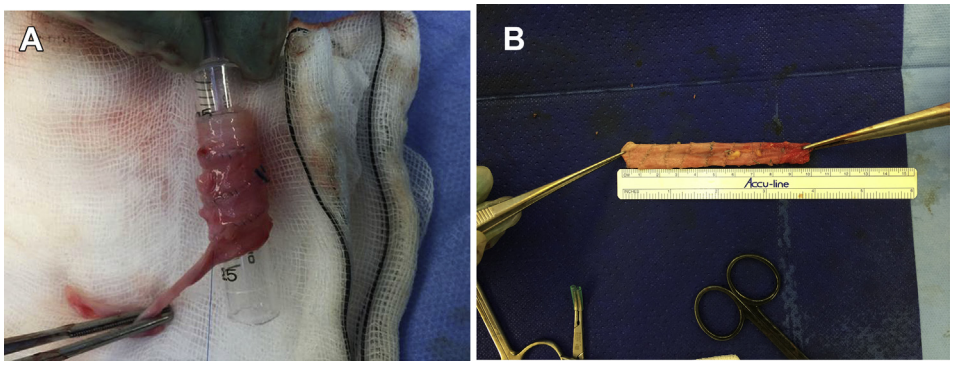

Figure 1. (A) The spiral vein graft is constructed around a sterile 2.5 mL syringe (8 mm diameter) using continuous sutures polypropylene 6-0. (B) A spiral vein graft with a length of 10 cm.

Follow up

A single antiplatelet agent (ASA) and statin were administered on a permanent basis. Clinical assessment, duplex ultrasound (Fig. 2), ankle and toe pressure measurements were done at one, three, six and 12 months post-operatively and annual follow up for five years in total was planned.

RESULTS

The mean graft length was 7.6 cm (range 5.0—10.0 cm). During construction, one graft became wider than intended (12 mm instead of 8—10 mm), but all graft diameters remained unchanged during follow up. Mean follow up was 14 months (range 8—21 months). At the last follow up, all grafts were open with a mean estimated flow of 320 mL/

Figure 2. Duplex ultrasound scan of a popliteal spiral vein graft at 12 months post-operatively. The arrows point to the distal anastomosis.

min (range 250—400 mL/min). Ankle brachial and toe brachial index values remained unchanged for all patients.

One graft developed intimal hyperplasia (IH) at the distal anastomosis three months post-operatively, increasing at six months to 40% stenosis but unchanged thereafter. There was one superficial wound infection, treated with antibiotics. One case of lymphatic fistula healed spontaneously after three months. There was one case of partial sural nerve injury following small saphenous vein harvesting.

DISCUSSION

Long term results following open and endovascular PAA treatment remain limited. A meta-analysis reported better primary patency rates for open repair at one and three years as compared with endovascular repair.[2] An Italian multicentre study found that at four years, primary patency for vein grafts was 84% *vs.* 52% for prosthetic grafts whereas corresponding patency for stent grafts was 73%.[1] The femoral artery transposition technique has been reported with good results but prosthesis infection, although rare, remains an issue.[5]

None of the patients in the present series had a suitable vein for bypass and would otherwise have been operated on using prosthetic grafts. This study demonstrates that it is possible to create a vein graft in patients lacking a suitable vein for bypass, thereby reducing the need for prosthetic grafts.

The diameter of the spiral vein graft in the present study may be of importance. The femoropopliteal arteries in PAA patients often have large diameters (8—10 mm) in contrast to the great saphenous vein. The diameter discrepancy in a conventional bypass may cause turbulent flow with subsequent anastomotic IH formation that may leave the graft prone to occlusion For IH, the large diameter of the spiral vein graft makes it less likely that the result will be a significant stenosis.

Interposition of a spiral vein graft using the inlay technique ensures a natural position with minimal external compression. The flexibility of the spiral vein graft may be particularly advantageous in the popliteal region, which has extreme three dimensional movements. These movements cause stress at graft anastomotic sites, especially if artificial grafts are used due to the stiffness of the prosthesis material. This may also trigger anastomotic IH formation.

CONCLUSION

This series demonstrates that PAA patients lacking a suitable vein for bypass can undergo surgery with the spiral vein graft technique and good short term results may be achieved. Spiral vein grafts may reduce the need for prosthetic grafts in selected cases. However, a larger study with longer observation is needed.

FUNDING

None.

REFERENCES

1 Pulli R, Dorigo W, Castelli P, Dorrucci V, Ferilli F, De Blasis G, et al. A multicentric experience with open surgical repair and endovascular exclusion of popliteal artery aneurysms. *Eur J Vasc Endovasc Surg* 2013 Apr;**45**:357—63.

2 Leake AE, Segal MA, Chaer RA, Eslami MH, Al-Khoury G, Makaroun MS, et al. Meta-analysis of open and endovascular repair of popliteal artery aneurysms. *J Vasc Surg* 2017 Jan;**65**:246—56.

3 van Zitteren M, van der Steenhoven TJ, Burger DHC, van Berge Henegouwen DP, Heyligers JMM, Vriens PWHE. Spiral vein reconstruction of the infected abdominal aorta using the greater saphenous vein: preliminary results of the tilburg experience. *Eur J Vasc Endovasc Surg* 2011;**41**:637—46.

4 Johnston PC. The helix fistula. *J Vasc Surg Cases* 2016;**2**:34—5.

5 Bounkong G, Davaine JM, Tresson P, Derycke L, Kagan N, Couture T, et al. Femoral artery transposition is a safe and durable option for the treatment of popliteal artery aneurysms. *J Vasc Surg* 2018;**68**:510—7.