Remote Endarterectomy: An Alternative to Surgical Bypass

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Abstract We present our preliminary results of remote endarterectomy performed during June 2003 to June 2010. 8 cases of unilateral iliofemoral disease, 3 cases of bilateral iliofemoral disease and 4 cases of femoro-popliteal disease constituting 18 limbs were successfully operated. All patients had comorbid conditions like Diabetes mellitus, hypertension, cardiac disease and smoking. Patency at 3 months with loss of one patient for follow up was 100 %. At one year follow up, the overall success rate was 90.90 %. One patient with Ilio-femoral Endarterectomy had progression of the disease and hence had to undergo Aorto-Femoral bypass. All patients who had tissue loss, showed complete recovery by 3 months and one patient was lost to follow up. A 5 year follow up had a patency rate of 74 %. Remote endarterectomy is a viable and durable alternative to standard bypass procedures. Remote endarterectomy combines the advantages of minimally invasive surgery with endovascular techniques.

Keywords Remote endarterectomy · Moll's ring cutter · Femoro popliteal disease · Ilio-femoral disease

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Introduction

Remote endarterectomy (RE), (first introduced by Ho and Moll in 1995), is a minimally invasive procedure that is performed through a small inguinal incision, allowing a complete debulking of the arterial plaque [1]. The traditional approach in the treatment of infrainguinal peripheral arterial occlusive disease has been medical management for patients with intermittent claudication and bypass procedures for those patients with extensive occlusive disease and limb-threatening ischemia. Results with bypass using autogenous conduits have been acceptable, however the low patency rates and high morbidity of the procedure has prevented its application to every patient with claudication [2]. Since the early 1990s, reports from Europe have espoused the virtues of RE of the superficial femoral and external iliac arteries from a small groin incision in patients with extensive disease [3]. The acceptance of this technique has been limited despite the availability of encouraging early patency data. The proposed advantages of RE include decreased morbidity, short hospital stays, available bypass options if required and a decreased incidence of limb-threatening ischemia if it fails. RE has evolved to treat occlusive disease of the iliac artery. It may be used as an adjunctive procedure for limb salvage when adequate length of the saphenous vein is not available for a bypass.

Over the past 7 years, we have performed and followed up 18 RE procedures for occlusive disease of iliofemoral and femoropopliteal segment.

Methods

This prospective study was conducted in the Department of Vascular Surgery at M.S. Ramaiah hospitals, during June 2003 to June 2010. A total of 15 patients who presented with symptoms of rest pain, non-healing ulcer and claudication pain were included in the study. Preliminary

investigations were done to assess the patient's well-being and to identify other comorbid conditions. All patients were subjected to color Doppler and angiographic evaluation (Fig. 1) and they were prepared for bypass (either aorto or distal) in cases of failure of the RE. Moll ring endarterectomy stripper was used either in retrograde or antegrade fashion, depending upon the block (Figs. 2 and 3) and monitored intraoperatively by antegrade and retrograde bleeding. RE was performed for obliterated femoral artery in 4 limbs and iliac artery in 14 limbs. Following intravenous administration of 100U/kg Heparin and clamping, longitudinal arteriotomy of 2 cm was made in the common femoral artery and superficial femoral artery. The endarterectomy plane was defined between the inner and outer arterial media, i.e. the plaque was separated from the arterial wall leaving the external elastic layer and adventitia. The diseased end artery in each patient varied in length from 20–24 cm and was removed entirely by applying traction distally. Brisk arterial inflow indicated a satisfactory revascularization.

“Tacking up” of the distal plaque of SFA was performed in 4 limbs: balloon angioplasty in 1 limb and open tacking of the plaque in 3 limbs to prevent further dissection. Any remnant thrombus/debris was removed with a Fogarty embolectomy catheter. All arteriotomies were closed with a vein or PTFE patch. Postoperative check angiograms were done to confirm clearance of the plaque (Fig. 4).

All patients were anticoagulated with heparin for 3 days, followed by oral anticoagulation (warfarin, based on INR value) for 3 months and life-long antiplatelet therapy with 150 mg acetylsalicylic acid (Aspirin), an oral phosphodiesterase inhibitor like cilostazol 100 mg and statins. A significant symptomatic

Fig. 1 MR angiogram of infra renal aorta showing left common iliac artery to distal SFA occlusion

Fig. 2 ileofemoral fibrous core taken out through the femoral arteriotomy using moll's ring cutter

relief in terms of decreased rest pain, increase in claudication distance and ulcer healing were noted. All patients were followed up every 3 weeks for the first 3 months and every 3 months thereafter with symptom gradation and duplex assessment.

Results

The study consisted of 13 male patients and 2 female patients (15 patients) with a mean age of 55.3 years (45–69 years) and a total of 18 affected limbs were studied (Table 1). Disabling claudication ($n=3$), critical ischemia ($n=7$) and non-healing ulcers ($n=13$) were the presenting

Fig. 3 both ilio femoral and femoro popliteal fibrous core extracted through the groin wound and above knee popliteal segmental arteriotomy for tacking the distal flap protecting it from dissection

Fig. 4 Peripheral conventional angiogram showing good revascularization of the femoropopliteal segment

complaints (Table 1). Eight cases of unilateral iliofemoral disease, three cases of bilateral iliofemoral disease and four cases of femoropopliteal disease constituting 18 limbs were studied (Table 2). Diabetes mellitus, hypertension, cardiac disease and smoking were associated conditions seen.

Patency at 3 months with loss of one patient for follow-up was 100 %. At one year follow-up, the overall success rate was 90.09 %. No intraoperative or immediate postoperative complications were seen in any patients. One patient with claudication pain had progressive disease after 6 months and underwent aortofemoral bypass procedure with PTFE graft. All patients with rest pain had complete recovery at 3 months. Except one patient who was lost to follow-up, rest of the patients with tissue loss showed complete recovery by 3 months. A 5-year follow-up in 2008 had a patency rate of 74 %. One, amongst the long-term followed-up patients, needed below knee amputation for gangrene.

Table 1 Patient characteristics, comorbid conditions and symptomatology

Patient characteristics	Number of patients
Sex	
Male	13
Female	2
Diabetes mellitus	8
Hypertension	7
Smoking	12
Cardiac diseases	10
Critical ischemia of the limb	7
Claudication pain	3
Non healing Ulcer	13

Table 2 Different levels of disease encountered

Level of disease	No of patients(<i>n</i> =15)
Iliofemoral unilateral	8
Iliofemoral bilateral	3(6 limbs)
Femoropopliteal	4
Total number of limbs with disease	18

Discussion

Atherosclerotic arterial disease of the lower extremities is a very common event, especially after the age of 55. The prevalence of intermittent claudication is 4.5 % of which 3–5 % of patients with intermittent claudication will develop critical limb ischemia, resulting in higher amputation rates (25 %) [4]. To date, the treatment algorithm has been comprised of medical management of patients with claudication and the use of bypass, primarily the reverse autogenous greater saphenous vein onto the first segment of popliteal artery in case of medical treatment failure or clinical stage III or IV fontaine grades. In case the greater saphenous vein is not morphologically suitable for bypassing, a synthetic prosthetic graft of Teflon or Dacron is used.

RE is a possible alternative solution in treating occlusions of the superficial femoral artery and iliac artery.

In a study by Smeets et al., with 49 remote iliac artery endarterectomies being performed in 48 patients, the indications for surgery were claudication in 28 patients (57 %), rest pain in 13 patients (27 %) and gangrene in 8 patients (16 %) [5]. In our study, a large number of patients presented with advance stages of the disease like gangrene and tissue loss (85 %). A few number of patients presented with early stages of rest pain and claudication pain, i.e. 50 % and 20 %, respectively.

Revascularization procedures in the femoropopliteal region often have a time-limited patency, and percutaneous transluminal angioplasty in indicated cases has a 5-year patency of 30 %. Reverse greater saphenous vein bypasses and artificial bypasses have a 5-year patency of about 60 % and 40 %, respectively [6]. Abbott et al., in a large multi-center study, reported a 58 % primary patency rate and a 75 % secondary patency rate for above-knee femoropopliteal bypass at 3 years [7].

RE with stent application is a new operative technique. The results from St. Antonius Hospital in Nieuwegein, the Netherlands, are encouraging. They show the 2-year primary, primary assisted and secondary patency of 73 %, 86 % and 86 %, respectively [8, 9]. Smeets et al. have shown a 3-year cumulative primary patency rate of 60.2 %±12 % with secondary patency rates of 94.2 %±5.5 % [5]. Another study by Rosenthal et al. also shows higher cumulative patency rates of 93.2 % at 3 months and 74.9 % at 1 year [10].

In our experience with RE, a primary patency rate of 100 % at 3 months and 90.09 % at the end of 1 year was seen. Of the patients who were followed up for 5 years, the primary patency rate of 62 % has been noted. Most of the failures were due to incomplete adherence to medical management postoperatively and due to progressive and worsening states of the comorbid conditions, especially in the elderly.

Conclusion

RE is a viable and durable alternative to standard bypass procedures. It combines the advantages of minimally invasive surgery with endovascular techniques. Operative trauma is minimal, allowing for a short hospital stay and recuperation period after discharge.

Another advantage of RE is the avoidance of a prosthetic graft with the associated risks of graft infection, false aneurysm and acute thrombosis, while maintaining similar primary patency rates (69.4 % for remote superficial femoral artery endarterectomy and 60.2 % for remote iliac artery endarterectomy) compared to bypass procedures.

It needs awareness of procedural complications and close monitoring. Patients can always undergo secondary salvage procedures. It also allows for a far better environment for the application of new endovascular therapies (e.g. stents, endografts) whenever needed.

References

1. Ho GH, Moll FL, Hedeman Joosten PPA et al (1995) The Mollring Cutter remote endarterectomy: preliminary experience with a new endovascular technique for treatment of occlusive superficial femoral arterial disease. *J Endovasc Surg* 2:278–287
2. Jackson MR, Belott TP, Dickason T, Kaiser WJ, Modrall JG, Valentine RJ et al (2005) The consequences of failed femoropopliteal bypass grafting: comparison of saphenous vein and PTFE grafts. *J Vasc Surg* 32:498–504
3. Van der Heijden FH, Eikelboom BC, van ReedeDortland RW, van der Graaf Y, Steijling JJ, Legemate DA et al (1993) Long-term results of a semi-closed endarterectomy and the outcome of failed reconstructions. *J Vasc Surg* 8:271–9
4. Management of Peripheral Arterial Disease (2000) Transatlantic InterSociety Consensus. *Int Angiol*. 19 (Suppl 1)
5. Smeets L, Borst GJ, deVries JP et al (2003) Remote iliac artery endarterectomy: seven-year results of a less invasive technique for iliac artery occlusive disease. *J Vasc Surg* 38:1297–1304
6. Jeans W, Armstrong S, Cole SEA, Horrocks M, Baird RN (1990) Fate of patients undergoing transluminal angioplasty for lower limb ischemia. *Radiology* 177:559–64
7. Abbott WM, Green RM, Matsumoto T, Wheeler JF, Miller N, Veith FJ et al (1997) Prosthetic above-knee femoropopliteal bypass grafting: results of a multicenter randomized prospective trial. *J Vasc Surg* 25:19–28
8. Ho G, Fl M, Joosten P, Van De Edwm P, Van De Jc B, Thic O (1996) Endovascular remote endarterectomy in femoropopliteal occlusive disease: one year clinical experience with the ring strip cutter device. *Eur J Vasc Endovasc Surg* 12:105–12
9. Moll FL, Ho GH (2000) Infrainguinal technical improvements. Remote endarterectomy. In: Greenhalgh R, Powell J, Mitchell A (eds) *Vascular and endovascular opportunities*. Saunders, Philadelphia, pp 455–62
10. Rosenthal D, Martin JD, Schubart PJ, Wellons ED (2004) Remote superficial femoral artery endarterectomy. *J Cardiovasc Surg* 45:185–92