Functional outcome after femoral endarterectomy: A single-centre experience

Muhammad S Sajid MBBS MBA MSc MD FRCS, Mittal Desai MBBS MRCS, Jasmin Rimpel MBBS, Daryll M Baker MD FRCS, George Hamilton MD FRCS

MS Sajid, M Desai, J Rimpel, DM Baker, G Hamilton. Functional outcome after femoral endarterectomy: A single-centre experience. *Int J Angiol* 2008;17(1):33-36.

OBJECTIVE: To assess limb salvage and functional outcome in patients who underwent femoral endarterectomy (FE).

METHODS: A single-centre, retrospective analysis of all patients undergoing FE in the past four years.

RESULTS: FE was performed on 30 patients (32 symptomatic legs) to treat gangrene (n=5), pain at rest (n=7) and incapacitating intermittent claudication (n=20). Patients had a mean age of 76.2 years. Twenty-three FEs were performed electively and nine were emergency procedures. Twenty-two patients were operated on under general anesthesia, five under local anesthesia and three under spinal/epidural anesthesia. Forty-six per cent of the patients underwent a simultaneous revascularization procedure (33% profundaplasty,

3% femoral-femoral cross-over, 3% femoral-popliteal and 3% aorto-bifemoral bypass). Overall patency rate and limb salvage rate was 80% and 74%, respectively, at mean follow-up of 25 months. Early mortality was 6% and morbidity was 24%. Among the living patients, 88% were happy with their quality of life and rated the procedure excellent, 6% rated the procedure as good and 6% rated the procedure as bad.

CONCLUSION: The functional outcome of FE is very favourable, either as a primary or adjunctive procedure where angioplasty is not possible. FE can be performed under locoregional anesthesia, which is potentially suitable in elderly patients to avoid major amputation and its associated sequelae.

Key Words: Amputation; Femoral artery; Femoral endarterectomy; Gangrene; Leg ischemia

Despite a dramatic increase in the use of endovascular techniques to treat chronic limb ischemia secondary to femoral arterial disease (FAD), femoral endarterectomy (FE) and profundaplasty remain the procedures of choice because long-term patency results are still superior to any other intervention (1). The results after endovascular interventions are associated with frequent occurrence of diffuse, long-segment disease, occlusion and small vessel calibre. Patients with critical ischemia have multilevel disease and have not been considered good candidates for an angioplasty, and there is a debate on whether endovascular treatments are effective for limb salvage. The American Heart Association (2) has recommended that angioplasty of the femoral artery be carried out only in single lesions of less than 10 cm, and better results are associated with short lesion length and good runoff, claudication, stenosis and the absence of diabetes. Nevertheless, long-segment, diffuse femoral stenosis or occlusion outside these recommendations are occasionally treated by angioplasty, and various attempts have been made to improve long-term patency in these adverse lesions, notably with the use of intravascular stents. The immediate placement of a stent after angioplasty may address the issues of elastic recoil and dissections and improve the early success rate, but it has not been shown consistently to improve long-term patency (3). The results of angioplasty and endovascular stenting for FAD have been sporadic. Therefore, open surgical intervention, which is more reliable and well proven, may only be the option in these patients. The objective of the present retrospective study was to analyze the functional outcome in patients with FAD in whom endovascular interventions were not possible; therefore,

these patients underwent FE (endarterectomy at the level of common femoral artery [CFA], proximal superficial femoral artery [SFA] and proximal profunda femoris artery [PFA]) with some other simultaneous revascularization procedures.

METHODS

A retrospective analysis of all patients who underwent FE and profundaplasty during the past four years in a major vascular unit was conducted. All patients who underwent FE with or without other simultaneous revascularization procedures were identified through a computerized database (Dendrite) and from surgical registers. Using the sole patient record that is shared by all departments in the institution, data were collected on current and previous cardiovascular, respiratory, renal, neurological and gastrointestinal diseases. Clinical data provided by general practitioners were also available for review. Anesthetic records, which are routinely completed by the anesthetist during the preoperative visit and record highlighted risk factors, were also evaluated in detail. Data on specific causes of death were obtained from death certificates of patients. Data extraction and analysis was performed by two authors (MS and MD) separately and results were compared and agreed on. FE and profundaplasty was given a category of major surgery. Late functional outcome in all living patients was assessed by clinical history, clinical examination, arterial duplex scanning and direct questioning by telephone.

Postoperative complications were defined as conditions developed postoperatively or pre-existing conditions that required either further medical or surgical treatment, or that prolonged the hospital stay. Record of total blood loss was

Department of Vascular Surgery, Royal Free Hospital, Pond Street, Hampstead, London, United Kingdom

Correspondence: Dr MS Sajid, Washington Suite, North Wing, Worthing Hospital, West Sussex BN11 2DH, United Kingdom.

Telephone 01-903-205-111 ext 4030, fax 01-903-285-052, e-mail surgeon1wrh@hotmail.com

TABLE 1
Preoperative risk assessment in patients undergoing femoral endarterectomy

Complication	n
Severe cardiac disease (eg, recent myocardial infarction, angina at rest, uncontrolled congestive heart failure, severe valve disease, uncontrolled arrhythmias)	8
Chronic renal failure (eg, patients on dialysis, urea >25 mmol/L to 40 mmol/L, creatinine >250 µmol/L to 400 µmol/L)	3
Severe chronic obstructive pulmonary disease (eg, forced expiratory volume in 1 s <60%, partial pressure of oxygen <8 kpa, partial pressure of carbon dioxide >6 kpa to 7 kpa)	3
Uncontrolled hypertension (eg, patient on more than three antihypertensive agents and diastolic blood pressure more than 100 mmHg)	9
Diabetes with its complications (eg, retinopathy, myopathy, neuropathy, nephropathy and poorly controlled diabetes mellitus)	5
Obesity (body mass index more than 27 kg/m ²)	2
Cerebrovascular accidents (still hemiparesis)	2
Smoking (more than 20 cigarettes/day)	19
Hypercholesterolemia (cholesterol level more than 6 mmol/L)	14

taken from nursing and anesthetic notes. Myocardial disease, renal disease and cerebrovascular disease were defined as in Table 1. Renal complications were defined as an increase in serum concentration of creatinine that required medical treatment and/or dialysis. The spectrum of respiratory complications ranged from pneumonia to radiographic evidence of atelectasis or pleural effusion. The diagnosis of ischemic heart disease was made by electrocardiographic changes of ischemia and/or elevated serum creatine kinase-MB and/or serum troponin T to standard positive level.

RESULTS

FE was performed on 30 patients admitted to a major vascular unit over the period of four years. There were 20 men and 10 women in the study cohort. There were 32 symptomatic legs treated for gangrene (n= 5), rest pain (n=7) and incapacitating intermittent claudication (n=20). The mean age of study group was 76.2 years. The majority of these procedures (23 of 30) were performed electively after preoperative optimization of patients. There were nine emergency procedures on patients who presented with acute critical leg ischemia or acute-on-chronic leg ischemia. Twenty-two patients were operated under general anesthetic, five under local anesthetic and three under combined spinal/epidural anesthetic. Thirteen patients were in the American Society of Anesthesiologists (ASA) operative risk group III, nine patients in were ASA II and eight patients were in ASA I (Table 1). Forty-six per cent of the patients underwent a simultaneous revascularization procedure. In 11 patients (33%), profundaplasty was performed due to associated profunda root stenosis or occlusion. One patient (3%) underwent a femoral-femoral crossover bypass due to proximal iliac artery occlusion. One patient (3%) underwent femoro-popliteal bypass surgery due to a 22 cm long occlusion of the SFA. One patient (3%) underwent an aorto-bifemoral bypass due to severe bilateral iliac disease with poor inflow at the femoral level. Overall femoral artery patency rate and limb salvage rate was 80% and 74%, respectively, at mean follow-up of 25 months (range, six to 49 months). At mean follow-up, 75% of patients were alive with viable limbs and 12% were alive with amputated limbs (Figure 1). Early mortality was 6% (n=2). Both patients died of sepsis and multiple organ failure secondary to gangrenous limbs. The postoperative complication rate was 24%. One patient developed severe myocardial infarction, which required admission to

the coronary care unit. Five patients developed wound infections, which required intravenous antibiotics. Two patients developed groin wound dehiscence, which required long-term wound care. Mean hospital stay was 8.14 days (range, three to 36 days). The readmission rate was 15% (n=5). Main causes of readmission were wound infection (n=3), wound dehiscence (n=2) and critical leg ischemia (n=1). Among the living patients, 88% were happy with their postoperative quality of life and rated the procedure excellent, 6% rated the procedure as good and 6% rated the procedure as bad (Figure 2) due to recurrence of leg ischemia and or reoperation. Only 9% (n=3) were reoperated. One of the three was revascularized successfully and two eventually required limb amputation.

DISCUSSION

The use of angioplasty and endovascular intervention for treating atherosclerotic disease of femoral arteries is controversial, owing to the disappointing long-term patency rate. Patency at one year, assessed using vascular laboratory criteria for SFA angioplasty without stenting, has been reported to be as low as 13% (4). The lack of sustained symptomatic relief is another issue that has limited its success (5,6). Many vascular surgeons believe angioplasty and endovascular interventions should not be considered as a primary treatment of FAD, especially in the SFA and PFA. Nevertheless, in view of its low morbidity and repeatability, angioplasty still remains the most utilized techniques for patients with FAD, especially those deemed unfit for surgery and those who wish to undergo a less-invasive alternative. The role of femoral angioplasty in advanced femoral disease, with its associated long and irregular stenosis/occlusions, diffuse involvement and poor runoff, is even more limited. Few studies have investigated the long-term results of angioplasty of these unfavourable lesions. One prospective case series of primary stenting in SFA occlusions (mean length 14 cm) in 71 limbs (90% claudicants) reported three-year primary and secondary patency rates of 30% and 68%, respectively, and a limb salvage rate of only 57% (1). Technical modifications, including the use of subintimal angioplasty for long segment lesions, have also been used as an alternative means of treating FAD but without any significant improvement in outcome.

According to TASC II recommendations (7), surgical revascularization should be performed in type D (long occlusion of CFA or SFA) lesions and in type C (multiple stenosis or occlusion of CFA with or without heavy calcification and

Figure 1) Functional outcome after femoral endarterectomy

recurrent stenosis or occlusions that need treatment after two endovascular interventions) lesions. This further strengthens the idea of open surgical revascularization in patients with FAD. The Bypass versus Angioplasty in Severe Ischaemia of the Leg (BASIL) trial (8) showed equivocal results (ie, in patients presenting with severe limb ischemia due to infringuinal disease and who were suitable for surgery and angioplasty, a bypass surgery-first and a balloon angioplasty-first strategy were associated with broadly similar outcomes in terms of amputation-free survival, and in the short term, surgery was more expensive than angioplasty). This trial included patients with chronic leg ischemia having disease in any infringuinal artery. Distal lesions (popliteal artery disease, tibial artery disease and trifurcation disease) are better managed by endovascular techniques (9), but outcomes are less favourable in proximal lesions such as CFA or SFA stenosis and occlusion. Thus, the BASIL trial may not have provided enough evidence to conclude the equal efficacy of both endovascular and open surgery for FAD.

We adopted a standard policy of FE and/or profundaplasty of all lesions in patients with FAD because of the inherent adverse nature of long segment disease and occlusions, and the frequent occurrence of suboptimal anatomical and hemodynamic results after angioplasty. A team of vascular surgeons in a dedicated vascular operating room conducted the procedures. We examined the long-term patency results using serial duplex scanning and clinical outcome by limb salvage. This group of patients had the most unfavourable lesions (occlusion moderate to severe stenosis, long segment involvement and poor distal runoff). A significant failure was expected due to the severity of arterial disease and associated cardiac, respiratory and renal diseases. Nevertheless, at 25 months, the 80% patency rate and 74% limb salvage rate is highly encouraging.

Groin wound complications following FE are the biggest nuisance in this group of patients. In our study, wound-related complications occurred in 23% (n=7) of the patients. Two of the patients developed deep wound infection and subsequent wound dehiscence. Five patients developed superficial wound infection and cellulitis requiring intravenous or oral antibiotics. All of these patients were given perioperative prophylactic antibiotics, and vertical groin incision was used to expose the CFA, SFA and PFA. It is probable that modifying the wound incision (a smaller incision or an oblique groin crease incision) would have influenced the outcome but evidence to justify these kinds of incisions is lacking.

Figure 2) Postoperative patient-reported level of satisfaction with femoral endarterectomy

In addition to open and endovascular techniques used for the management of FAD, new interventions such as Silverhawk atherectomy, FoxHollow atherectomy or laser atherectomy (3,10-12) are also being used, but with variable success rates. Long-term results are required before recommending these techniques for the management of FAD.

CONCLUSIONS

The functional outcome of FE is very favourable in FAD, either as a primary or adjunctive procedure, in patients in whom angioplasty is not possible and results after endovascular intervention are equivocal. FE can be performed under loco-regional anesthesia, which is potentially suitable in elderly patients to avoid major amputation and its associated sequelae. Based on our experience, FE should be performed as a first line of action in patients with peripheral vascular disease due to femoral stenosis, rather than endovascular interventions that result in questionable outcomes. However, further studies are required to quantify the efficacy of FE versus endovascular techniques for FAD.

NOTE: Presented at the AGM of European Society of Cardiovascular Surgery 2007, Venice, Italy.

REFERENCES

- Adam DJ, Beard JD, Cleveland T, et al; BASIL trial participants. Bypass versus angioplasty in severe ischaemia of the leg (BASIL): Multicentre, randomised controlled trial. *Lancet* 2005;366:1925-34.
- Ahn SS, Rutherford RB, Becker GJ, et al. Reporting standards for lower extremity arterial endovascular procedures. Society for Vascular Surgery/International Society for Cardiovascular Surgery. *J Vasc Surg* 1993;17:1103-7.
- Dieter RS, Pacanowski JR Jr, Ahmed MH, Mannebach P, Nanjundappa A. FoxHollow atherectomy as a treatment modality for common femoral artery occlusion. *WMJ* 2007;106:90-1.
- Golledge J, Ferguson K, Ellis M, et al. Outcome of femoropopliteal angioplasty. *Ann Surg* 1999;229:146-53.
- Gordon IL, Conroy RM, Arefi M, Tobis JM, Stemmer EA, Wilson SE. Three-year outcome of endovascular treatment of superficial femoral artery occlusion. *Arch Surg* 2001;136:221-8.
- Karch LA, Mattos MA, Henretta JP, McLafferty RB, Ramsey DE, Hodgson KJ. Clinical failure after percutaneous transluminal angioplasty of the superficial femoral and popliteal arteries. *J Vasc Surg* 2000;31:880-7.
- Norgren L, Hiatt WR, Dormandy JA, Nehler MR, Harris KA, Fowkes FGR on behalf of the TASC II Working Group. Inter-society consensus for the management of peripheral arterial disease (TASC II). *Eur J Vasc Endovasc Surg* 2007;33:S1-S70.

8. Parsons RE, Suggs WD, Lee JJ, Sanchez LA, Lyon RT, Veith FJ. Percutaneous transluminal angioplasty for the treatment of limb threatening ischemia: Do the results justify an attempt before bypass grafting? *J Vasc Surg* 1998;28:1066-71.
 9. Pentecost MJ, Criqui MH, Dorros G, et al. Guidelines for peripheral percutaneous transluminal angioplasty of the abdominal aorta and lower extremity vessels. A statement for health professionals from a special writing group of the Councils on Cardiovascular Radiology, Arteriosclerosis, Cardio-Thoracic and Vascular Surgery, Clinical Cardiology, and Epidemiology and Prevention, the American Heart Association. *Circulation* 1994;89:511-31.
 10. Shafique S, Nachreiner RD, Murphy MP, Cikrit DF, Sawchuk AP, Dalsing MC. Recanalization of infrainguinal vessels: Silverhawk, laser, and the remote superficial femoral artery endarterectomy. *Semin Vasc Surg* 2007;20:29-36.
 11. Slovut DF, Demaioribus CA. Hybrid revascularization using silverhawk atherectomy and infrapopliteal bypass for limb salvage. *Ann Vasc Surg* 2007;21:796-800.
 12. Zeller T, Sixt S, Schwarzwalder U, et al. Two-year results after directional atherectomy of infrapopliteal arteries with the SilverHawk device. *J Endovasc Ther* 2007;14:232-40.
-