Peripheral vascular disease is an important risk factor for lower extremity amputation in diabetic patients with chronic foot ulcers. There is a geographic difference in the prevalence of peripheral arterial disease in diabetes. Successful revascularization reduces the major amputation rate in diabetic patients. This can be achieved either by peripheral bypass or by percutaneous transluminal angioplasty. Recent studies are favouring peripheral angioplasty over traditional bypass surgery in diabetic lower limb. This article surveys the literature on the current role of percutaneous transluminal angioplasty and peripheral vascular bypass in lower limb revascularization in diabetic patients. The article also provides an insight on our own experience with revascularization. The literature shows that only 5% of non diabetic persons with peripheral vascular disease require vascular reconstruction. There has been a 50% reduction in the annual number of infrainguinal bypass surgeries with the advent of percutaneous transluminal angioplasty (PTA). Data from our institute in India reveals that only 3.32% of patients with diabetic foot ischemia require vascular bypass procedures. This article provides for the first time data on the revascularization procedures required in diabetic foot patients at a diabetic limb salvage centre in India, a country known to have the highest number of diabetic individuals in the world.

Key words: diabetes, foot ulcer, lower limb, revascularization

INTRODUCTION

India, with a population greater than 1.1 billion, has the dubious distinction of having a larger number of people with diabetes than any other country in the world, after China. It was estimated in 2000 that there were 32 million people with diabetes in India, a number that is predicted to increase to nearly 80 million by 2030. The global burden of diabetes is projected to increase from 246 million people to over 380 million people by the year 2025.

The lifetime risk for foot ulcers in people with diabetes is estimated to be 15%. Diabetic patients are at higher risk for limb loss owing to neuropathy, infection and presence of arterial occlusive disease.

However, the distribution of peripheral vascular disease in diabetics has regional differences. Arterial disease was present in 48% of foot ulcers in Germany but only 11% in Tanzania and 10% in India.

The basic aim of any successful revascularization is to achieve pulsatile flow to the foot. The two methods currently available are peripheral bypass surgery and peripheral angioplasty.
The objective of the angioplasty was to achieve straight line flow from the aorta down to either a patent dorsalis pedis or plantar arch. The aim of treatment is limb salvage. Percutaneous transluminal angioplasty (PTA) is today considered the first choice revascularization procedure in many cases. It is feasible, safe and cost effective for limb salvage in a high percentage of diabetic patients [Table 1].

Dayananda et al reported a high limb salvage rate of 75.8% at the end of one year by using infrapopliteal angioplasties in diabetic patients. Saab et al also reported a clinical success rate of 58.75% in a general population comprising of diabetic and non-diabetic patients. In another study, Faglia et al achieved a 5 year primary patency of 88% in diabetic patients undergoing peripheral angioplasty.

Currently, many promising novel endovascular techniques such as cryoplasty, drug eluting stenting, plaque debulking lasers and excision atherectomy are being investigated and are potentially useful adjuncts to PTA. Zhu et al showed that subintimal angioplasty for arterial lesions below the ankle in diabetic patients could achieve a limb salvage rate of 94.6%.

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Peripheral bypass surgery

For more than 50 years, the standard procedure performed for lower limb arterial revascularization has been vascular bypass surgery using reversed saphenous vein. Various methods were developed to render valves incompetent in order to allow the vein to be used non-reversed or “in situ”. Vascular surgeons began to employ in situ bypass and reporting improved results with this technique.

In 1980s, Ascer et al reported the first series of bypass grafts with inflow taken from the popliteal artery. This procedure has proved to be another important advance in arterial reconstruction for patients with diabetes. Because atherosclerotic occlusive disease often spares the superficial femoral artery in diabetic patients, the popliteal artery can be readily used as a source of inflow for a distal vein graft. Only the most experienced vascular surgery centers in the world perform extreme distal arterial reconstructions.

In one study, limb salvage was achieved in nearly 70% at 5 years when pedal bypasses were performed. In one centre, bypass to the dorsalis pedis artery constitute approximately 25% of all the lower limb arterial reconstructions in diabetic patients. Since the introduction of endovascular interventions, most vascular surgical units have seen at least a 50% reduction in the annual number of infrainguinal bypass operations. However, there are still a few subsets of patients who require peripheral vascular bypass to salvage a diabetic foot.
Our centre in India is a large tertiary, superspecialty referral hospital with 1450 in-patients beds. The division of diabetic lower limb and podiatric surgery is integrated with the Department of Endocrinology. Currently, it is the only medical college in India offering postdoctoral training in podiatric surgery and it is one of the largest diabetic lower limb salvage centres in India.

Nearly 50 inpatients beds are dedicated to patients with diabetic foot problems and our daily outpatient census is around 55-60 patients. Peripheral angiograms and angioplasties are performed by a dedicated interventional radiologist and peripheral bypass surgeries are performed by vascular surgeons. The decision regarding the need for the diagnostic angiogram and subsequent revascularization is taken by our diabetic limb salvage and podiatric surgeons in order to obtain a scientific and biomechanically acceptable functional foot [Figure 1]. Post revascularization foot care and surgeries are done by our podiatric surgeons to achieve a favorable outcome.

In order to analyze the revascularization procedures in our patients, we retrospectively reviewed our data on 1083 patients admitted for diabetic foot complications. Of these, 769 (71%) were males and 314 (29%) were females.

Six hundred and nine patients (56.2%) with diabetic foot complications had some form of peripheral arterial disease (PAD). Patients were considered to have PAD when distal pulses were absent, hand held Doppler showed monophasic flow signals or when ankle-brachial indices (ABI) was less than 0.9.13

Only 180 patients (16.6%) with diabetic foot problems had undergone peripheral angiogram. Angiograms are performed only in those patients in whom wounds fail to heal with customary care. Thirty-six patients (3.32%) underwent peripheral vascular bypass surgeries whereas seventy-three patients (6.73%) underwent peripheral angioplasty. Seventy-one of our patients (6.55%) with diabetic foot problems had non-revascularizable lesions.

Figure 1. Midfoot amputated stump at the end of 1 year with therapeutic foot wear. The ultimate goal of a podiatric surgeon after any revascularisation or reconstructive procedure is to provide a scientific and biomechanically acceptable functional foot. Only then should a limb be considered as salvaged.
Lower extremity arterial disease is clinically identified by intermittent claudication and absence of peripheral pulses in the lower legs and feet. Chronic limb ischemia (CLI) represents the most severe stage of peripheral vascular disease, with limb loss being a feared complication. In Western society, the prevalence of symptomatic peripheral arterial occlusive disease (PAOD) producing intermittent claudication in men and women aged 55-74 years is 45%.

People with diabetes are twice as susceptible as non-diabetic persons.

In non diabetics with PAD and claudication, the natural history of PAOD usually follows a benign course with only 23% deteriorating over a 5-year period; 5% requiring vascular reconstruction and only 2% progressing to amputation.

In the diabetic population, the onset of PAOD is particularly sinister, as the risk of progression to amputation increases tenfold to 20%. In diabetic patients, PAOD is characterized by distal, multiple obstructions with a higher percentage of occlusions with respect to stenosis.

The aim of the revascularization procedure is to provide sufficient blood flow to relieve rest pain and heal skin lesions. The ideal revascularization procedure is one that avoids general anesthesia, poses a lesser systemic stress and has fewer serious complications. Both surgical bypass and endovascular revascularization are currently accepted forms of treatment. Arterial bypass surgery has traditionally been the main treatment with a well-documented long-term patency and limb salvage rate. However, technical and anatomical limitations such as the availability of the long vein graft and the presence of infection near the site of planned distal anastomosis often make surgery technically challenging and difficult [Table 2].

Additionally, patients often have multiple co-morbidities such as cardiovascular disease, failure, and other pathologies associated with diabetes. Their co-morbidities increase general anesthesia risk and lead to poor tolerance for prolonged surgery. PTA is thus an attractive alternative in this subset of patients. Today, PTA has become a feasible, safe, effective and first choice procedure for the treatment of diabetic lower limb ischemia.

At our institute, all patients whose wounds do not heal with underlying ischemia are referred for peripheral angiogram, which is done by our interventional radiologist. After evaluating the angiogram and local wound, the patient’s systemic condition is assessed and the podiatric surgeons subject the patients for angioplasty. In cases where angioplasty cannot be completed or when angioplasty fails, a vascular surgeon’s opinion is sought and peripheral arterial bypass is done if possible.

In one of the earlier studies from our institute, Dayanand et al showed a reasonably good ulcer healing rate of 58.62% and a limb salvage rate of 75.8% at the end of one year following infrapopliteal percutaneous transluminal angioplasties.
CONCLUSION

Lower limb ischemia in patients with diabetic foot problems imposes a huge social impact on the cost as well as a major economic burden on health and social care, not only in developed countries, but also increasingly in developing countries. In India, only 10% of patients with diabetic foot ulcers have underlying peripheral arterial disease. Current literature shows that percutaneous transluminal angioplasty (PTA) is the first choice of procedures in revascularization of the lower limb. Data from our institute (Amrita), the largest diabetic limb salvage center in India, reveals that around 6.73% of the patients with diabetic foot problems require peripheral angioplasty whereas only 3.32% of the patients require peripheral vascular bypass. The overall diabetic limb salvage rate at our institute is 91.5% which is comparable to the best centres in the world.

REFERENCES


