

# The Endovascular Treatment of Varicose Veins

The "gold standard" for the surgical treatment of varicose veins has been high ligation and stripping of the great saphenous vein (GSV) or short saphenous vein ligation and stab avulsion of peripheral varicosities. This is, however, not without its problems. The recurrence rate is 10-15% at 2 years and as high as 60-70% after 20 years. Approximately 25% of patients require further surgery and recurrent disease accounts for 20% of all varicose vein surgery.

Despite being a relatively minor procedure for a non life-threatening condition, varicose vein surgery is a common reason for litigation, accounting for 17% of settled claims in general/vascular surgery. Complications include cutaneous nerve injury (5-7%), haematoma (10%), DVT (<2%) and pulmonary embolism (0.2-0.5%), wound infection and pain. Patients require 2-6 weeks off work to recover. Many younger active patients do not receive treatment as the prolonged recovery time interferes with work and family, and older patients do not receive treatment because of the risks of anaesthesia or the recovery is too arduous.

## What Is the Ideal Treatment for Varicose Veins ?

The ideal treatment should treat the symptoms and prevent the complications of venous hypertension due to superficial reflux, improve cosmesis, be minimally invasive, and be associated with low morbidity. It should also have a low recurrence rate and short recovery time, be cost effective, simple for the operator and acceptable to the patient.

Endovascular techniques are revolutionizing arterial vascular surgery and there are a number of techniques in venous surgery that are beginning to challenge the role of open surgery. These include radiofrequency ablation, endovenous laser, and foam injection sclerotherapy.

Radiofrequency and laser ablation are alternatives to stripping of the GSV. Peripheral varicosities still need treatment with either hook phlebectomy or injection sclerotherapy. Foam injection sclerotherapy can be used to treat truncal incompetence as well as peripheral varicosities. These procedures have the advantages of being minimally invasive, and can be done under local anaesthetic as an hospital outpatient or in the consulting rooms with similar, if not better overall outcomes compared to surgery.

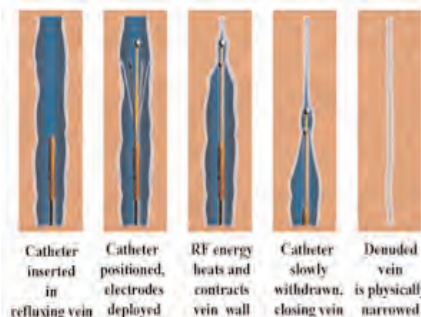
## Radiofrequency Ablation (RFA)

RFA uses thermal energy to cause collagen contraction and destruction of the vein wall. The vein wall is heated up to 85°C. The saphenous vein is cannulated. Using ultrasound guidance the RFA catheter is introduced and the tip positioned at the saphenofemoral junction.

Lignocaine with adrenaline, saline and sodium bicarbonate is infiltrated along the entire length of the vein to be treated.

This is known as tumescent anaesthesia and provides both excellent analgesia as well as causing contraction of the vein and a 'pool' of fluid around the vein to absorb heat and prevent damage to the skin and tissues.

The catheter is withdrawn at 2.5-3cm/minute, and the vein wall temperature is maintained at 85°C via a thermocouple feedback mechanism.



Complications of RFA treatment include focal paresthesia (12% @ 1 week), DVT (0.5%), pulmonary embolus (PE), phlebitis, infection, and skin burns (0.5%).

There are a number of case series documenting the efficacy and safety of RFA. A large prospective, multicentre registry involving over 1000 patients showed an immediate success rate of 91%. This was sustained over time with a vein occlusion rate of 88% at 4 years. The EVOLVeS Trial, although the numbers were small, was able to demonstrate a similar early efficacy and complication rate to surgery with an

earlier return to work and normal activity. Although the procedure itself is more costly than traditional surgery, it ultimately is more cost efficient if one takes into account the "days of work" lost.

## Endovenous Laser

Although the technique of endovenous laser is almost identical to radiofrequency ablation, the mechanism of action is very different. Laser energy causes the blood in the vein to boil and it is the steam bubbles that are generated that causes the thermal damage to the vein wall.

The most common side-effect (90%) of laser is a feeling of "tightness" or pulling along the treated vein. Pigmentation or bruising (24%) and thrombophlebitis (5%) are the next most common complications. These are fairly minor, do not need intervention and usually resolve spontaneously.

Once again there are many case series that document the efficacy and safety of Laser. There are no randomized controlled trials. A large case series (Min et al, JVIR 2003) involving almost 500 patients showed a 99.3% immediate technical success rate. There was a 7% recurrence rate at 2 years. All recurrences were evident by 9 months and the majority before 3 months.

## Foam Injection Sclerotherapy

Ultrasound guided foam sclerotherapy has rejuvenated the use of sclerotherapy in the treatment of major truncal varices. In foam sclerotherapy, the sclerosant is mixed with air or CO<sub>2</sub> in a 1:3 or 1:4 ratio to form a mousse. When injected into the vein, the air displaces blood and this together with the larger surface area of the sclerosant in the wall of the air bubble results in greater endothelial exposure to the sclerosant and increased efficacy. The foam bubbles are also echo-dense and with a combination of elevation and massage, can be manipulated into the desired branch varicosities.



Most adverse events are fairly minor the commonest being skin pigmentation which occurs in up to 40% of patients. There has been concern regarding the potential consequences of micro-embolization of foam particles. Transient visual disturbance and cough post procedure occur fairly commonly. There has been a single documented case of a mild stroke in a patient with a large patent foramen ovale.

The evidence for foam sclerotherapy is again in the form of large case series. A recent systematic review for the National Institute of Clinical Excellence in the UK showed an immediate technical success with an overall occlusion rate of 84% (67-94%). Long term results are not yet known.

## Which treatment?

Radiofrequency causes a uniform, transmural thermal injury to the vein wall. In contrast, the thermal injury caused by laser is less uniform with charring of the vein wall and micro-perforations. Clinically this translates into more post-operative symptoms in the leg and increased bruising. Foam sclerotherapy has the advantage of being much cheaper to administer than the other 2 options.

The 3 techniques do rely heavily on duplex ultrasonography and require new skills, foreign to the traditional surgeon. These endovascular skills, however, are reasonably easy to acquire and should be in the armamentarium of all vascular surgeons.

All 3 endovenous techniques have been shown to have short and intermediate results at least equivalent to surgery, while offering decreased recovery times. It will be a number of years before long term data (>10 years) is available. Randomized controlled trials are necessary to compare the newer techniques to surgery and to each other.

It is unlikely that all specialists will offer all the possible treatment modalities, but they ought to be able to give good advice about treatment choices and to provide a range of options.

# SURGCARE UPDATE

## Vascular Topics

Dr Jeffery & Partners

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# Diabetic Foot Ulcers

## Why are Diabetic Foot Ulcers Difficult to Heal ?

One of the most common complications of diabetes in the lower extremity is the diabetic foot ulcer.

An estimated 15% of patients with diabetes will develop a lower extremity ulcer during the course of their disease.

The annual cumulative incidence of diabetic foot ulcers is 0.5% to 3%, rising to 7% per year in neuropathic patients.

The prevalence of foot ulcers ranges from 2% to 10%. Neuropathy, deformity, high plantar pressure, poor glucose control, duration of diabetes, and male gender are all contributory factors for foot ulceration.

7% to 20% of patients with foot ulcers will subsequently require an amputation.



**In persons with diabetes, foot ulceration is the precursor to approximately 85% of lower extremity amputations .**

Diabetes is commonest cause of non-traumatic lower extremity amputations and accounts for more than 60% of lower extremity amputations in the USA.

Many factors lead to foot ulceration:

Diabetic peripheral neuropathy allows abnormal forces to be applied to the foot without appreciable discomfort to the patient and diabetic ischaemia renders the skin less able to withstand these insults.

Other contributing complications include poor vision, limited joint mobility and the consequences of cardiovascular and cerebrovascular disease. The

most common precipitant, however, is accidental trauma, especially from ill-fitting footwear. Once the skin is broken, many processes contribute to defective healing.

with dystrophic nails and susceptible to the pressure from a shoe or even an adjacent toe.

Bacterial infection, tissue ischaemia, continuing trauma, and poor management cause diabetic foot ulcers to heal slowly and transform readily into chronic wounds.

Several aspects of immunity are altered in patients with diabetes.

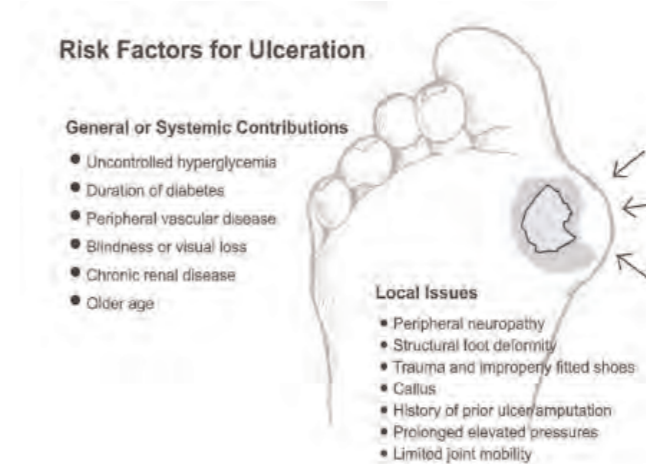
Polymorphonuclear leukocyte function is depressed, particularly when diabetes is poorly controlled. Leukocyte adherence, chemotaxis, phagocytosis and the intracellular killing of bacteria are impaired. Cutaneous responses to antigen challenges and measures of T-cell function

may also be depressed. As a result, patients with diabetes tolerate infection poorly. Infection in turn, adversely affects diabetes control and uncontrolled diabetes adversely affects the host's response to the infection.

Cells within the diabetic wound have also been shown to be abnormal. Fibroblasts are senescent and show a decreased response to growth factors. Macrophages show a decrease in the release of cytokines (TNF, IL-1 and VEGF) that are necessary for wound healing. Excessive activation of MMP's impairs cell migration and leads to the breakdown of matrix proteins and certain growth factors.

## The principles of treatment are:

1. Treat any infection
2. Establish whether any associated ischaemia is amenable to revascularization
3. Keep forces applied to the ulcer to a minimum
4. Improve the condition of the ulcer by wound-bed preparation, topical applications and removal of callus
5. Once healed prevention of ulcer recurrence.



In diabetes, nerve damage results from interacting metabolic abnormalities, worsened by disease of the vasa nervorum. The damage affects peripheral sensation, innervation of the small muscles of the foot, and fine vasomotor control of the pedal circulation.

In sensory neuropathy, loss of protective sensation leads to a lack of awareness of incipient or actual ulceration. Motor neuropathy affects the muscles required for normal foot movement, altering the distribution of forces during walking and causing reactive thickening of skin (callus) at sites of abnormal load. Ischaemic necrosis of tissues beneath the callus leads to breakdown of skin and subcutaneous tissue, resulting in a neuropathic ulcer with a punched-out appearance.

Arteriolar-venular shunting causes dysfunction of the microcirculation with reduced distribution of blood to areas of need.

Foot tissues can become ischaemic because of macrovascular disease (atherosclerosis), notably in the calf with relative sparing of proximal vessels.

Ischaemia also results from microvascular disease, both structural (thickened basement membrane, capillary wall fragility, and thrombosis) and functional (vasomotor neuropathy with defective microcirculation and abnormal endothelial function). Protective sweating is lost and the skin of the ischaemic foot is red, dry, thin

## When should a specialist opinion be sought?

### In the acute phase

- callus formation
- ulceration
- ischaemic change
- acute local sepsis
- non healing

### In the chronic phase

- recurrent callus/ulceration
- worsening deformity
- worsening neuropathy
- deteriorating sugar control
- onset of ischaemia



# Kingsbury Vascular Unit turns 5!

In August 2002 the Kingsbury hospital opened the first private multi-disciplinary peripheral vascular unit in this country. This has not only provided a comprehensive vascular service to the local community but has become a major tertiary referral centre for vascular patients across Southern Africa.



Martin Forlee, Peter Jeffery, Phil Matley and James Tunnicliffe

The unit comprises four vascular surgeons supported by an experienced team of ancillary and para-medical staff including specialist nursing staff, physiotherapists, orthotists, physicians, anaesthesiologists, clinical psychologists, biokineticists and dieticians.

The focal point of the unit is the endovascular suite. This comprises a fully equipped ceiling-mounted cath-lab with state-of-the-art digital vascular radiology within a large operating theatre enabling the entire range of both open and percutaneous vascular interventions to be performed in one facility. The theatre staff have developed considerable expertise with these procedures.



The Endovascular Suite

Patients are managed in a dedicated 22-bed vascular and neurology ward led by a unit manager and a clinical nurse specialist who has received specialist training at the St George's Hospital vascular unit in London.



Vascular ultrasound specialists Greta Blacker and Gail Jeftha

In modern vascular units most investigations are non-invasive and are based on duplex ultrasound. The unit boasts two full-time vascular ultrasound specialists who offer a full range of non-invasive vascular investigations.



Vascular Ward Staff

The unit has taken a lead in new vascular innovations in South Africa including stenting of complex aortic aneurysms, carotid stenting and peripheral sub-intimal angioplasty. Endovascular training has become a key focus area.

Several members of the team have been travelling widely providing education and support for other surgeons who are learning these techniques.

## SUPERFICIAL THROMBOPHLEBITIS

Superficial thrombophlebitis is a common problem in general practice. It is estimated that 123 000 Americans develop it annually. Little more than 50% occur in varicose veins and recurrence rates vary from 5-50%. It is notoriously persistent with more than 50% persisting beyond 30 days and many cases taking up to 3 months to resolve.

Ascer in a study in 1995 demonstrated that in patients with superficial thrombophlebitis involving the greater saphenous vein in the thigh or approaching the sapheno-femoral junction can, with colour flow duplex, be shown to have associated deep vein thrombosis in 40%.

This may be either contiguous (an extension of clot through the sapheno-femoral junction) or non-contiguous. High ligation of the saphenous vein has traditionally been recommended when the process extends to within 5cm of the SFJ but this may actually result in pulmonary embolism if the clot has already extended deeply.

Treatment usually consists of rest, analgesia, aspirin and careful reassessment. Topical anti-inflammatory gels and elastic support are helpful. Extensive thigh involvement demands anticoagulation and a colour duplex scan of the deep veins becomes very important in such cases. High ligation is seldom required. A proportion of cases are associated with underlying hyper-coagulable states (especially malignancy) and appropriate investigation is required in recurrent cases or when several areas of the body are affected (thrombophlebitis migrans).

## PAIN ON WALKING

Pain on walking is a very common problem. Many causes such as spinal pathology, arthritis, venous insufficiency, muscle trauma, tendon and ligament inflammation and trauma need to be accurately differentiated from leg ischaemia. This is especially difficult in the presence of mild peripheral vascular disease when the typical evidence of peripheral ischaemia may be not be evident.

If the pulses are absent or weak then ischaemic disease is present. Non invasive studies are then indicated to assess the extent of the disease and the place of conservative or invasive treatment. If pulses are normal, doppler pressures after exercise provide an accurate indicator of the presence and degree of ischaemia. If the ankle pressures increase or remain unchanged, ischaemia can be excluded preventing further expensive and unnecessary investigations.

The doppler pressures at the ankle give a very sensitive indicator of the severity of the disease. Pulses may feel normal with an ankle pressure of 120mm/Hg, but the simultaneous brachial pressure may be 180mm/Hg indicative of significant stenosis. With absent pulses a pressure of 80mm/Hg would indicate ischaemia with no immediate danger to the limb but at 30mm/Hg a more immediate danger.

The decision on conservative or operative management can usually be made on clinical and doppler pressure assessment. If there appears to be an indication for angioplasty or bypass surgery then colour flow duplex assessment is indicated to define the extent of the disease and the specific segments involved. This will also provide sufficient information for definitive angioplasty or surgery to be planned. Diagnostic angiography will only be indicated in about 5% of patients.

## WINTER CHILBLAINS

This common benign vascular cutaneous syndrome caused by exposure to cold, humid conditions is poorly understood. Acute chilblains appear as extremely painful and often symmetrical erythematous or erythrocyanotic plaques or papules with shiny tense overlying skin involving the fingers or toes. As the temperature rises they tend to become intensely pruritic and resolve over 3-4 weeks. They may or may not be associated with Raynaud's Phenomenon. Chronic chilblains persist throughout winter as ulcerated painful lesions usually on the toes. They may be associated with SLE, polyarteritis, anorexia nervosa or chronic myeloid leukaemia.

Peripheral pulses are usually easily palpable and laboratory tests are helpful only in excluding other systemic diseases. The differential diagnosis includes systemic vasculitis and the "blue toe syndrome" from athero- embolism or malignancy.

Apart from the avoidance of cold and the application of vaseline the mainstay of treatment is nifedipine (Adalat) which appears to

have vaso-dilatory, anti-inflammatory and platelet anti-aggregating properties. Intramuscular vitamin K appears to improve resolution as does photo- therapy with ultraviolet light.

Occasional cases with severe necrosis may require an endoscopic sympathectomy.



Erythematous Plaque



Chilblains on the toes

### We offer a multi-disciplinary service:

Screening assessment and evaluation of risk

Podiatry

Wound care

Direct access to orthotic, orthopaedic, endocrine and vascular surgery specialist care

the diabetic foot clinic

### Did you know?

- Diabetes is the comonest cause of non-trauma induced lower limb amputations.
- Foot complications are common in diabetics
- Foot ulcers preceed 85% of lower limb amputation
- Ulcers are caused by poor circulation and damage to nerves in the feet
- 20-40%of diabetics develop poor circulation
- 20-40% of diabetics have damage to the nerves in the feet

### Who should attend?

- All newly diagnosed type 2 diabetics
- All type 1 diabetics > 5 years duration
- Diabetic patients with ulcers, foot infection, callus (corns) dry skin, abnormal feeling and poor circulation.

## What's new at Jeffery & Partners



**Dr Jeffery and Partners** are pleased to announce that in March 2007 **Danie Theunissen** joined their General Surgical Practice.



Danie is the son of Kosie Theunissen, whom many would remember as a senior surgeon in Cape Town. He matriculated from Paarl Boys High School in 1983 and graduated with an MBChB from the University of Stellenbosch in 1989. After graduating he worked as intern and medical officer at Victoria Hospital in Wynberg before completing his post-graduate surgical training at Groote Schuur Hospital in 1998. He was a member of the local and national Registrars Committee as well as being the representative of the registrars on the Association of Surgeons executive committee.

He was appointed as Senior Specialist Surgeon at 2 Military Hospital in Wynberg in 1999 and was later appointed Chief Specialist and Head of Surgery in 2002. At 2 Military Hospital he headed a very busy surgical department gaining broad experience in all aspects of general surgery. He had the opportunity to be actively involved in clinical research and the training of Surgical Registrars from Groote Schuur Hospital.

He has been author and co-author of six papers in peer review journals and has presented at 12 national and international meetings. His other interests are information technology and painting.