The management of varicose veins in a modern vascular surgical unit

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INTRODUCTION

The aims of this assignment are to review treatments for varicose veins (VVs) and discuss how the management has evolved over the past decade. This literature review is based on visits to a one-stop VV clinic and a VV theatre. It focuses on the pre-operative assessment as well as the new management techniques, concluding with some thoughts about the strengths and weaknesses of each treatment modality, and finally which patients are most suitable for a specific treatment type.

A decade ago a patient suffering from VVs was given the option of having injection sclerotherapy or surgery. Only these two techniques have existed for long enough to know about their longterm results and both have shown high recurrence rates over time. In the past few years, we have seen the development of new techniques for minimally invasive treatment of VVs. This has meant that decision making for VVs treatment has become more complicated. New minimally invasive techniques include: thermal ablation in the form of endovenous laser ablation (EVLA) or radiofrequency ablation (RFA), and foam sclerotherapy.

VVs are enlarged, long, tortuous and dilated superficial veins of the leg, defined as being greater than 3mm in the upright position. VVs occur as a result of malfunctioning venous valves and reduced wall elasticity, causing blood to pool and therefore enlarging the veins. VVs exist in several types as exhibited in table 1.

Primary VVs	Derived from the long saphenous vein (LSV) and/or short saphenous vein (SSV) and/or their major tributaries
Secondary VVs	Dilated superficial trunk veins may be acting as the collateral venous return when deep venous disease is present

Table 1 Types of varicose vein

Anatomy

The long saphenous vein (LSV) and the short saphenous vein (SSV) are part of the superficial venous system. Most of the blood from the legs is returned to the heart via the deep vein legs; therefore if the LSV becomes varicotic then blood will be sent back down the leg like a loop circuit, and cause the varicose veins to bulge.

A patient's suitability for VV treatment is established through clinical examination. This is to identify the source of the venous incompetence and establish the extent to which the veins need to be treated. Location(s) of the VVs may be

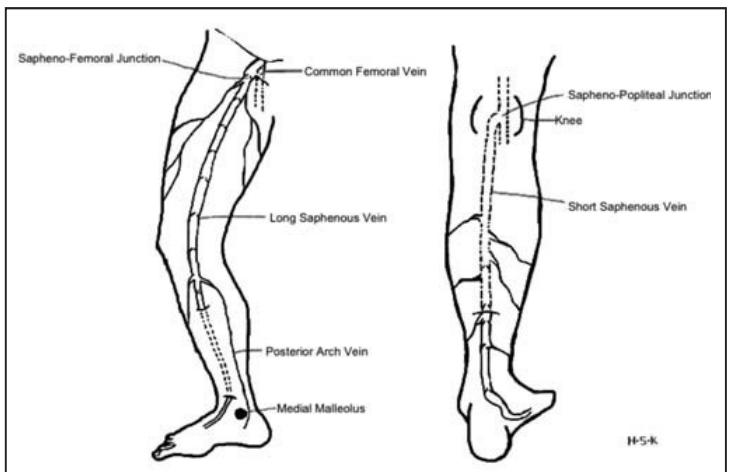

Figure 1 The saphenous system with unidirectional valves

suggestive of their relation to the LSV or SSV. A palpable large varicosity can be evidence of an incompetent perforating vein.

It has been widely accepted that clinical assessment of VVs via inspection, the Trendelenburg test and torniquet test is unreliable. Hand-held Doppler is accurate as it helps to identify patients most suitable for a duplex ultrasonography scan (DUS). Screening using the hand-held Doppler machine gives a good indication to select those in need of a DUS as it accurately localises sites of reflux, delineates venous anatomy and eliminates the possibility of a deep vein thrombosis (DVT).

VVs can cause significant VV symptoms: leg heaviness, itching and aching pain which is common and results from dilated vessels exerting pressure on surrounding nerve fibres. Traditional pointers of VVs include worsening of symptoms after prolonged standing or walking, and relieving symptoms by wearing support stockings or elevating the leg. Additional symptoms include leg fatigue, leg swelling, thrombophlebitis, external bleeding, skin changes (hyperpigmentation), varicose eczema, lipodermatosclerosis and venous ulceration. All the above symptoms call for referral to a vascular surgeon or an intervention.

METHODS

Literature search strategy

Well-conducted systematic reviews and primary studies were selected for inclusion in this review. Any articles found within this search were then critically appraised; their relevance to this review was also then decided.

Using MeSH and by applying limits refined results from databases using the following keywords: varicose vein treatment, sclerotherapy, varicose vein surgery, sapheno-femoral ligation, stripping, transilluminated powered phlebectomy, cryosurgery, endovenous laser ablation, and radiofrequency ablation.

DISCUSSION

The reviews and primary research articles encountered described the following treatment options as shown in table 2.

Treatment option	Description
Conservative therapy	Limit disease progression. They are recommended in asymptomatic patients or those with mild-to-moderate V V symptoms
Compression support hosiery	Below knee grade II (30-40mmHg) compression stockings
Liquid sclerotherapy foam sclerotherapy (UGFS)	Direct injection of sclerosant into varicosities as an outpatient. Ultrasound-guided (LSV) sclerotherapy (foam or liquid). Also called endovenous chemical ablation
Surgery: saphenofemoral ligation, LSV stripping and phlebectomies	Widely available. Outpatient basis or overnight inpatient stay. General anaesthesia required. Method of stripping varies
Minimally invasive: RFA	RFA (thermal) of the LSV and sometimes phlebectomies or sclerotherapy – usually done under general anaesthetic. Outpatient or overnight inpatient stay
Minimally invasive: EVLA	EVLA of the LSV with pulsed diode laser and sometimes with sclerotherapy (6/52). Local anaesthesia required. Outpatient procedure

Table 2 Outline of treatment options for varicose veins

Lifestyle modification

Lifestyle changes, including physical exercise and weight loss, help to promote blood circulation. Patients are also discouraged from prolonged sitting or standing and are advised to elevate the affected limbs whenever possible to reduce pressure on impaired vein valves. Conservative therapies tend to limit disease progression; they are recommended in asymptomatic patients or those with mild to moderate V V symptoms.

Compression support hosiery

Compression stockings provide relief for V V symptoms, such as pain, leg heaviness and oedema, whilst helping to drain blood from superficial veins down into the deep venous system. This results in reduced venous hypertension and a reduction in complications.[1,2] They do not, however, treat the underlying pathology.

Usually, class two compression stockings (20-30mmHg) are used during the day providing moderate compression. Compression after an intervention may reduce the risk of thromboembolism, provide comfort and contribute to a quicker recovery time.[3]

A large study suggests that compression stockings worn postoperatively after V V surgery for over a week are of no benefit to patients in pain.[3] Compression also had no effect on complications occurring such as bleeding, bruising, DVT, recurrence, pigmentation and saphenous nerve injury.

Conventional and foam sclerotherapy

Conventional sclerotherapy is mainly used to treat small V Vs.[4] More recently, foam sclerotherapy has been developed as a suitable technique for larger V Vs.

Conventional sclerotherapy is performed as an outpatient procedure. It involves the injection of a small volume of liquid chemical/sclerosant into the target vein to initiate inflammation, occlusion and scarring.[5] The damaged vein then collapses and eventually atrophies. The commonly used sclerosing agents are sodium tetradecyl sulphate, polidocanol and chromated glycerine.[4]

Foam sclerotherapy mixes air or gas with the sclerosant to produce a foam, allowing a small amount of sclerosant to cover a larger surface area by displacing blood within the vein.[5] This means it can spread widely through the larger lower limb veins,[6] and due to its scanning properties allows targeted and selective treatment under ultrasound control.[7]

It is common for patients to suffer from phlebitis after the injection, which can last for up to ten days with approximately 25% of patients suffering from longterm skin staining due to the phlebitis.[4] Major complications are rare, and relate to sclerosant leaking into the systemic circulation.

Evidence suggests that foam sclerotherapy is more effective than compression stockings in improving cosmetic appearance and relieving symptoms, but not as effective as V V surgery. Sclerotherapy has a 20-70% longterm recurrence rate and V Vs can persist, compared to surgery.[8]

Overall, sclerotherapy is a quick and low-risk intervention. It can be difficult, however, to completely eradicate major sites of superficial reflux without repeated treatments, thus making it an unattractive treatment option for many patients with primary V Vs. It seems to have found it's place as a quick 'tidy up' for the treatment of residual veins following surgery or endovenous treatment or for those patients with recurrent varicosities in whom further surgery will be risky.[9]

Surgery

Surgical intervention for varicose veins has long been considered necessary when symptoms affect a patient's quality of life.[10] The different types of V V surgery include sapheno-femoral or sapheno-popliteal ligation, long saphenous stripping, cryosurgery and multiple-stab phlebectomy.

Sapheno-femoral or sapheno-popliteal ligation and long saphenous stripping

The 'high tie and strip' is a traditional technique used in the treatment of symptomatic V Vs of the LSV and SSV. Junction ligation is generally appropriate when the long and short saphenous veins show a high degree of incompetency, which is usually identified on the Doppler ultrasound. Junction ligation involves tying off the vessel at the sapheno-femoral junction (SFJ) or sapheno-popliteal junction (SPJ) and can usually only be performed under general anaesthetic.[10]

In most cases, sapheno-femoral ligation is accompanied by LSV stripping.[11] This involves passage of a wire (stripper) from the groin down the length of the LSV to just below the knee where a counter incision is made to retrieve the wire. The top

end of the LSV is tied onto the stripper, which is gently withdrawn, removing the vein ideally via an inversion mechanism.[12] Ligation of the junction without stripping leads to an increased rate of VV recurrence and patients may need to have sclerotherapy as part of their aftercare treatment.[11] Stripping, however, increases postoperative morbidity, including sensory loss, bruising and pain in up to 40% of patients.[13]

Cryosurgery
Cryosurgery, or cryostripping, is a variant of surgical stripping and is performed following a sapheno-femoral ligation under general anaesthesia. A cryoprobe is passed down the LSV and activated to achieve a temperature of -85°C. The vein freezes against the probe and is then stripped. Compared to surgical stripping, this technique provides a faster route of removing a varicosity and a distal incision is not required. Despite postoperative pain being much greater, patients tend to favour cryosurgery due to better cosmesis.[14]

Multiple-stab phlebectomy (avulsions)
Phlebectomy (avulsions) involves removing varicosities distal to the SFJ and SPJ, and is best used on medium or large veins with no major junctional venous reflux.

Commonly employed as an adjunct to sapheno-femoral ligation and LSV stripping, it is performed under a general anaesthetic through small incisions where the underlying vein is snagged and brought to the surface before being carefully followed and as much length as possible removed. A variety of implements may be used to snag the veins through the stab incision.[15]

Although surgery gives the most secure results with the lowest chance of requiring a secondary procedure, it also carries the highest risk of early complications (see figure 2) as well as high longterm recurrence rates often due to new vessels developing in the groin and thigh (neo-vascularisation).

- Bleeding
- Bruising
- Pigmentation (may be permanent)
- Varicose vein recurrence (with or without neo-vascularisation)
- Saphenous nerve injury – resulting in areas of numbness in the operated leg
- Motor nerve injury (rare complication of popliteal surgery)
- DVT
- Pulmonary embolism

Figure 2 Potential complications of varicose vein surgery

Minimally invasive endovenous techniques
Modern technology has allowed minimally invasive techniques for ablation of VVs to become effective, practical and safe. RFA and EVLA therapy are now establishing themselves as methods of treating VVs with enhanced cosmesis and a reduction in the time to return to normal activity and work compared to standard VV surgery.[16] It has been suggested that endovenous ablation techniques could lead to less neovascularisation than surgery, reducing the recurrence of VVs.[17]

Both techniques can be performed percutaneously under local anaesthesia using a modified Seldinger technique. A heat-generating fibre is introduced into the incompetent LSV at the level of the knee under ultrasound control. The heating element (either laser tip or radiofrequency element) is positioned just below the SFJ or SPJ, under ultrasound guidance, and the vein is ablated by thermal injury as the tip or element is withdrawn.[18]

Following the extreme endovenous temperatures, endothelial thermal damage occurs along with the formation of a thrombus and abolition of blood flow.[19] This causes the vein wall to contract and scar, leading to subsequent eradication of the vein.[20,21] These methods avoid groin incisions and may lead to less bruising and a faster recovery. These modern techniques reduce the need for general anaesthesia and are associated with decreased inpatient stay and postoperative pain and an improved quality of life, and eventually lower costs.[22,23] Although broadly similar, each endovenous method appears to be associated with its own particular risks and benefits.

RFA
A recent study shows that RFA causes less pain and bruising postoperatively than conventional surgery; it may, however, be unsuitable for patients with a vein diameter less than 2mm or greater than 12mm, long saphenous thrombophlebitis or tortuous veins. Studies have shown that rates of successful occlusion after two years were 85-90%, making it an efficient treatment choice.[21,24]

Complications of RFA include thermal injury to the saphenous nerve or the skin, erythema, bruising, and phlebitis can be clinically significant in some patients. DVT has been reported, although recent technological improvements are said to have reduced this risk.

EVLA
EVLA involves high-laser energy which is used to generate thermal damage to the venous wall, leading to destruction of the intima, collagen denaturation of the media and eventually fibrotic occlusion of the vein.[25,26]

In 2003, the largest experience of EVLA was published, with early success rates of 98%, of which 93% was successful occlusion of the LSV after two years.[27]

Complications of EVLA include possible damage to nerves and skin around the vein. Expertise in EVLA gives rise to minimal complications.[28] Large-scale direct-comparison studies between surgery, RFA and EVLA are still awaited and until completed the efficacy and complications of EVLA compared to RFA and surgical techniques will remain debatable.

In the short-term, however, it appears that endovenous thermal ablation (EVLA or RFA) is as effective as a well-performed surgical procedure.

The perfect treatment for VVs would rapidly and permanently eradicate all superficial venous reflux, relieve all symptoms, improve leg appearance and allow immediate return to normal activities. It would be affordable and widely available.[29] Such technology may never exist, but with the advent of minimally invasive procedures we are approaching a better solution.

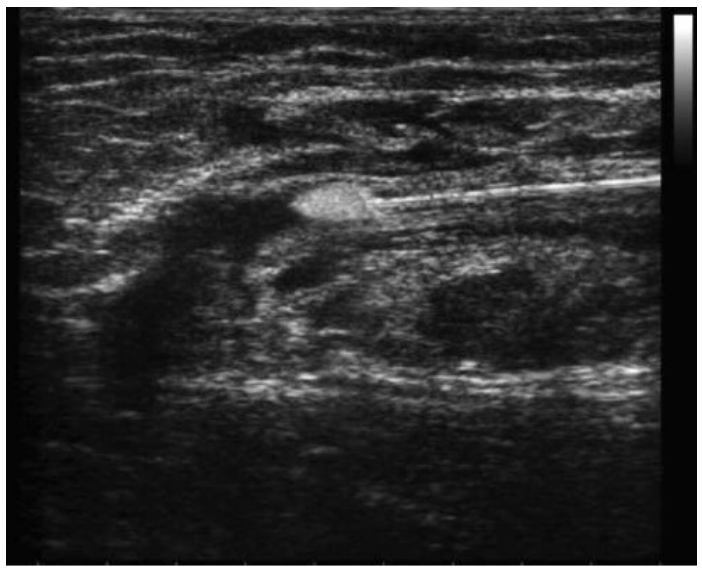

Figure 3 EVLA probe positioned in the LSV as it approaches the SFJ to enter the femoral vein

CONCLUSIONS AND EVALUATION

Interventional treatment for VVs contributes to an improvement in quality of life. Ligation with stripping with additional avulsions is still regarded as the 'gold standard' for treating LSV varicosities by many vascular surgeons. Current evidence suggests that well-performed surgical stripping, RFA, EVLA and foam sclerotherapy are similar, in terms of eliminating reflux in the LSV or SSV. Therefore, older techniques such as sclerotherapy and surgery both still appear to have a place in the management of VVs. Although some authors believe conventional surgery should remain the treatment of choice for all VVs, more evidence is accumulating regarding the longterm effectiveness of newer treatments such as EVLA and RFA.[30]

From international surveys of vascular surgeons there appears to be an increasing preference for minimally invasive VV treatments used in a non-theatre environment. Surgery, in the form of a 'high tie and strip', although widely performed, is falling out of favour as the treatment of choice for VVs, as it is a more invasive technique. A true comparison of the endovenous ablative techniques is not feasible as of the present time. Prospective randomised controlled trials to identify longterm outcomes are under way, but require time. The short-term advantages of the modern endovenous techniques, however, offer an attractive alternative for patients.[31]

Widespread use of foam sclerotherapy as treatment for primary VVs has not been seen in Europe due to the difficulty in obtaining an immediate and durable result in patients with SFJ or SPJ reflux. It may yet find a place in the treatment of patients unfit for surgery, for recurrent VVs or for those without evidence of major valvular reflux.

	Advantages	Disadvantages	Main indications / preferred patient type
Compression stockings	➢ Cheap ➢ Relieves symptoms	➢ Only temporary relief	➢ Patients who are unfit for other treatment ➢ Patients with established deep vein occlusion or incompetence
Surgery	➢ Good follow-up ➢ Well established ➢ Well investigated ➢ Risks and benefits known	➢ Usually general anaesthetic ➢ Long recovery ➢ Scarring and pain	➢ Possibly best for the young patient ➢ Primary tortuous VVs ➢ Low-risk individuals
Foam sclerotherapy	➢ Patient is fully mobile within a few minutes ➢ Quick ➢ Low risk ➢ Outpatient procedure ➢ Cheap (only require 10-12mL of foam or less) ➢	➢ Efficacy/recurrence ➢ Skin pigmentation and lumpiness/cosmesis ➢ Thrombophlebitis ➢ Small risks of CVA/MI ➢ Risk of DVT – foam ➢ inevitably enters the deep venous system ➢ Surgeon may be inexperienced	➢ Patients with recurrent VVs ➢ Unfit patient
EVLA **RFA**	➢ Minimally invasive ➢ Local anaesthetic ➢ Outpatient basis	➢ Expensive – requires single-use dedicated equipment ➢ May take longer than surgery ➢ No longterm follow-up ➢ Some risks ➢ Primary efficacy may not be as high as surgery	➢ Majority of patients with non-tortuous and symptomatic LSV varicosities

Table 3 A varicose vein management evaluation

Commentary . . .

Mark Tomlinson is clinical lead for vascular surgery at University Hospitals of Morecambe Bay Foundation Trust.

This paper provides a useful, well-written and timely overview of the current varied management options now available to patients with symptomatic superficial venous reflux disease (SVRD) and resulting varicose veins. As discussed, minimally invasive endovenous thermal ablation techniques offer some significant advantages over conventional surgical techniques, having virtually eradicated the need for groin or popliteal fossa exploration and stripping of long or short saphenous veins in primary and even recurrent varicose vein procedures. Thus wound infection and lymphatic problems are virtually abolished, and postoperative severe bruising, pain, swelling and limited mobility are significantly reduced or abolished.

EVLA uses laser thermal energy (>600°C) whereas RFA uses controlled thermal energy (120°C). There have been no well-conducted randomised trials directly comparing both techniques reported to date, but it is clear in the literature and at conferences that both are equally effective with similar advantages, and both can be readily performed under local anaesthesia alone. The article seems to suggest that EVLA has some advantages as smaller calibre or tortuous veins can be treated, but 2mm veins do not tend to cause significant symptoms, and both techniques can treat tortuous veins segmentally. Clinicians tend to advocate the technique they are familiar with, but many who have tried both feel that they are equally effective with little to choose between them.

Neither technique removes visible minor varicosities however, though these become less pressurised, shrink and patient's symptoms are usually abolished. Removal of these visible cosmetic varicosities (phlebectomy) can be performed at the same time under either general or local anaesthesia (depending on the number and distribution).

John Calvey has been providing our EVLA service based at Furness General Hospital whilst I have been offering RFA at Westmorland General Hospital and Royal Lancaster Infirmary and thus our unit is providing NHS patients with a choice of all therapeutic modalities. I personally evaluated both methods some time ago and noted that EVLA can lead to minor perforation of the vein with bruising, and red cell haemolysis due to the high temperature involved, the latter giving some patients a metallic taste during the procedure. These are well-recognised minor disadvantages. Logistically laser therapy requires certain staff and environmental precautions and training.

I have audited my initial RFA experience and was pleased to find an excellent 98% success rate with minimal complications, despite offering patients simultaneous phlebectomies. Since introduction of the technique I have rarely had to perform open groin or popliteal surgery. Even during the initial introductory period 50% of procedures were performed entirely under local anaesthesia, and both vascular nurse practitioners' and patients' feedback at follow-up has been excellent over the last three years since the techniques were introduced locally.

So we now have a range of treatment options with improved methods of treating patients with symptomatic SVRD, yet whether these will remain available to NHS patients is under debate, as many regions class varicose vein procedures as either cosmetic or 'procedures of limited clinical value', and commissioners are reviewing or have already ceased to fund such treatments as part of their austerity measures in many areas of the country. Lancashire PCT/GPC cluster is soon to undertake such a review and Cumbria PCT already insists that general practitioners (GP) must complete an additional referral form detailing that the patient either has severe complications of varicose veins (bleeding, ulceration or phlebitis) or has failed non-interventional management and in the opinion of the referring GP has such severe symptoms interfering with work activity or quality of life to warrant NHS treatment.

Not only will patients potentially be denied treatment of their symptoms if commissioners decide not to fund these procedures, but surgical training may be affected. These procedures offer ideal training opportunities for vascular surgical trainees to gain supervised experience of vascular ultrasound, ultrasound-guided cannulation and therapeutic techniques. These are best learnt initially during lower-risk venous procedures rather than arterial procedures just as open venous surgery offers early training in exposure of groin vessels (but is increasingly less available!). Furthermore as elective surgical procedures do generate income for acute trusts, any decisions to withdraw these treatments will impact on hospital trust finances also.

Perhaps commissioners should consider restricting NHS treatment to the symptomatic SVRD of ultrasound-proven long or short saphenous vein incompetence, and not fund phlebectomy of visible varicose veins. The latter more regularly requires general anaesthesia and adds considerable operative time, wounds, dressings, bruising, discomfort and overall cost for little symptom gain other than cosmetic appearance. One can question whether sclerotherapy of varicose veins should be offered at all as an NHS treatment, unless for very frail patients with complications of SVRD. Vascular clinicians would welcome some open clarity, consistency and uniformity of NHS treatment availability rather than the current postcode lottery.

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