A Review of Minimally Invasive Techniques for the Treatment of Lower Extremity Varicose Veins

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Learning objectives

In this educational poster we will provide an outline of ultrasound-guided minimally invasive procedures combined with a minimally invasive surgical procedure for the treatment of varicose veins in an outpatient setting.

Background

Endovenous thermal ablation (EVLA) and foam sclerotherapy (FS) are ultrasound guided interventional procedures for the treatment of varicose veins. These procedures are less invasive than surgical vein stripping and have been shown to be non-inferior in efficacy when compared to surgery. The main advantage over surgery is the improved quality of life as these minimally invasive procedures are performed as a day case under local anaesthetic and have been shown to result in fewer complications and reduced peri-procedural morbidity. When EVLA and FS are used in combination with outpatient ambulatory microphlebectomy, early results have shown a superior efficacy when compared to surgery with a lower incidence of recurrence. In our centre we have performed over 2,000 of these combined procedures to date.

Imaging findings OR Procedure details

Anatomy (Figure 1):

The anatomy of the two main superficial veins is assessed using duplex ultrasonography.

- Great saphenous vein (GSV): the largest vein in the body, originates from the medial marginal vein of the foot, travels upwards medial to the tibia, behind the medial border of the patella, up towards the saphenous opening, where it travels deep to terminate at the femoral vein [1].
- Short Saphenous Vein (SSV): originating from the lateral marginal vein, it travels posterior to the lateral malleolus, before crossing the calf posteriorly, before perforating the deep fascia in the popliteal fossa, where it terminates at the popliteal vein [2].

Common anatomical variants:

- Vein of Giacomini: a connection between GSV and SSV, which runs in the posterior thigh and can be a site of incompetence causing posterior thigh varicosities [3].
• **Anterior Accessory Great Saphenous Vein (AAGSV):** travels anterior to the GSV, originates from the GSV just below SFJ and travels along the anterior thigh [3]. A potential cause for anterior thigh varicosities.

### Aetiology of varicose veins:

Lower limb varicosities occur due to increased vein wall elasticity and valvular damage and subsequent incompetence resulting in reversed flow [4]. The most common sites of venous valve incompetence are the sapheno-femoral junction (SFJ) and the sapheno-popliteal junction (SPJ).

### Contraindications to treatment [5,6]:

- Coagulation defects
- Inability to ambulate
- Arteriovenous malformation
- Uncompensated deep vein obstruction
- Arterial insufficiency
- Signs of infection/cellulitis
- Pregnancy
- Allergy to local anaesthetic

### Duplex:

The duplex is performed to assess for valvular incompetence and feasibility for thermal ablation. The most peripheral point of incompetence is mapped and targeted for the sheath entry point.

*Ultrasound guided procedures:*

### 1. Endovenous thermal ablation:

The technique used for endovenous laser ablation (EVLA) and radiofrequency ablation (RFA) is essentially the same, with the difference being the mode of energy delivered for thermal ablation of the vessel. RFA uses a bipolar endovenous catheter that produces high temperatures to induce thermal damage to the vein wall, causing collapse and closure of the vessel [4]. EVLA aims to induce thermal damage to the vein wall using a laser fibre that emits monochromatic light (810 or 940nm wavelength) to create the thermal reaction (figure 5).

### Technique:

- Equipment trolley prepared (Figure 3)
- Patient supine
• Needle access is gained under ultrasound guidance at the most peripheral (caudal) level of vein incompetence
• A long sheath is introduced over a wire
• A laser fibre is passed through the sheath with the tip positioned just below the SFJ/SPJ (figure 6).
• Tumescent local anaesthesia (see text box below) is administered along the length of the vein
• The laser fibre is slowly withdrawn at a rate of 2cm/minute until the entire desired vessel is treated (figure 4)
• The entry sites are cleaned, dressed and compressive stockings are applied.

**Efficacy:**

There are several case series in the literature on EVLA. The UK National Institute of Health and Care Excellence (NICE) guidelines on EVLA discuss results of a number of these studies, with mean follow up ranging from 1 to 17 months and saphenous vein closure rates ranging from 90% and 100% [7]. One study followed up patients for 2 years with a closure rate of 93.4% (113/121 veins) [8]. This study even reported 40 patients who were followed up for 3 year with no new recurrences reported.

**Tumescent local anaesthesia (TLA):**

This is a local anaesthetic diluted into a large volume which is injected into the perivenous space prior to that treatment. Our practice uses 50mL of 1% lignocaine and 10mL of Sodium Bicarbonate 8.4% diluted into 1 L of Sodium Chloride 0.9%. The tumescent local anaesthesia is administered with ultrasound guidance of the needle using a 21G needle [9]. The benefits of TLA include:

- **Anaesthetic:** to make the procedure as comfortable and painless as possible
- **Perivenous tissue separation:** insulating the treating vein, causing separation from surrounding nerves, arteries and skin to reduce thermal damage to these structures.
- **Reduces vein diameter:** promoting vein wall contact with the ablation device in order to maximise the circumferential energy transfer to the wall [3].

**2. Ultrasound guided foam sclerotherapy (UGFS):**

Foam sclerotherapy is used in our practice as an adjunct to laser ablation. It is performed the day following EVLA and is usually followed by ambulatory microphlebectomy (detailed below). The sclerosant used is Sodium Tetradecyl Sulphate. The concentration is diluted from 3 to 1.5% prior to being formed into a foam using the Tessari method, during which the sclerosant is mixed with air to form a foam [6]. The foam is then injected into the targeted veins under ultrasound guidance.
3. Ambulatory microphlebectomy (Figure 8):

Ambulatory microphlebectomy in our centre is performed at the same time as UGFS under local anaesthetic. The visible veins are marked with the patient in the standing position. A series of small cuts are made with a scalpel at regular intervals along the marked varicosity. Venous phlebectomy hooks are then used to externalise the veins through the tiny incisions (Figure 7). Artery clamps are then used to slowly extract the vein until the varicose vein is completely removed or ruptures [10]. This process is completely within each small incision along the full extent of the vein until completely removed. Steri-strips and water resistant dressings are then applied to each incision for 5-6 days.

Post procedure care:

Patients are instructed to wear compression hosiery for 2 weeks post procedure. Walking is encouraged immediately after the procedure. Paracetamol, anti-inflammatories and antibiotics are prescribed after the procedure. Low molecular weight heparin (LMWH) is used in some cases for a short period following the procedures, in those at higher risk of thromboembolic complications, to reduce the risk of deep venous thrombosis (DVT) [9].

Images for this section:
Fig. 1: Veins draining the lower limb form superficial and deep groups [11].
Fig. 2: Varicose Veins [12].

Fig. 3: Equipment trolley prior to EVLA.
**Fig. 4:** The laser catheter is guided into the great saphenous vein. As it is being withdrawn, the laser heats the vein causing the vein to close up [13].

**Fig. 5:** Total vein system energy source for the EVLA.
Fig. 6: This ultrasound image shows the confluence of the GSV with the femoral vein. The tip of the sheath is positioned 3cm distal to the confluence as shown.
Fig. 7: Equipment prior to phlebectomy; including the phlebectomy hook and artery clamps

Fig. 8: Ambulatory microphlebectomy [14].
Conclusion

This poster aims to outline minimally invasive procedures that are mostly performed under ultrasound guidance. Our centre utilises a method combining endovenous laser ablation (EVLA), ambulatory phlebectomy (AP) and ultrasound guided foam sclerotherapy (FS). Whilst level I evidence on the efficacy of these minimally invasive procedures used in combination is scarce, early results are very promising and the lower complication rate and faster patient recovery are proving very popular with patients.

Personal information

References


