Endovenous Laser Ablation (EVLA) of the Anterior Accessory Great Saphenous Vein (AAGSV): Abolition of Sapheno-Femoral Reflux with Preservation of the Great Saphenous Vein

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Anterior saphenous vein (ASV);
Anterior accessory great saphenous vein (AAGSV);
Endovenous laser ablation (EVLA);
Great saphenous vein sparing;
Varicose veins

Abstract
Aim: During surgery for sapheno-femoral junction (SFJ) and anterior accessory great saphenous vein (AAGSV) reflux, many surgeons also strip the great saphenous vein (GSV). This study assesses the short-term efficacy (abolition of reflux on Duplex ultrasound) of endovenous laser ablation (EVLA) of the AAGSV with preservation of a competent GSV in the treatment of varicose veins occurring due to isolated AAGSV incompetence.

Method: Thirty-three patients (21 women and 12 men) undergoing AAGSV EVLA alone (group A) and 33 age/sex-matched controls undergoing GSV EVLA (Group B) were studied. Comparisons included ultrasound assessment of SFJ competence, successful axial vein ablation, Aberdeen Varicose Vein Symptom Severity Scores (AVVSS) and a visual analogue patient-satisfaction scale.

Results: At the 1-year follow-up, EVLA had successfully abolished the target vein reflux (AAGSV: median length 19 cm (inter-quartile range, IQR: 14–24 cm) vs. GSV: 32 cm (IQR 24–42 cm)) and had restored SFJ competence in all patients. Twenty of the 33 patients (61%) in group A and 14 of the 33 (42%) in group B (p = 0.218) required post-ablation sclerotherapy at 6 weeks post-procedure for residual varicosities. The AVVSS at 12 months follow-up had improved from the pre-treatment scores in both the groups (group A: median score 4.1 (IQR 2.1–5.4) vs. 11.4 (IQR 6.0–14.1), p < 0.001) and SFJ/GSV competence was found to be restored at the 1-year follow-up.

Conclusions: AAGSV EVLA abolishes SFJ reflux, improves symptom scores and is, therefore,
Incompetence at the saphenofemoral junction (SFJ) is the most common cause (70%)\(^1\) of varicose veins, and SFJ ligation and stripping of the great saphenous vein (GSV) are the standard treatment for varicose veins due to GSV reflux. In some patients, reflux may occur in the anterior accessory great saphenous vein (AAGSV) rather than the GSV, although many surgeons strip the latter when performing surgery. Endovenous laser ablation (EVLA) employs laser energy to ablate incompetent axial veins selectively and was originally described for the treatment of GSV reflux and its related varicosities.\(^3\) This study assesses the safety and short-term efficacy of AAGSV EVLA with preservation of a competent GSV in patients with isolated SFJ/AAGSV reflux.

**Methods**

**Patients**

Of the 474 patients who had laser treatment for their varicose veins between March 2004 and January 2007 at the Leeds Vascular Institute, 33 patients (median age: 43 (range: 32–65) years; 21 women and 12 men) underwent AAGSV EVLA alone (group A) for isolated SFJ/AAGSV reflux. Twelve of these patients had undergone previous treatment for varicose veins (GSV EVLA (n = 3) and surgical stripping of GSV (n = 9)). Outcomes in these patients were compared with those for 33 age/sex-matched controls who had undergone GSV EVLA alone during the same time period (Group B: isolated SFJ/GSV reflux), 13 of whom had previous treatment for varicose veins. Demographic data and the disease severity (Clinical, Etiology, Anatomy and Pathophysiology (CEAP) classification)\(^4\) for the two groups are compared in Table 1. Patients who had varicosities (primary or recurrent) arising from an incompetent SFJ with reflux in either the AAGSV (Group A) or GSV (group B) were included. Patients who had previous deep vein thrombosis (DVT) and those who had reflux in more than one axial vein (AAGSV and GSV) were excluded from this study. Further, limbs that had intra-saphenous reflux with a competent SFJ were also excluded.

**Data collection and follow-up**

Prior to EVLA, all patients undertook a duplex ultrasound scan (DUS; TITAN\(^5\), Sonosite Inc., Bothell, USA, 5–10 MHz linear probe) to determine the site of superficial venous incompetence. Previous treatment for varicose veins was documented. Ultrasound examination was performed on the patient in a standing position. Following calf compression and release, retrograde flow in the axial vein lasting >1 s represented significant reflux. The diameter of the GSV (5–10 cm distal to the SFJ whilst standing) was measured in both groups, as well as the AAGSV diameter in group A. Suitability for GSV EVLA was established using criteria described previously.\(^5\) Similarly, suitability for AAGSV EVLA depended upon a ≥10-cm long, relatively straight, segment of AAGSV immediately distal to the SFJ, an absence of significant varicosities arising within 10 cm of the SFJ and an AAGSV diameter of ≥3 mm at the intended cannulation site (Fig. 1). Further, the common anatomical variations in AAGSV anatomy, together with an indication as to whether EVLA is appropriate, are shown in Fig. 2. Disease severity was assessed using ‘C’ of the CEAP clinical classification\(^6\) prior to treatment (following DUS examination, all patients were found to be Ep As Pr) and the Aberdeen Varicose Vein Severity Score (AVVSS) was determined before and at 1 year after EVLA. All data were collected prospectively by a consultant vascular surgeon or vascular research fellow.

EVLA was performed using tumescent local anaesthesia (0.1% lignocaine) and an 810-nm diode pulsed laser at 12 W power delivering 60–80 J cm\(^{-1}\). Neither concomitant phlebectomies nor foam sclerotherapy was undertaken. Following treatment, a compression bandage was applied for a week, followed by class II support stocking for another week. Patients were reviewed at 6, 12 and 52 weeks. All patients with visible residual varicosities of 4-mm diameter or greater were treated with foam sclerotherapy at 6 weeks (if required) using 0.5–1% sodium tetradecyl sulphate (STD) foam (Fibro-vein\(^6\), STD Pharmaceutical Products Ltd., Hereford, England) that was prepared by the Tessari method.\(^6\) A non-stretch compression bandage was applied for 1 week following foam sclerotherapy of residual varicosities.

During follow-up, in addition to clinical examination for residual varicosities, symptomatic improvement and complications, DUS was performed at 6, 12 and 52 weeks to assess SFJ and tributary incompetence and ablation of the treated axial vein. Patency of the deep veins was assessed at 6 and 12 weeks, and the diameters of visible veins were re-measured at 1 year. Absence of flow in a non-compressible vein or a non-visible axial (GSV or AAGSV) vein on DUS represented successful ablation. The primary

### Table 1

<table>
<thead>
<tr>
<th></th>
<th>Group A (AAGSV reflux)</th>
<th>Group B (GSV reflux)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of patients</td>
<td>33 (33)</td>
<td>33 (33)</td>
</tr>
<tr>
<td>Age</td>
<td>43 (32–65)</td>
<td>43 (32–65)</td>
</tr>
<tr>
<td>Male:female</td>
<td>21:12</td>
<td>21:12</td>
</tr>
<tr>
<td>Primary:recurrent varicose veins</td>
<td>21:12</td>
<td>20:13</td>
</tr>
<tr>
<td><strong>CEAP classification</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C2</td>
<td>28 (85%)</td>
<td>26 (79%)</td>
</tr>
<tr>
<td>C3</td>
<td>4 (12%)</td>
<td>5 (15%)</td>
</tr>
<tr>
<td>C4</td>
<td>1 (3%)</td>
<td>1 (3%)</td>
</tr>
<tr>
<td>C5/6</td>
<td>0</td>
<td>1 (3%)</td>
</tr>
<tr>
<td>All patients: Ep As Pr</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
outcomes were the DUS ablation rates and the improvement in AVVSS in both groups at 1 year post-procedure. Patient satisfaction was assessed at the 1-year follow-up using a visual analogue scale with scores from 1 to 10 on a 10-cm scale. Patients were asked to locate their satisfaction point on this scale which was then calculated as a percentage. A log of complications was maintained throughout the study. Secondary outcomes included patients’ satisfaction, sclerotherapy requirement and complication rates. All data were collected prospectively.

## Statistical analysis

The AVVSS before and after laser ablation were compared within a group using a Wilcoxon test, and the improvements in AVVSS between groups were compared by a Mann–Whitney U test. Sclerotherapy requirements were compared using a chi-square ($\chi^2$) test. A $p$-value of $<0.05$ was considered significant. Data descriptors are the median (inter-quartile range, IQR), unless stated otherwise. All analyses were performed using the statistical package SPSS® for Windows (SPSS ver. 14.0, Chicago, IL, USA).

### Results

The treatment details for both groups are summarised in Table 2. All treated AAGSVs and GSVs were completely ablated, and SFJ reflux was found to be abolished in all patients of both groups at the 1-year follow-up. Foam sclerotherapy for residual varicosities was required in 20 of the 33 patients (61%) in group A and 14 of the 33 patients (42%) in group B ($\chi^2 = 2.2$ (df = 1) $p = 0.218$). Median patient-satisfaction scores were similar (group A: 84% and group B: 90%, $p = 0.23$) and the AVVSS had improved at 1 year when compared to pre-treatment scores (group A: median 4.1 (IQR: 2.1–5.2) vs. 11.6 (IQR: 6.9–15.1) and group B: 3.3 (IQR: 1.1–4.5) vs. 14.5 (IQR: 7.6–20.2); $p < 0.001$ for both groups). The percentage improvement in AVVSS was 64.6% (group A) and 77.2% (group B), with no significant difference between the groups ($p = 0.18$, Mann–Whitney test).

None of the participants developed a DVT or signs of sensory nerve damage, although two patients in group A and one in group B had symptoms of phlebitis in the EVLA-treated vein before sclerotherapy was performed. In addition, of the 34 patients (from both groups) who received delayed foam sclerotherapy, five (three in group A and two in group B) developed symptomatic phlebitis. Although skin staining was not documented at 6 weeks, it was present in 11 patients following foam sclerotherapy at 12 weeks. This had faded in all patients by the 1-year follow-up, but was still visible in three of the 34 (9%) patients. No other complications occurred.

Twelve patients in group A had undergone previous treatment for varicose veins, and thus the GSV was only preserved in the remaining 21 patients. These were all in continuity with the SFJ without evidence of reflux at the 1-year follow-up, with no change in mean GSV diameter (3.2 cm).
SD 0.9 (pre-treatment) vs. 3.3 SD 0.6 (1 year); \( p = 0.32 \). The AVVSS scores also improved in this subgroup (median 4.4 (IQR 2.0–5.4) vs. 11.4 (IQR 6.0–14.1), \( p = 0.002 \)). The treated AAGSV was not visible on DUS at the 1-year follow-up in any patient in group A, and no clinical recurrences were visible in patients from either group at final review.

**Discussion**

Abolition of SFJ reflux requires ablation of all incompetent axial veins arising from the junction. Thus, AAGSV ablation abolishes reflux at the SFJ when associated with isolated reflux in this vein. Fig. 3 illustrates the fate of the SFJ, GSV and AAGSV following successful AAGSV ablation. The subsequent improvement in symptom scores was similar to that achieved after GSV ablation.

Although SFJ reflux can be associated with incompetence in one or more of its tributaries, most patients (85%) only have GSV reflux,\(^7\) and GSV ablation abolishes SFJ reflux with persistent competence of its tributaries at the 1-year follow-up.\(^8\) Equally, when SFJ incompetence is associated with reflux in more than one axial vein (5%),\(^7\) all incompetent veins require either ablation (EVLA) or stripping (surgery) to restore SFJ competency.

**Table 2** Details of the vein for EVLA in Group A (AAGSV reflux) and Group B (GSV reflux).

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Group A (AAGSV)</th>
<th>Group B (GSV)</th>
<th>( p )-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diameter of vein (mm)</td>
<td>7.1 (5.2–8.0)</td>
<td>7.8 (5.2–8.8)</td>
<td>0.12</td>
</tr>
<tr>
<td>Length of vein (cm)</td>
<td>19 (14–24)</td>
<td>32 (24–42)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Total laser energy (J)</td>
<td>1178</td>
<td>2012</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Laser energy density (J cm(^2))</td>
<td>61</td>
<td>63</td>
<td>0.34</td>
</tr>
</tbody>
</table>

All data are shown as median (inter-quartile range).

Isolated AAGSV/SFJ reflux occurs in around 10% of the patients.\(^7\) During conventional surgery, many surgeons also strip the competent GSV because of the possibility that, post-SFJ ligation, neo-vascularisation may subsequently promote GSV reflux and recurrence. Although stripping of incompetent axial veins is required to avoid recurrence, there is no evidence to support this for competent veins. During EVLA, selective ablation of the incompetent axial vein can be achieved without the temptation to ablate competent axial veins. Thus, a healthy GSV may be preserved. Subsequently, it will still be available, if required, for vascular or coronary artery reconstruction.

Ideally, AAGSV EVLA should have been compared with surgery for AAGSV reflux. The issue of routine practice for this type of reflux (in the UK) made this comparison difficult. Further, most patients with varicose veins now choose EVLA over surgery if their axial veins are suitable for ablation. Nevertheless, the comparison of AAGSV and GSV EVLA in this study suggests that symptom improvement is similar for both procedures. Further, previous studies show that EVLA and surgery in patients with SFJ/GSV reflux\(^9,10\) are equally effective in improving symptom scores.

Despite these results, EVLA is unlikely to replace surgery for all patients with SFJ/AAGSV reflux as anatomical considerations indicate that it is only feasible in 70% of cases (Fig. 2) (unpublished data). Although not statistically significant (because of the small sample size), the sclerotherapy requirement was higher following AAGSV EVLA as compared to after GSV EVLA. This reflects the shorter segment of AAGSV that can be ablated, and the extensive varicosities that may be present distal to the site of vein cannulation. This is consistent with previous findings that the need for adjuvant sclerotherapy is minimised by commencing ablation at the lowest point of reflux.\(^11\)

Following GSV EVLA, almost 40% of the patients do not have any tributaries in continuity with the SFJ.\(^1\) In contrast, following AAGSV EVLA, the GSV remains in continuity with the SFJ in all patients, allowing normal GSV function.

**Figure 3** Diagrammatic representation of GSV-sparing AAGSV laser ablation.
In conclusion, GSV-sparing EVLA of the AAGSV abolishes SFJ reflux associated with isolated SFJ/AAGSV reflux and improves symptom scores to a similar degree as GSV EVLA with no evidence of GSV neo-reflux or recurrent varicosities at the 1-year follow-up. This treatment option preserves the healthy GSV for future use if required. Although long-term follow-up is required, the technique appears both safe and effective.

References


7 Theivacumar NS, Dellagrammaticas D, Mavor AID, Gough MJ. “Can we increase the proportion of patients with sapheno-femoral junction (SFJ) reflux who are suitable for endovenous laser therapy (EVLA)?”. In: Presented at the venous forum spring meeting, Bristol; March 2007.


