NATIONAL INSTITUTE FOR CLINICAL EXCELLENCE

INTERVENTIONAL PROCEDURES PROGRAMME

Interventional procedure overview of Radiofrequency ablation of varicose veins (VNUS closure)

Introduction

This overview has been prepared to assist members of IPAC advise on the safety and efficacy of an interventional procedure previously reviewed by SERNIP. It is based on a rapid survey of published literature, review of the procedure by Specialist Advisors and review of the content of the SERNIP file. It should not be regarded as a definitive assessment of the procedure.

Procedure name

Radiofrequency ablation of varicose veins
Synonyms: VNUS Closure; endovascular obliteration; endovascular closure; endoluminal obliteration; endoluminal closure; saphenous vein obliteration

SERNIP procedure number

132

Specialty society

Vascular Surgical Society of Great Britain and Ireland

Executive summary

Treatment of varicose veins via radiofrequency ablation appears to result in acute occlusion of 90-100% of veins and 90-98% occlusion with a maximum follow-up of two years. In one RCT, radiofrequency ablation patients had less pain compared to stripping, less analgesia and less time of work.[1] Radiofrequency ablation was less cost effective than stripping due to the high cost of the catheter, but if the indirect cost of “lost working days” is included, it is more cost effective than stripping.[1]

Symptom severity score significantly reduced after the procedure with usually <5% still having symptoms such as leg pain, leg fatigue, oedema and varicose veins at 6[2] or 24[3] month follow-up. There were high satisfaction rates with the procedure for 94 to 100%[2-6] of patients recommending the procedure.

The randomised controlled trial[1] showed similar total postoperative complication rates between radiofrequency ablation and stripping arms of approximately 50%. Studies showed that skin burns occurred in 2 to 7% of patients, but the infiltration of solution between the skin and vein when the vein is less than 5mm from the skin surface should help to alleviate this complication. Paresthesias occurred in 0-15%[1-6] of patients, and were more common in patients where treatment was below the knee. Clinical phlebitis

occurred in 2-3%[1,2,4-6] of patients, deep vein thrombosis occurred in 1%[2,6] and pulmonary embolism in <1%.[2,6]

Indication(s)

Symptomatic venous insufficiency is common, affecting 1-15% of adult men and 20-25% of adult women.[4] Saphenous vein insufficiency is the most common form of venous insufficiency in patients presenting with symptoms, which include pain, oedema, fatigue, varicose veins and venous ulcers. Specific indications for treatment of saphenous vein insufficiency with radiofrequency ablation include; saphenofemoral, sphenopopliteal or truncal vein reflux in response to Valsalva's manoeuvre in 15 degrees reverse Trendelenburg's position or with standing manual compression and release, identified with duplex ultrasound. The diameter of the lumen of the vein must be less than 12mm as measured with duplex scanning with the patient in a supine position. Excessive tortuosity of the vein would impede catheter advancement and should be excluded from treatment via radiofrequency ablation. Patients on anticoagulants, with concomitant peripheral artery disease, with pacemakers, serious systemic disease or who are pregnant should also be excluded.

Summary of procedure

Radiofrequency ablation of varicose veins (Closure® System, VNUS Medical Technologies, Inc., Sunnyvale, CA, USA) uses a bipolar generator and catheters with sheathable electrodes, which exchanges electrical polarity between the collapsible electrodes and a central ball tip. This provides resistive vein wall heating of 6-8mm in length that can be drawn along the length of the vein to be closed. The saphenous vein is accessed above or below the knee either percutaneously via an intravenous cannula/venipuncture sheath or via a small cut down. The catheter tip is positioned at the saphenofemoral junction (while the patient is in the reverse Trendelenburg position). Local anaesthetic is applied along the remaining portion of the limb to be treated and the leg is then wrapped from foot to thigh to exsanguinate the vein. The catheter position is checked and manual compression of the groin is performed before radiofrequency heating commences. The catheter is manually withdrawn at 2.5-3cm/minute, and the vein wall temperature is maintained at 85°C.

Literature review

A systematic search of MEDLINE, PREMEDLINE, EMBASE, Current Contents, PubMed, Cochrane Library and Science Citation Index using Boolean search terms was conducted, from the inception of the databases until November 2002. The York Centre for Reviews and Dissemination, Clinicaltrials.gov, National Research Register, SIGLE, Grey Literature Reports (2002), relevant online journals and the Internet were also searched in November 2002. Searches were conducted without language restriction.

Articles were obtained on the basis of the abstract containing safety and efficacy data on radiofrequency Ablation of Varicose Veins in the form of randomised controlled trials (RCTs), other controlled or comparative studies, case series and case reports. Conference abstracts and manufacturer's

information were included if they contained relevant safety and efficacy data. Foreign language papers were included if they contained safety and efficacy data and were considered to add substantively to the English language evidence base, and that could be translated in the time available.

Studies were rejected for reporting no clinical outcomes, being review articles, or involving techniques other than treatment of varicose vein by radiofrequency ablation. In the case of duplicate publications, the latest, most complete study was included. Studies were selected for extraction of data firstly if they were comparative, then case series were rated as to number of patients, breadth of study population (therefore multicentre studies were rated most highly) and length of follow-up. Included studies are highlighted in bold in the reference list. Studies for which data were not tabulated are listed in the annex following the reference list, with reasons for exclusion.

List of studies found
Total number of studies:

- Randomised controlled trials – 1
- Systematic reviews – 0
- Non-randomised comparative studies – 0
- Case series – 13
- Case reports – 0

RCTs in progress
None located.

Summary of key efficacy and safety findings
See following tables;

Abbreviations:

CEAP	clinical, etiologic, anatomic, pathophysiologic (scoring system)
CI	Confidence interval
DVT	Deep vein thrombosis
GSV	Greater Saphenous Vein
SD	Standard deviation
VAS	Visual Analogue Scale

Authors, date, location, number of patients, length of follow-up, selection criteria	Key efficacy findings	Key safety findings	Appraisal/Comments
Randomised controlled trials			
Rautio *et al*.[1] 2002, FINLAND, CANADA Radiofrequency ablation: 15 patients Stripping: 13 patients *Follow-up*: mean 50 days (100% of patients) *Selection criteria*: 121 consecutive patients, between January and June 2000, scheduled for varicose vein surgery were screened for the appropriate indications for VNUS, 85 patients were excluded due to bilateral disease, large or tortuous veins, no greater saphenous vein reflux, simultaneous lesser saphenous vein reflux, previous treatment, veins with a curve >90° on ultrasonography, unsuitable for day surgery and patient refusal. 36 patients were admitted during study period and three refused due to an unsuitable schedule.	<u>Operation times</u> VNUS: 75 min (SD 16.6) Stripping: 57 min (SD 11.0) p=0.003 <u>Outcomes</u> *Colour duplex scan* No duplex scan-detectable flow in the obliterated (VNUS) greater saphenous vein segments in 15/15 (100%) VNUS patients. *Postoperative venous segmental disease score* The postoperative venous segmental disease score fell from 1 to 0 in 15/15 (100%) of VNUS patients. 1/13 (8%) stripping patients had reflux in an accessory branch of the greater saphenous vein, which resulted in a postoperative venous segmental disease score of 1. *Decrease in venous clinical severity* VNUS: mean 5.1 (SD 1.5) Stripping: mean 4.4 (SD 1.1) p=0.19 *Postoperative venous disability score* VNUS: Score 0 in 14/15 (93%) Stripping: Score 0 in 12/13 (92%) (The two patients occasionally needed compression stockings while working) <u>Visual analogue pain scale (VAS)</u> VNUS n = 15 / Stripping n = 13 / p= Rest: 0.7 (SD 0.5) / 1.7 (SD 1.3) / 0.017 Standing: 1.3 (SD 0.7) / 2.6 (SD 1.9) / 0.026 Walking: 1.8 (SD 0.8) / 3.0 (SD 1.8) / 0.036 <u>Analgesia</u> (average daily number of 600mg ibuprofen tablets) VNUS: 0.4 (SD 0.49) Stripping: 1.3 (SD 1.09) p=0.004	<u>Intraoperative complications</u> VNUS: small second degree thermal skin injuries 3/15 (20%) (resulting in tenderness and induration over the treated greater saphenous vein) Stripping: Painful groin haematoma 1/13 (8%) <u>Postoperative complications</u> VNUS 15 patients / Stripping 13 patients Saphenous nerve paresthesia: 2/15 (13%) / 3/13 (23%) Clinical thrombophlebitis: 3/15 (20%) / - Local haematoma: 1/15 (7%) / 4/13 (31%) Thermal skin injury*: 1/15 (7%) / - Total: 7/15 (47%) / 7/13 (54%) * This patient was one of the three with a thermal skin injury noted intraoperatively, but the injury was still present at the follow-up visit and was considered as a late complication.	*Potential for bias*: Small study numbers. 33 patients were randomised to radiofrequency ablation or stripping with a sealed envelope method. Patients were not blinded and four patients withdrew through disappointment with the stripping allocation. One patient from the VNUS group was excluded due to pregnancy. External validity may be compromised as 121 patients screened reduced to 33 patients randomised. No authors have stated involvement with VNUS Medical Technologies. No losses to follow-up. *Outcome measures and their validity*: The validity of the CEAP scoring system, the venous clinical severity score, the venous segmental disease score, the venous disability score and the visual analogue pain scale (VAS) were not specifically stated. Colour duplex ultrasonography. *Other comments*: Basic characteristics of patients were similar between groups except for higher mean age (p=0.045) in the stripping group. Standardised balanced general anaesthesia was used for both groups. No significant differences were seen in the bispectral index, sevoflurane minimum alveolar concentration, immediate recovery from anaesthesia, or home readiness (p value not stated). All radiofrequency ablation procedures performed by one surgeon in collaboration with one radiologist (investigators performed >30 VNUS procedures prior to this study). The stripping procedure was performed by the same

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Sick leave (days)
VNUS: 6.5 (SD 3.3)
Stripping: 15.6 (SD 6.0) 95% CI 5.4 to 12.9, p<0.001
A more distinct difference was noted in the patients' own assessment of the length of required sick leave
VNUS: 6.1 (SD 3.3)
Stripping: 15.6 (SD 6.0) 95% CI 7.2 to 18.9, p<0.001

RAND-36 Quality of life index
Physical function was restored faster in VNUS group compared to stripping group.
Only bodily pain was statistically different (p=0.05) between VNUS 23 (5-24) and Stripping 38 (20-45) at one week postop (median difference from baseline postop. value).

Patient satisfaction
All patients were satisfied with the treatment, but 1/15 (7%) VNUS and 4/13 (31%) stripping were dissatisfied with cosmetic outcome.

Cost analysis
The cost of radiofrequency ablation was higher than stripping mainly because of the cost of the catheter, but also due to the presence of a surgeon and a radiologist and the cost of the radiofrequency generator and ultrasound equipment. Postoperative costs were higher for the stripping group. If the indirect cost of lost working days were taken into account, radiofrequency ablation is more cost effective than stripping.

surgeon.

Case series

Study details	Key efficacy findings	Key safety findings	Appraisal/Comments
Dauplaise and Weiss[2] 2001, USA 288 patients (316 legs) *Follow-up*: up to 6 months (91% of patients at 1 week postop. and 29% at 6 months postop.) *Selection criteria*: Patients with non-aneurysmal saphenous vein reflux in veins less than 12mm in diameter were eligible for treatment, but excluded if the vein was tortuous as it would impede the advancement of the catheter.	Postoperative vein occlusion (absence of duplex ultrasound-determined flow) *1 week* 280/288 (97%) patients (flow was not always accompanied by saphenous vein reflux since reflux was eliminated in 282/288 veins (98%). *6 months* Reflux absent in 86/93 (92%) veins (flow was not always accompanied by saphenous vein reflux since reflux was eliminated in 88/93 (95%). Symptom resolution (legs) Patient satisfaction Determined by asking whether the patient would recommend the procedure to a friend with similar leg vein problems. At 6 months, 83/88 (94%) patients (93 treated legs) indicated they would recommend the procedure	Adverse events within the first postoperative week • Nonocclusive thrombus extension to the common femoral vein in 3 legs (1%). • Pulmonary embolism in 1 leg (0.3%) * Skin burns were associated with instances where the vein was very close to the skin surface. Duplex scanning is now routinely used to ensure the saphenous vein in at least 5-10mm from the skin surface before treatment, and if not, dilute lidocaine solution is infiltrated between the skin and the vein.	*Potential for bias*: It was not clear why patients were consecutive or selected in same way. Loss to follow-up not stated. Some patients had not reached six weeks or six months follow-up. Possible unit of analysis errors – legs not patients analysed. Conflict of interest was not stated, and Weiss is a consultant for VNUS Medical and Diomed Lasers (this was stated in another article by the same author). *Outcome measures and their validity*: Duplex ultrasound for determination of saphenous vein flow. Patient satisfaction assessed by asking whether the patient would recommend the procedure to a friend with similar leg problems. *Other comments*: Adjunctive procedures Adjunctive high ligation 67 legs (21%) – performed early in clinical experience, until persistent vein occlusion was known to occur with high frequency. Phlebectomy 194 legs (61%). Treatment was typically limited to the vein from the saphenofemoral junction to above the calf area in order to reduce the risk of paresthesia, which can occur when treating the below-calf segments.

Symptom	Pre-treatment (N=316)	6 weeks (N=228)	6 months (N=93)
Leg pain	251 (79%)	44 (19.3%)	8 (8.6%)
Leg fatigue	216 (68%)	24 (10.5%)	3 (3.2%)
Oedema	105 (33%)	19 (8.3%)	2 (2.2%)
Varicose veins	308 (97%)	14 (6.1%)	5 (5.4%)

Adverse event	Within 1 week postop.	6 months
DVT	3/288 (1.0%)	0/93 (0%)
Skin burns*	8/288 (2.8%)	0/93 (0%)
Clinical phlebitis	9/288 (3.1%)	2/93 (2.2%)
Paresthesia (above calf treatment)	31/228 (13.6%)	3/53 (5.7%)

Study details	Key efficacy findings	Key safety findings	Appraisal/Comments
Goldman and Amiry[5] 2002, USA 47 patients (50 legs) *Follow-up*: Up to 24 months *Selection criteria*: Sequential patients presenting to clinic with incompetent greater saphenous vein (GSV) from an incompetent saphenofemoral junction and painful varicosities.	Procedure times Average time to access the GSV in the medial thigh – 7 min (1-30 mins) with 27 patients having the GSV accessed in 1 min. Average catheter pullback rate 2.76cm/min over an average length of treated GSV of 19cm (6-42cm) Resumption of activities 95% of patients could resume all preoperative activities within 24 hr, the other 2 patients could resume all activities within 48 hr • All patients (100%) had complete elimination of leg pain and fatigue (postop. time not stated). • 21/22 (95%) who presented with ankle oedema had resolution of oedema (postop. time not stated). • All patients (100%) would recommend the procedure to a friend. • 1/50 legs (2%) no heparinised saline flow in the catheter causing excessive localised thrombosis of the catheter tip – three additional insertions were required with additional compression to achieve complete closure. Postoperative duplex evaluation[$] (legs) Veins closed: 28/41 (68%) Veins open without reflux: 9/41 (22%) Veins open with reflux: 4/41 (10%) Recurrent veins: 3/41 (7%)* Recurrent symptoms: 1/41 (2%)** [$] Time after Closure procedure of last evaluation 8 legs @ 24 months 8 legs @ 18 months 6 legs @ 12 months 8 legs @ 9 months 11 legs @ 6 months 9 patient legs unavailable for 6 month evaluation * No new varicose veins noted to appear in three patients with recurrent reflux in the GSV ** One patient who developed reflux had the development of new veins at one year posttreatment.	4/47 (9%) patients complained of heat distal to the saphenofemoral junction during the procedure – resolved with the addition of tumescent anaesthesia. No evidence of cutaneous damage in any patient. Complications Oedema: 0 Phlebitis: 0 Paresthesia: 0 Superficial thrombophlebitis: 0 Haematoma: 0 Thrombus extension: 0 Infection: 0 Purpura: 28/50 legs (56%)† Erythema: 5/50 legs (10%)‡ Fibrous cord: 8/50 legs (16%)£ † lasted less than 2 weeks ‡ lasted 2 to 3 days £ over sites of ambulatory phlebectomy that lasted up to 6 months	*Potential for bias*: Consecutive patients. Six patients (9 legs) were lost to follow-up after 6 months due to change in location. 39/47 (79%) patients, 41 treated legs were available for follow-up, two patients unaccounted for. Possible unit of analysis errors – legs not patients analysed. Authors indicated no significant interest with commercial supporters. Disagreements between numbers stated in tables and in the text for initial patient number and denominator for complications. *Outcome measures and their validity*: Duplex ultrasound. Patient satisfaction assessed by whether the patient would recommend the procedure to a friend with similar leg problems. *Other comments*:

Merchant *et al*.[6] 2002, USA

286 patients (318 legs; one leg was treated twice as it immediately recanalised after the first treatment as a result of only treating a 6cm segment)

Follow-up:
24 months – 142 legs;
2 months – 232 legs;
6 months – 223 legs;
1 week – 286 legs.

Selection criteria:
Multicentre study. Patients with reflux in non-aneurysmal veins less than 12mm in lumen diameter as measured with duplex scanning were offered the Closure procedure after informed consent and discussion of the treatment alternatives. Legs with tortuous veins were excluded. Prospective protocol, case series. Data collected in an ongoing registry from December 1998 to June 2000, and includes follow-up data through January 2002.*Continued over…*

Outcomes over time

	Follow-up time period							
	1 week		6 months		12 months		24 months	
Outcome	n/N	%	n/N	%	n/N	%	n/N	%
*CO**	*267/286*	*93.4*	*192/223*	*86.1*	*194/232*	*83.6*	*121/142*	*85.2*
Varicose veins absent	239/267	89.5	178/192	92.7	183/194	94.3	111/121	91.7
Reflux absent	267/267	100	192/192	100	194/194	100	121/121	100
NCO†	*14/286*	*4.9*	*17/223*	*7.6*	*13/232*	*5.6*	*5/142*	*3.5*
Varicose veins absent	12/14	85.7	15/17	88.2	11/13	84.6	5/5	100
Reflux absent	10/14	71.4	11/17	64.7	11/13	84.6	5/5	100
Recanalisation‡	*5/286*	*1.7*	*14/223*	*6.3*	*25/232*	*10.8*	*16/142*	*11.3*
Varicose veins absent	4/5	80.0	6/14	42.9	15/25	60.0	7/16	43.8
Reflux absent	1/5	20.0	4/14	28.6	7/25	28.0	2/16	12.5

*CO - complete occlusion - veins with no evidence of flow
†NCO – near complete occlusion - veins with less than or equal to 5cm segment of flow within an otherwise occluded vein.
‡Recanalisation defined as greater than 5cm of flow in any treated vein segment

Paired statistical comparisons (outcomes)
Rates of reflux and varicose veins between the CO and recanalisation groups were significantly different ($p<0.01$) at each of the 6, 12 and 24 month follow-ups.
Comparison of outcomes between the CO and NCO groups showed significant differences ($p<0.01$) in the rate of reflux at 6 and 12 months but no difference in the rate of varicose veins at 6, 12 and 24 months of follow-up.
Comparison of outcomes between legs in the NCO and recanalisation groups showed significant differences ($p<0.05$) in the rate of varicose veins at 6 and 24 months and in reflux rates at 12 and 24 months ($p<0.01$).

Complications
Deep vein thrombosis
3/286 legs (1%) – one of these patients had a pulmonary embolism – all thrombotic episodes successfully treated with anticoagulation therapy.
Skin burns
6/143 (4.2%) in the first 143 of 286 legs in which 1 week follow-up was obtained.
0/143 (0%) legs treated in the second half of the study.
Clinical phlebitis
6/286 (2.1%) at 1 week, 1/223 (0.4%) at 6 months and in 0/232 and 0/121 legs at 12 or 24 months, respectively.
Infection
No legs showed signs of an infection at any follow-up visit.
Paresthesia (focal hypoesthesia)
43/286 (15%) legs at 1 week, 21/223 legs (9.4%) at 6 months, 9/232 (3.9%) at 12 months and in 8/142 legs (5.6%) at 24 months. When treatment was limited to the thigh and just below the knee (as is done with limited vein stripping), paresthesia rates at 12 and 24 months were 5/179 (2.8%) and 5/111 (4.5%) compared with and 4/53 (7.5%) and 3/31 (9.7%) respectively when

Potential for bias: Only cases from 30 centres that followed the prescribed Closure protocol were included. One centre was excluded as the prescribed pull-back technique was not used. VNUS Medical Technologies administered the data collection and analysis and provided limited funding to obtain some follow-up duplex scans on patients 1 and 2 years after treatment. Lead author reviewed all of the data from all involved study centres. Technical assistance in preparation of article was provided by VNUS but data interpretation, writing of the report and decision to submit were under control of the authors. The lead author has been paid a consulting fee by VNUS Medical Technologies for providing educational opportunities for their technical staff. There appears to be a discrepancy between the numbers reported for physician assessment of successful outcome and patient satisfaction assessment. Follow-up is ongoing and no losses were stated. Data from some patients were excluded because of lack of follow-up data at each follow-up opportunity. Outcome assessor was not blinded. Possible unit of analysis errors – legs not patients analysed.

Outcome measures and their validity: Colour duplex ultrasound, clinical examination and CEAP. Validity of the CEAP classification not specifically stated. Patient satisfaction

Symptom resolution

	Symptoms									
	Pain		Fatigue		Oedema		Pigmentation		Dermal sclerosis	
Follow-up time period	n/N	%	n/N	%	n/N	%	n/N	%	n/N	%
Pretreatment	265/319	83.1	243/319	76.2	97/319	30.4	69/319	21.6	21/319	6.6
6 months										
CO	9/192	4.7	1/192	0.5	2/192	1	15/192	7.8	3/192	1.6
NCO	0/17	0	0/17	0	0/17	0	3/17	17.6	0/17	0
Recanalisation	4/14	28.6	2/14	14.3	1/14	7.1	1/14	7.1	1/14	7.1
12 months										
CO	6/194	3.1	2/194	1	1/194	0.5	18/194	9.3	3/194	1.5
NCO	0/13	0.0	0/13	0	0/13	0	1/13	7.7	0/13	0
Recanalisation	3/25	12.0	3/25	12	1/25	4.0	4/25	16	1/25	4
24 months										
CO	4/121	3.3	2/121	1.7	5/121	4.1	9/121	7.4	1/121	0.8
NCO	1/5	20	1/5	20	0/5	0	0/5	0	0/5	0
Recanalisation	4/16	25	3/16	18.8	2/16	12.5	3/16	18.8	2/16	12.5

Mean symptom severity scores

Follow-up time period	N	Mean pretreatment score	Mean posttreatment score
Pretreatment	319	2.00	N/A
6 months			
CO	192	1.93	0.07
NCO	17	1.71	0.00
Recanalisation	14	2.14	0.50
12 months			
CO	194	2.02	0.06
NCO	13	1.38	0.00
Recanalisation	25	2.20	0.32
24 months			
CO	121	1.85	0.10
NCO	5	1.60	0.40
Recanalisation	16	2.31	0.63

N/A, not applicable

Absence of the four principal symptoms of venous insufficiency (pain, fatigue, oedema and varicose veins) was determined to learn the number and percent of treated legs that were asymptomatic at follow-up:

103/121 (85.1%) CO legs, 4/5 (80%) NCO legs and 6/16 (37.5%) recanalisation legs were asymptomatic after 24 months after treatment. Significant differences ($p<0.01$) were seen in symptomatic status among the CO, NCO and recanalised legs.

treatment extended to the ankle.

assessed by whether the patient would recommend the procedure to a friend with similar leg problems.

Other comments:

The Radiofrequency ablation procedure was performed with general anaesthesia in some centres, but most procedures were completed with local anaesthesia.

Adjunctive procedures

High ligation of the saphenofemoral vein was not performed on any patient. Adjunctive procedures at the time of treatment included phlebectomy in 187 (59%) legs and scelrotherapy in 11 (4%) legs.

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Paired statistical comparisons of the CO and recanalisation groups (asymptomatic status)
Paired comparisons of the CO and recanalisation groups found significant differences ($p<0.01$) in asymptomatic status at 6, 12 and 24 month follow-up.
Paired comparison of the CO and NCO groups showed no significant difference in asymptomatic status at all follow-up periods.
Asymptomatic status was different ($p<0.05$) between the NCO and recanalisation groups at 6 months, but not at 12 or 24 months.

Physician assessment of successful outcome (by leg)

	Follow-up time period					
	6 months		12 months		24 months	
	n/N	% successful	n/N	% successful	n/N	% successful
CO	187/192	97.4	192/194	99	119/121	98.3
NCO	11/17	64.7	12/13	92.3	5/5	100
Recanalisation	3/14	21.4	10/25	40	6/16	37.5

Patient satisfaction (patients stating that they would recommend procedure to friend)

	Follow-up time period					
	6 months		12 months		24 months	
	n/N	% satisfied	n/N	% satisfied	n/N	% satisfied
CO	163/169	96.4	166/175	94.9	104/108	96.3
NCO	14/16	87.5	12/12	100	5/5	100
Recanalisation	9/14	64.3	17/25	68	12/15	80

At 24 months follow-up, 5 patients (5 legs) indicated they would recommend the procedure, despite an unsuccessful assessment by the physician. All 5 legs had recanalisation and the average symptom score was 0.2, compared to 1.8 before treatment. In patients with CO, there were 5 instances in which the physician assessed outcome as successful and the patient's report were different – 3/5 did not answer the question on patient satisfaction, 2/5 patients had paresthesia in the calf or ankle region.

Study details	Key efficacy findings	Key safety findings	Appraisal/Comments
Weiss and Weiss[3] 2002, USA 120 patients (140 legs) *Follow-up*: 24 months – 21 patients; 12 months – 67 legs; 6 months – 98 legs; 6 week – 140 legs; 1 week – 140 legs *Selection criteria*: Patients with incompetent saphenofemoral junctions were treated after informed consent.	Procedure times Average time from access to completion of pullback 52.3 min Actual pullback time average 17.9 min. Vein occlusion (absence of any duplex ultrasound-determined flow) At 1 week – 137/140 (98%) legs (3 patients had flow seen only in small segments that was not accompanied by reflux and at 6 weeks, 2 additional saphenous veins with flow but no reflux were detected) At 6 weeks – 135/140 (96%) (original 3 patients plus 2 additional patients - 3/5 patients (4%) in which vein occlusion was not successfully achieved went on to complete recanalisation at 6 months and demonstrated complete occlusion at 6 months and the other 2 were treated with sclerotherapy and demonstrated complete occlusion at 6 months). At 12 months, no patient developed recanalisation that was not seen at 6 weeks. At 24 months 19/21 (90%) patients had complete disappearance of the treated saphenous vein. Improvement of visible varicosities, with or without concomitant ambulatory phlebectomy, 140/140 (100%) Symptom resolution Symptom | Pretreatment N=140 | 6 weeks N=140 | 6 months N = 102 | 2 years (N = 21) Leg pain | 119 (85%) | 8 (6%) | 5 (5%) | 1 (5%) Leg fatigue | 119 (85%) | 17 (12%) | 7 (7%) | 1 (5%) Oedma | 27 (19%) | 11 (8%) | 2 (2%) | 0 (0%) Patient satisfaction (would the patient recommend procedure to a friend) 98% would recommend the procedure at 6 months follow-up.	Adverse events • Thrombus 0 (0%) • Thrombus extension 0 (0%) • Skin burns or skin abnormalities 0 (0%) • Paresthesias 12/140 (6%) at 1 week follow-up (authors switched to perivenous, subfacial placement of tumescent anaesthesia which helped resolve the occurrence of paresthesias after the first year of performing the procedure) • Paresthesias 1/102 (1%) at 6 months follow-up • Bruising and tenderness occurred in less than 1%	*Potential for bias*: It was not clear if the patients were consecutive. Weiss is a consultant for VNUS Medical and Diomed Lasers. All equipment and catheters were paid for by the authors. Follow-up is ongoing. Disagreements between numbers stated in tables and in the text for 6 month follow-up. Possible unit of analysis errors – legs not patients analysed. *Outcome measures and their validity*: Duplex ultrasound. Patient satisfaction assessed by whether the patient would recommend the procedure to a friend with similar leg problems. *Other comments*: Adjunctive procedures High ligation was not performed in any patient. Phlebectomy performed concomitantly in 87/147 (62%) legs.

Specialist advisor's opinion / advisors' opinions

Specialist advice was sought from the Vascular Surgical Society of Great Britain and Ireland.

Most Specialist Advisors believe that radiofrequency ablation of varicose veins is a novel procedure. They state that it is more complicated to perform than standard alternatives, though they quote similar risks and benefits. Specialist Advisors were concerned about a lack of long-term results regarding the efficacy of the procedure, particularly around the risk of recurrence. Specialist Advisors noted that this procedure is mostly used in private practice in the UK, and several felt that it was unlikely to disseminate widely in the NHS.

Issues for consideration by IPAC

No further issues noted.

References

1. **Rautio T, Ohinmaa A, Perala J, Ohtonen P, Heikkinen T, Wiik H, Karjalainen P, Haukipuro K, Juvonen T. Endovenous obliteration versus conventional stripping operation in the treatment of primary varicose veins: A randomized controlled trial with comparison of the costs. *Journal of Vascular Surgery* 2002;35(5):958-965.**

2. **Dauplaise TL, Weiss RA. Duplex-guided endovascular occlusion of refluxing saphenous veins. *Journal of Vascular Technology* 2001;25(2):79-82.**

3. **Weiss RA, Weiss MA. Controlled radiofrequency endovenous occlusion using a unique radiofrequency catheter under duplex guidance to eliminate saphenous varicose vein reflux: a 2-year follow-up. *Dermatologic Surgery* 2002;28(1):38-42.**

4. Callam MJ. Epidemiology of varicose veins. *British Journal of Surgery* 1994;**81**(2):167-173.

5. **Goldman MP, Amiry S. Closure of the greater saphenous vein with endoluminal radiofrequency thermal heating of the vein wall in combination with ambulatory phlebectomy: 50 patients with more than 6-month follow-up. *Dermatologic Surgery* 2002;28(1):29-31.**

6. **Merchant RF, DePalma RG, Kabnick LS. Endovascular obliteration of saphenous reflex: A multicenter study. *Journal of Vascular Surgery* 2002;35(6):1190-1196.**

ANNEX: Studies that met the inclusion criteria but which were not tabulated.

Chandler JG, Pichot O, Sessa C, SchullerPetrovic S, Kabnick LS, Bergan JJ. Treatment of primary venous insufficiency by endovenous saphenous vein obliteration. *Vascular Surgery* 2000; **34**(3):201-214.

Excluded as is a duplicate study of Merchant et al. 2002 which is presented in this review.

Fassiadis N, Kianifard B, Holdstock JM, Whiteley MS. No recurrence of reflux following endovascular radiofrequency ablation of the long saphenous vein at one year. *British Journal of Surgery* 2001; **88**:49-50.

Excluded on the basis of patient numbers and follow-up time.

Fassiadis N, Kianifard B, Holdstock JM, Whiteley MS. A novel approach to the treatment of recurrent varicose veins. *International Angiology 21(3):275-6,* 2002.
Excluded on the basis of patient numbers and follow-up time.

Fassiadis N, Kianifard B, Holdstock JM, Whiteley MS. A novel endoluminal technique for varicose vein management: The VNUS closure. *Phlebology* 2002; **16**(4):145-148.
Excluded on the basis of patient numbers and follow-up time.

Fassiadis N, Kianifard B, Holdstock JM, Whiteley MS. Ultrasound changes at the saphenofemoral junction and in the long saphenous vein during the first year after VNUS closure. *International Angiology 21(3):272-4,* 2002.
Excluded as article could not be retrieved.

Goldman MP. Closure of the greater saphenous vein with endoluminal radiofrequency thermal heating of the vein wall in combination with ambulatory phlebectomy: preliminary 6-month follow-up. *Dermatologic Surgery* 2000; **26**(5):452-456.
Excluded on the basis of patient numbers and follow-up time.

Manfrini S, Gasbarro V, Danielsson G, Norgren L, Chandler JG, Lennox AF et al. Endovenous management of saphenous vein reflux. *Journal of Vascular Surgery* 2000; **32**(2):330-342.
Excluded as is a duplicate study of Merchant et al. 2002 which is presented in this review.

Pichot O, Sessa C, Chandler JG, Nuta M, Perrin M. Role of duplex imaging in endovenous obliteration for primary venous insufficiency. *Journal of Endovascular Therapy: Official Journal of the International Society of Endovascular Specialists* 2000; **7**(6):451-459.
Excluded on the basis of patient numbers and follow-up time.

Rautio TT, Perala JM, Wiik HT, Juvonen TS, Haukipuro KA. Endovenous obliteration with radiofrequency-resistive heating for greater saphenous vein insufficiency: A feasibility study. *Journal of Vascular & Interventional Radiology* 2002; **13**(6):569-575.
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