ENDOVENOUS LASER THERAPY FOR VARICOSE VEINS

LOWELL S. KABNICK, MD
NYU LANGONE MEDICAL CENTER

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Disclosure Slide

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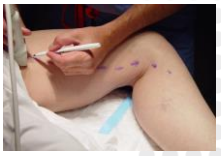
EndoVenous Laser Procedure

Endovenous Laser Ablation

Preoperative Planning



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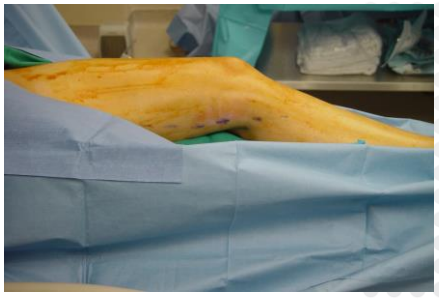
Preparation of the Patient



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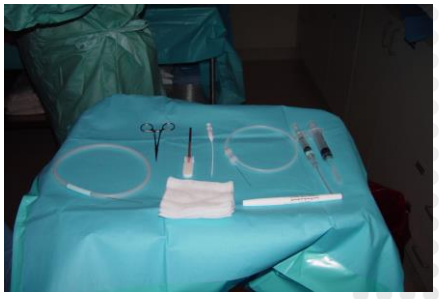
Percutaneous Insertion Supplies



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Access Methods

- 19 g thin walled needle with 035 system long or short sheath
- 18 g needle with 035 system long or short sheath system
- 18g wire long sheath system
- 18g wire short sheath system and direct fiber insertion
- 21g 018 micropuncture system

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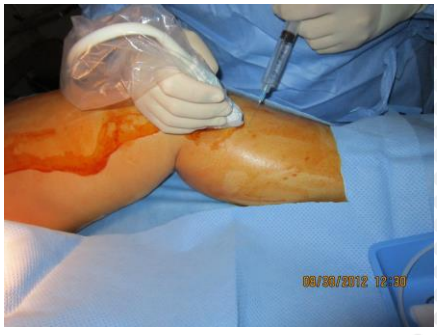
Local Anesthesia



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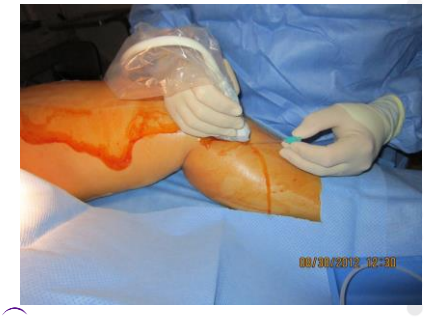
Insertion of 21 g Needle



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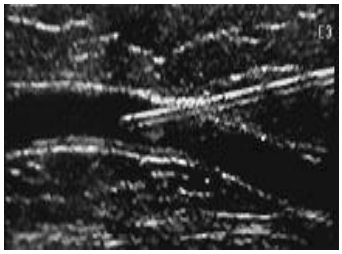
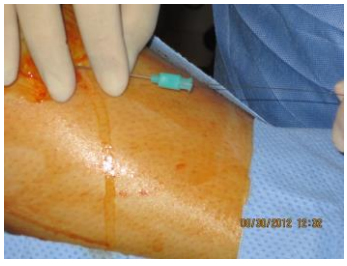
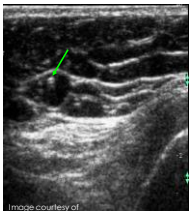
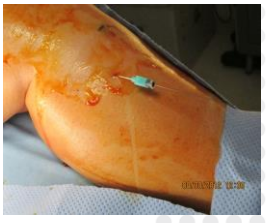
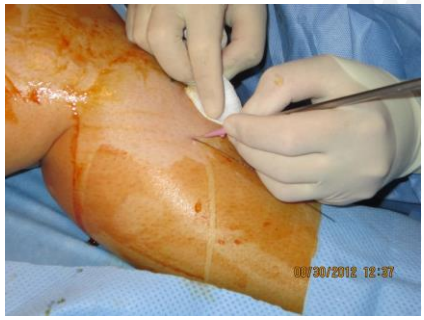




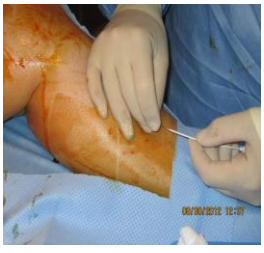
Insertion of Micropuncture 018" Wire

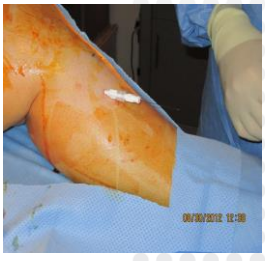




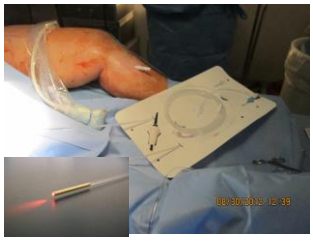


Insertion of Micropuncture Sheath

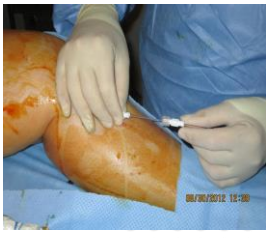




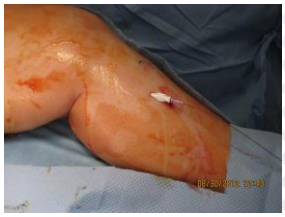
Laser Kit



Dilator Removal



035 Wire Insertion



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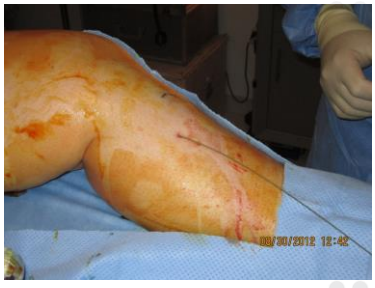
Removal of Microsheath



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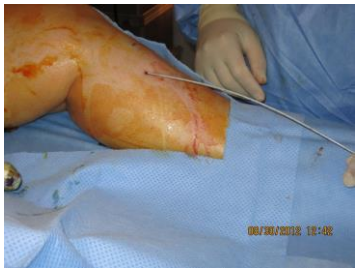
4 Fr Sheath Back-Loaded



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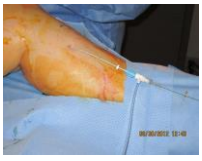
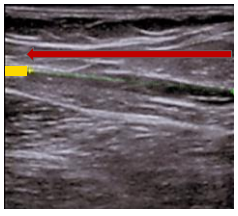
Sheath and Covered Fiber

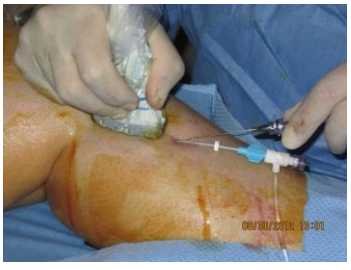




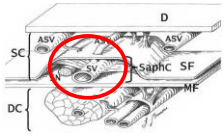
Fiber Position >2cm from the SFJ



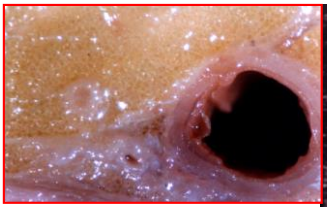
Tumescent Anesthesia

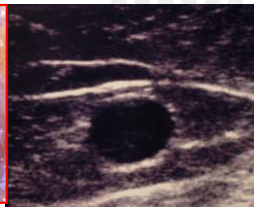


Contents of the Saphenous Compartment



Saphenous Eye





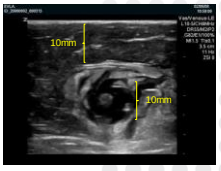
Tumescent Anesthesia

Preparation of Tumescent Anesthetic Solution: 0.1% Lidocaine

500cc of Normal Saline
Remove 55cc of fluid
Add 50cc of 1% Lidocaine with epinephrine 1:100,000
Add 5cc of Sodium Bicarbonate

Tumescent Halo

- 10 mm diameter around vein
- 10 mm between target vein & skin
- 10cc/cm



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Purpose of Local Anesthesia

- Protect against thermal skin injury
- Provide local anesthesia along the treatment vein pathway

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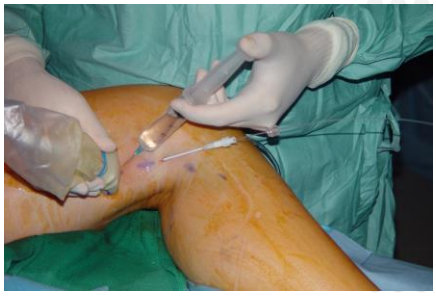
Manual Tumescent Anesthesia



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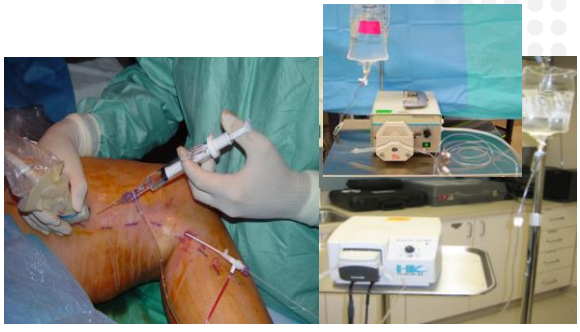
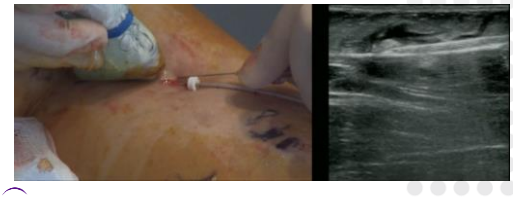
Tumescent Anesthesia



Tumescent Anesthesia



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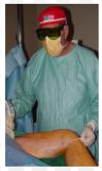
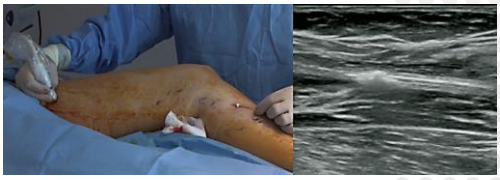
Laser Pull Back

•5-7 W 30-50J/cm





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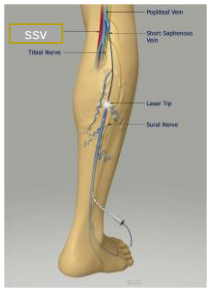
Small Saphenous Vein

Small Saphenous Vein Procedure



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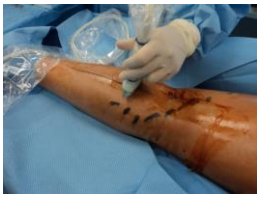
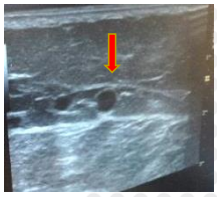
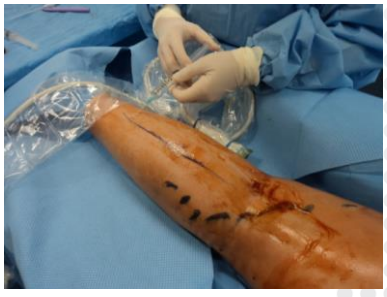
DUS SSV

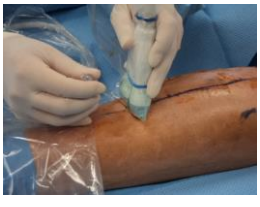


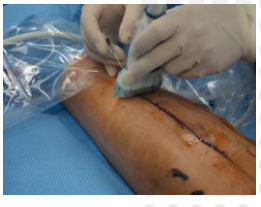


Skin Anesthesia

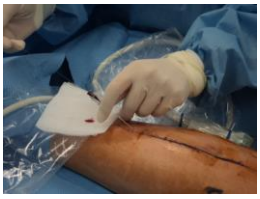


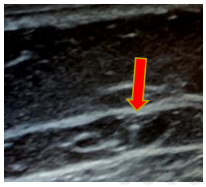
21 Gauge Needle Insertion



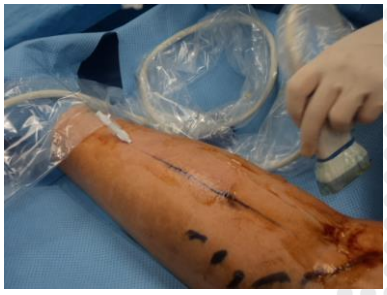


018 wire

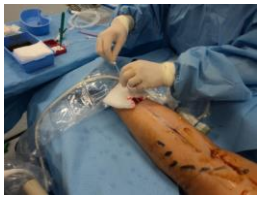


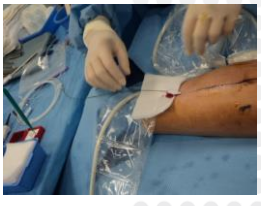


Micropuncture sheath

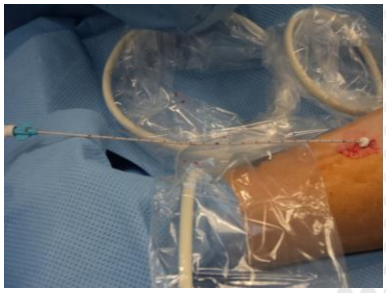


Upsize 035 wire





4 Fr Sheath



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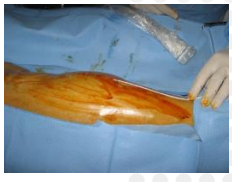
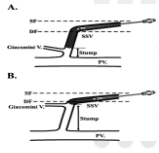
Placement of Sheath and Covered Fiber

Fiber

just before the SSV "dives" to the popliteal vein
2-3cms from the Junction





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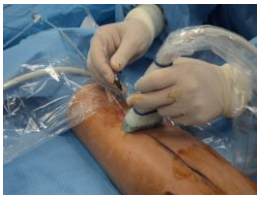
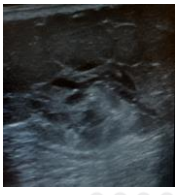
Tumescent Anesthesia





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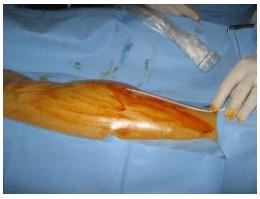
Pull Back



- Watts 5-7 W
- LEED 30-50 J/cm
- 6W ~50J/cm
- 8 secs/cm

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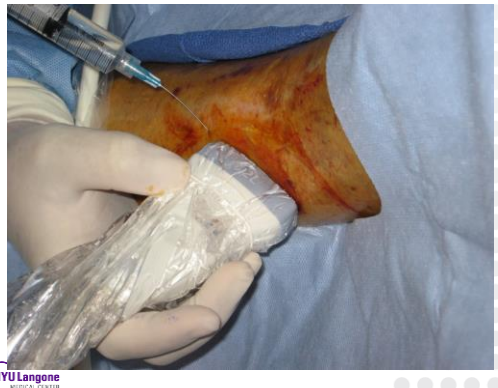
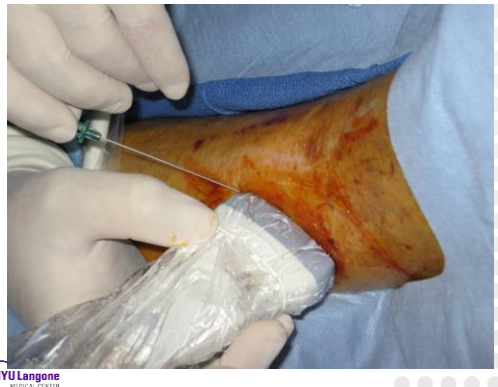
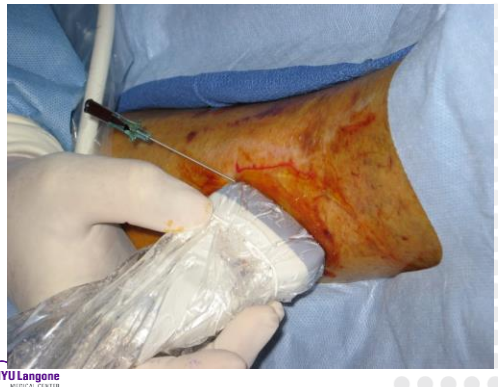
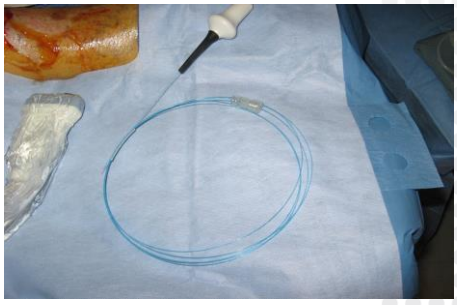
Laser Perforator Procedure









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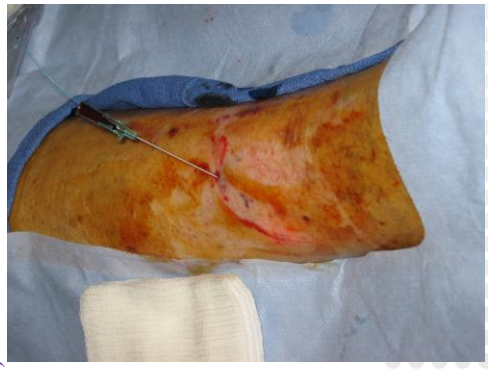

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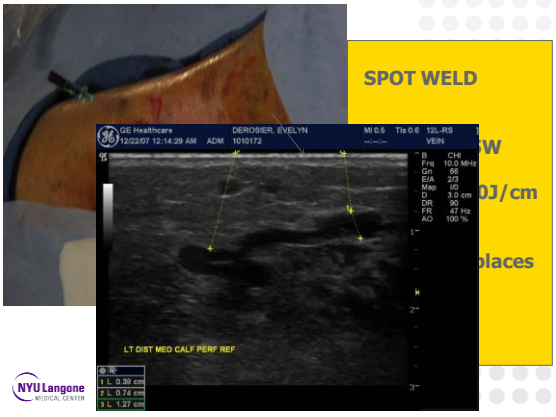

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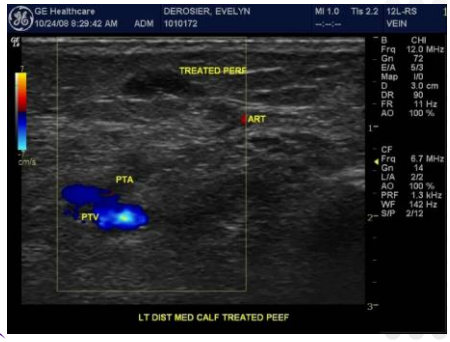

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So What Do We Know

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Hemoglobin based wavelengths produce more short term side effects than longer wavelengths

Less side effects (pain, bruising) with 980nm than 810nm at the same watts

Less side effects (pain, bruising) with 1320nm at 5 watts than at 8 watts

Kabnick L. Outcome of different endovenous laser wavelengths for great saphenous vein ablation. J Vasc Surg. 2006 Jan;43(1):88-93.

Proebstle TM, Moehler T, et al. Endovenous treatment of the great saphenous vein using a1320 nm Nd:YAG laser causes fewer side effects than using a 940 nm diode laser. Dermatol Surg. 2005 Dec;31(12):1678-83.

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Laser side effects

- Most likely caused by laser induced **vein wall perforation** with extravasation of blood into the surrounding tissue
- Perforations are more common with;
  - **HSLW, higher power (watts), greater LEEDs**

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EVLT: So What Else Do We Know?

- **Efficacy and Safety Profile:**
  - **Benchmark** 97-99% efficacy
- **Randomized Control Trials**:
  - VCSS scores improved
  - QOL improved

- ***Murad et al; J Vasc Surg 2010***
- ***Shepherd et al, Br J Surg 2010***

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6 Randomized Controlled Trials

- 1 EVLA, RFA, sclerotherapy, surgery
- **1 EVLA, sclerotherapy**
- **2 EVLA, sclerotherapy, surgery**
- **1 RFA, glue embolization**
- **1 RFA, mechanochemical (MOCA) treatment**

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Randomized clinical trial comparing endovenous laser ablation, radiofrequency ablation, foam sclerotherapy and surgical stripping for great saphenous varicose veins

L. H. Rasmussen, M. Lawaetz, L. Bjoern, B. Vennits, A. Blemings and B. Eklof

Danish Vein Centres, Naestved, and Surgical Centre Roskilde, Roskilde, Denmark
Correspondence to: Dr L. H. Rasmussen, Danish Vein Centres, Eskadronsvej 4A, 4700 Naestved, Denmark (e-mail: lhr@vartx.dk)

Background: This randomized trial compared four treatments for varicose great saphenous veins (GSVs).
Methods: Five hundred consecutive patients (580 legs) with GSV reflux were randomized to endovenous laser ablation (980 and 1470 nm, bare fibre), radiofrequency ablation, ultrasound-guided foam sclerotherapy or s…
Mini… were
surgery.
Results: Ac…
of the GSVs w…
respectively (P < 0.…
one a deep vein throu…
The mean(s.d.) postinte…
2·25(2·23) respectively (…
1 (0–30), 1 (0–30) and 4 (…
was 3·6 (0–46), 2·9 (0–…
quality-of-life and Short…
SF-36® domains bodily …
better in the short term (…
Conclusions: All treatme…
sclerotherapy, but both radio…
postoperative pain than endovenous laser ablation and stripping.

Paper accepted 15 March 2011
Published online in Wiley Online Library (www.bjs.co.uk). **DOI:** 10.1002/bjs.7555

580 limbs, 500 patients

Inclusion criteria
- Symptomatic varicose veins with GSV reflux
- $C_2 – C_4$

Exclusion criteria
- Previous DVT
- Axial deep venous reflux

Br J Surg. 2011

BJS

Primary Endpoint
GSV Closure

Patent GSV with Reflux

	EVLA N=144 n(%)	RFA N=148 n(%)	UGFS N=144 n(%)	Stripping N=142 n(%)	*P* value
3 days	0 (0)	0 (0)	3 (2.1)	4 (2.8)	.053
1 month	1 (0.7)	0 (0)	2 (1.4)	3 (2.2)	.20
1 year	7 (5.8)	6 (4.8)	20 (16)	4 (4.8)	<.001

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30-day Complications

	EVLA N=144	RFA N=148	UGFS N=144	Stripping N=142
Major				
Deep vein thrombosis	0	0	1	1
Pulmonary embolism	0	0	1	0
Minor				
Phlebitis*	4	12	17	5
Infection	0	1	4	1
Paraesthesia	3	6	2	5
Hyperpigmentation	3	8	8	6
Haemorrhage	1	0	1	1

* *P*=.006

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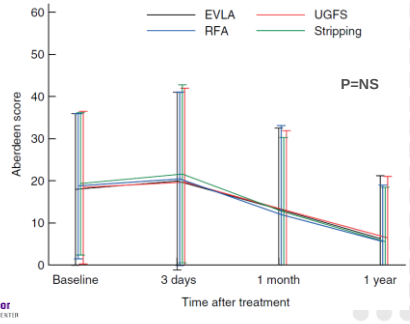
Disease Specific Quality of Life (AVVSS)



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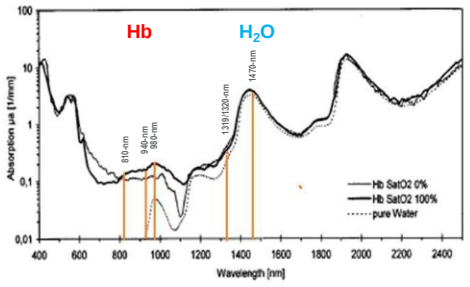
WHICH IS MORE IMPORTANT FOR POSTOPERATIVE RECOVERY?

LASER WAVELENGTH

FIBERS

Endovenous Laser Ablation



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What Do We Know About Fibers?

Bare **Covered Fiber**

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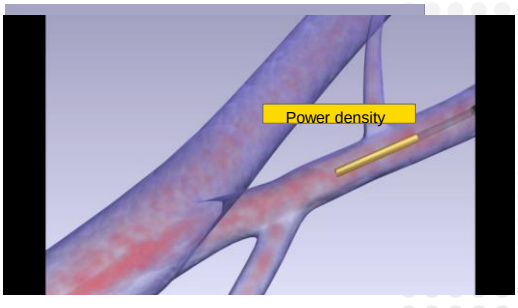

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Courtesy AngioDynamics

Journal of Vascular Surgery: Venous and Lymphatic Disorders
Available online 28 February 2016
In Press, Corrected Proof — Note to users

Clinical paper

Fiber type as compared to wavelength may contribute more to improving postoperative recovery following endovenous laser ablation

Presented at the Twenty-fourth Annual Meeting of the American Venous Forum, Orlando, Fla, February 8-11, 2012.

Lowell S. Kabnick, MD, RPhS, FACS, Mikel Sadek, MD, FACS
NYU Langone Medical Center, Division of Vascular Surgery, New York, NY

2016

The use of a JT fiber appeared to be more significant in reducing pain and bruising as compared to a longer wavelength. Moreover, the results appeared additive, and the cohort using 1470 nm with a JT fiber produced the best treatment outcomes. Additional study is required to confirm the efficacy and durability of the various iterations evaluated; however, these data should be taken into consideration when undertaking treatment with endovenous laser ablation.

What is More Important?

- Wavelength is Important
- Fiber Type is Important
- The Type of Fiber seems to be more important than the Laser Wavelength

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Concluding Remarks

- Laser ablation is very versatile including spot welding
- There is no significant difference between laser and RF in terms of
  - Efficacy
  - QOL
  - Safety profile
- **Clinical Equipoise**

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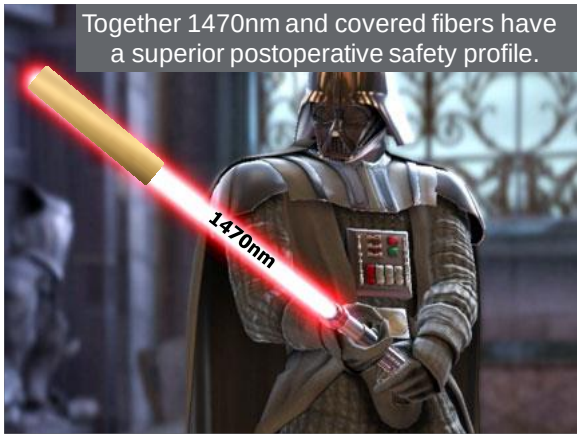

Together 1470nm and covered fibers have a superior postoperative safety profile.
1470nm

Micro-foam Therapy for Treatment of Superficial Venous Disease

Paramjit "Romi" Chopra, MD
Associate Professor, RUSH University,
Midwest Institute for Minimally Invasive Therapies (MIMIT), Chicago, IL

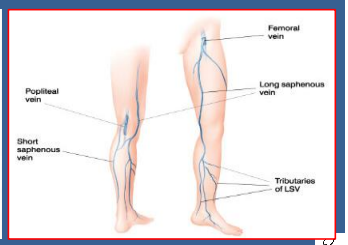
Disclosures

SUPERFICIAL VENOUS DISEASE
IS NOT UNCOMMON
IS NOT BENIGN

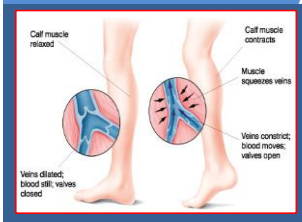
WHAT DO WE WANT?

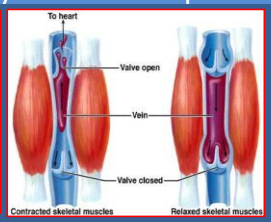
healthy strong, good looking legs without pain or discomfort

Normal Anatomy & Physiology

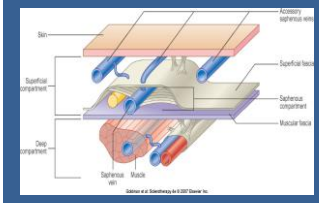


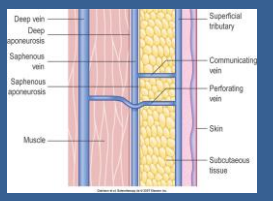
Venous Anatomy- Lower Extremity Venous Pump





Anatomy

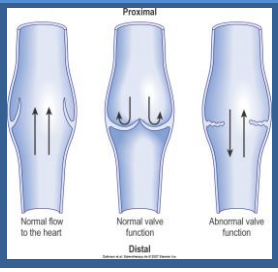




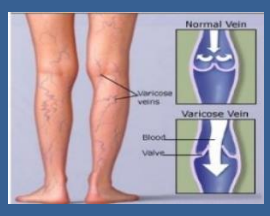
PATHOPHYSIOLOGY

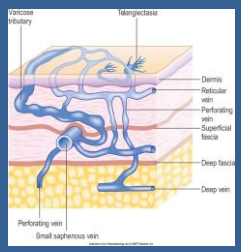
- Pathologic:
  Valvular incompetence of the venous system.
- Physiologic:
  Leaky valve syndrome, superficial valvular reflux

Venous Hypertension

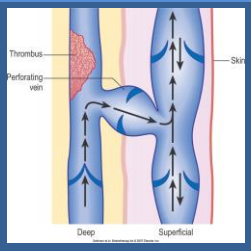


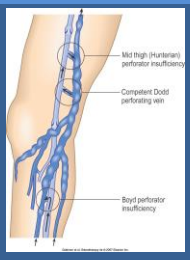
Venous Reflux



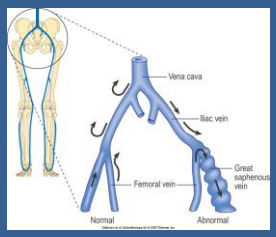


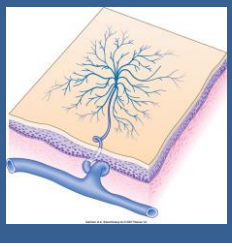
Obstruction V/S valvular Incompetence





Reflux leading to Venous hypertension

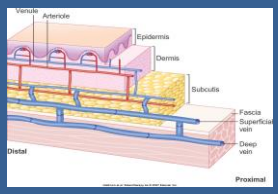




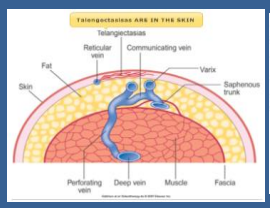
Foundational Principle

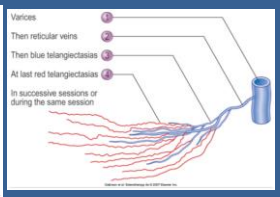
- Regardless of the size or type of the vein

Find the underlying source of the venous hypertension

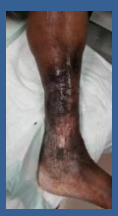


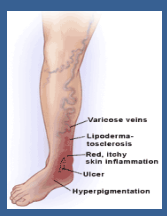
Foundational Principle

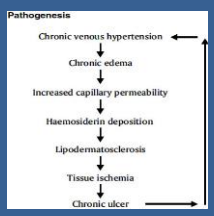




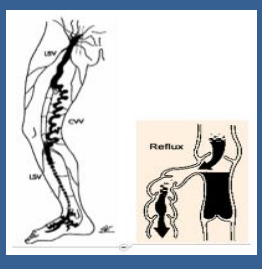
Foundational principle



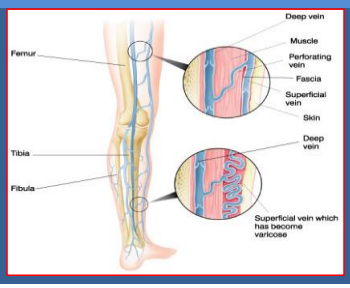




Create a Map of venous hypertension



Leaking perforators- Varicose veins



Medically Significant Venous Incompetence

Disease Progression

CEAP Classification[1]

CEAP = clinical, etiologic, anatomy, pathophysiologic classification of venous disorders

1. Eklöf, B et al. Revision of the CEAP classification for chronic venous disorders: Consensus statement. Journal of Vascular Surgery. 2004 60(6): 1248-1252.
2. Labropoulos N, Leon L, Kasser S, et al. Study of the venous reflux progression. J Vasc Surg. 2005;41(3):391-398.
3. Kaplan RM, et al. Quality of life in patients with chronic venous disease: San Diego population study. J Vasc Surgery. 2003; 37:1047-53
4. Callam MJ et al., Chronic ulcer of the leg: clinical history. British Medical Journal. 1987; 294:1389-1391.

Create a Map of venous hypertension

Treatment Options

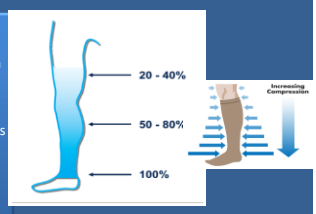
- Relief of the hypertension
- Conservative
- Thermal Tumescent

PLANNING AND COUNSELING

- Planning the therapy
  - Detailed discussion
  - What's the baseline
  - Establish the Goals of treatment
    - Healing a wound
    - Relief of symptoms
      - Pain, swelling etc
    - Cosmetic
  - Conservative therapy first
- Counseling
  - Timeline of therapy
  - Realistic expectations
  - Cost issues
  - Long term follow-up

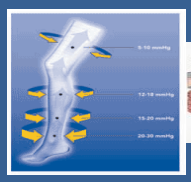
Graduated Compression Therapy

- is the cornerstone of the modern treatment of venous insufficiency
- Properly fitted gradient compression stockings provide 30-40 or 40-50 mm Hg of compression at the ankle
- sufficient to restore normal venous flow patterns in many or most patients with superficial venous reflux and to improve venous flow, even in patients with severe deep venous incompetence.



Graduated Compression

- Graduated compression of superficial veins
- Allows blood to drain upwards
- Decrease venous hypertension in legs



Interventions

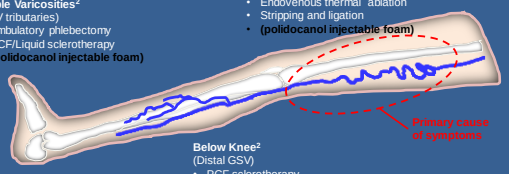
- Move to interventions if compression therapy not meeting the goals of therapy
- Important to establish goals of therapy and timeline of expected improvement
- The patient reached this degree of problem over a prolonged period
  - Important to emphasize that this will not all magically disappear

MICROFOAM THERAPY

Polidocanol injectable foam is a Comprehensive Above and Below the Knee Intervention[1]

Visible Varicosities[2]
(GSV tributaries)
- Ambulatory phlebectomy
- PCF/Liquid sclerotherapy
- **(polidocanol injectable foam)**

Above Knee[2]
(Proximal GSV)
- Endovenous thermal ablation
- Stripping and ligation
- **(polidocanol injectable foam)**



Below Knee[2]
(Distal GSV)
- PCF sclerotherapy
- Some endovenous thermal ablation
- **Varithena®**

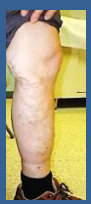
PCF = physician-compounded foam

1. Todd et al. *Phlebology*. 2012;1-41.
2. Gibson K.R. et al. *J Vasc Surg*. 2011;53(suppl 5):2S-48S.

CEAP 2

Medial thigh and leg

Before

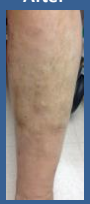


After

Lower leg

Before

After



CEAP 6
CASE STUDY
MICRO-FOAM THERAPY

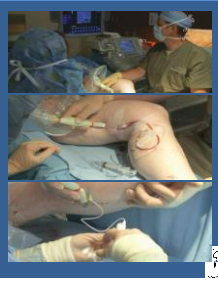
Polidocanol injectable foam Endovenous Microfoam Ablation Procedure

Catheter based endovascular procedure performed under ultrasound guidance

- FDA approved as first line treatment for GSV Incompetence
  - Not adjunctive or subsequent to surgical ligation or thermal ablation
  - Does not require tumescent anesthesia
- Physician performed18 step procedure
- Procedure requires ≥ 2 professionals

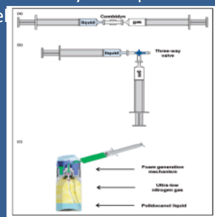
FDA agreed upon physician training Risk Management Plan (RMP)

- Physician prerequisite of ≥ 100 vein cases within past two years & attestation of experience
- Must complete four online training modules
- Documented proficiency (exam)
- Must successfully complete training program to gain access to product
- BTG clinical specialist support is required for each physician's initial cases



Addressing a History of Decreased Efficacy with Physician Compounded Foam (PCF)

- Historically, physician compounded foam has yielded poor performance in large diameter vessels such as the Great Saphenous Vein (GSV)[1]
- Why?
  - Variability in foam (differing compositions)
  - Low stability of foam



1. Rasmussen et al, British Journal of Surgery 2011; 98: 1079-1087.
2. Carugo et al, Phlebology , June 2015.

www.themimit.com

Chemical Ablative Properties

Polidocanol injectable foam

FDA approved
- Manufactured drug/device under Good Manufacturing Practice (GMP) standards
- Endovenous Microfoam Chemical Ablation Agent
- Stable, low density, sterile, cohesive microfoam provides a two-step mechanism of action
  - Displace blood from vein to be treated
  - Chemically ablates endothelial layer
- Nitrogen Content <0.8%
  - 65% O_2 / 35% CO_2
  - 1:7 Liquid to gas ratio by volume
- Small consistent narrow bubble size
  - Median bubble size <100 µm
  - No bubble >500 µm
- Little to no remaining surfactant after bubbles take their effect

Polidocanol Liquid

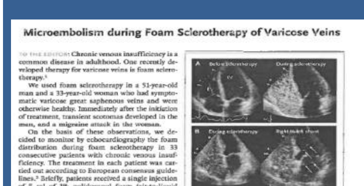
- FDA approved
- Manufactured via GMP
- Liquid Sclerosing Agent
- Indicated for uncomplicated spider and reticular veins (< 3 mm in diameter)[1]

Polidocanol injectable foam ® PCF

Physician compounded foam (PCF)
- Not FDA approved
- Non-GMP
- Extemporaneously compounded in the physician office setting using a variety of techniques, gases, active agents, and concentrations
- Final product is highly variable and operator dependent

1. Asclera Full Perscribing Information , p. 1

Adverse Events Associated with PCF


Microembolism during Foam Sclerotherapy of Varicose Veins

TO THE EDITOR: Chronic venous insufficiency is a common disease in adulthood. One recently developed therapy for varicose veins is foam sclerotherapy.[1]

We used foam sclerotherapy in a 51-year-old man and a 33-year-old woman who had symptomatic varicose great saphenous veins and were otherwise healthy. Immediately after the initiation of treatment, transient scotomas developed in the man, and a migraine attack in the woman.

On the basis of these observations, we decided to monitor by echocardiography the foam distribution during foam sclerotherapy in 33 consecutive patients with chronic venous insufficiency. The treatment in each patient was carried out according to European consensus guidelines.[2] Briefly, patients received a single injection of 5 ml of 1% polidocanol foam (air-to-liquid ratio, 4:1). The foam was injected with the pa-

Significant Adverse Events have been reported with physician compounded foam[1,2,3]

Why?
- Large bubbles migrate in vasculature and block vessels downstream to treatment area
- Large bubble migration is associated with Nitrogen content of the gas mixture used[4]

1. Ceulen et al, New England Journal of Medicine, 2008: 358;14
2. Murad et al. J Vasc Surg. 2011;53 (suppl):49S; 2. Sarvananthan et al. J Vasc Surg. 2012;55:243;
3. Bush et al. Phlebology. 2008;23:189
4. Eckmann, Dermatol Surgery, 2005: 31;636-343

Polidocanol injectable foam Safety Profile

Clinical significance of cerebrovascular gas emboli during polidocanol endovenous ultra-low nitrogen microfoam ablation and correlation with magnetic resonance imaging in patients with right-to-left shunt

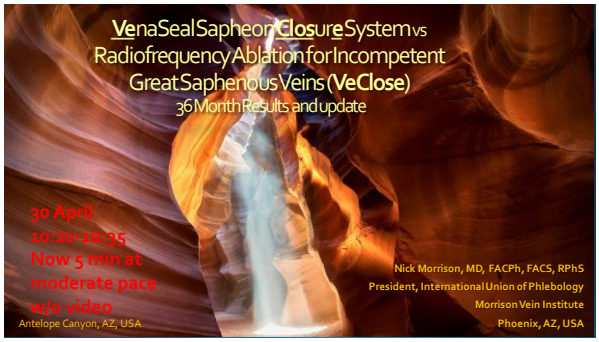
John D. Regan, MD,[a] Kathleen D. Gibson, MD,[b] Janet E. Rosh, MD,[c] Cynthia K. Shortell, MD,[c] Stanley A. Hirsch, MD,[d] and David D. I. Wright, MB, FCRR,[e] Winston-Salem, NC; Bellevue, Wash; Durham, NC; Pittsburgh, Pa; London, United Kingdom; and W. Conshohocken, Pa

- 60 high risk patients with confirmed right to left shunt treated with Polidocanol injectable foam
- No evidence of lesion on diffusion weighted MRI sequence
- No neurological symptoms
- No elevation in cardiac troponin levels

1. Regan et al, Journal of Vascular Surgery 2011; 53: 131-138

Summary

- Newer Non-thermal Non tumescent treatment options available
- FDA approved
- Safe
- Effective
- Faster and Better
- Reimbursed by Insurance
- Cost-effective

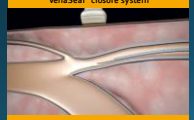

VenaSeal Sapheon Closure System vs
Radiofrequency Ablation for Incompetent
Great Saphenous Veins (VeClose)
36 Month Results and update
30 April
10:20-10:35
Now 5 min at
moderate pace
w/o video
Antelope Canyon, AZ, USA
Nick Morrison, MD, FACPh, FACS, RPhS
President, International Union of Phlebology
Morrison Vein Institute
Phoenix, AZ, USA


Disclosures
Medtronic
Research Grant
Speakers Bureau/Consultant
Pierre Fabre
Speakers Bureau
Medi
Educational Grant
Speakers Bureau
Morrison Training Institute
Medical Director
Sedona, AZ, USA

VENASEAL™ CLOSURE SYSTEM: PROCEDURE

VenaSeal™ closure system

Access GSV using catheter technique

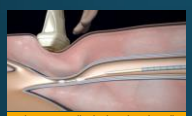


Position catheter 5 cm from SFJ

Compress cephalad to catheter

4

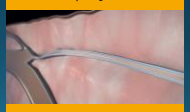
VENASEAL™ CLOSURE SYSTEM: PROCEDURE



Inject 0.10 cc adhesive into the vein, pull back 1 cm, inject 0.10 cc pull back 3 cm

Compress 3 minutes

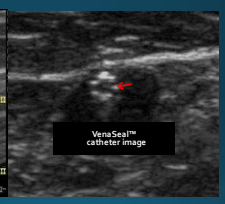
Inject 0.10 cc, pull back 3 cm, compress for 30 seconds



Repeat process throughout vein

5

ULTRASOUND VIEW OF VENASEAL™ CATHETER

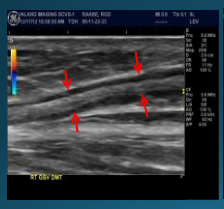


Images courtesy of Dr. R. Raabe

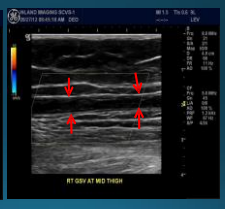
6

ULTRASOUND IMAGES 8 WEEKS POST TREATMENT

VenaSeal™ Procedure Closure



RFA Procedure Closure



Images courtesy of Dr. R. Raabe

7

FEATURES OF THE VENASEAL™ PROCEDURE

- Eliminates need for tumescent anesthesia
- No risk of thermal injury
- No post treatment compression stockings needed[1,2]*
- Rapid return to normal activities
- No capital equipment

1. Almeida JI, et al. Two-year follow-up of first human use of cyanoacrylate adhesive for treatment of saphenous vein incompetence. Phlebology / Venous Forum of the Royal Society of Medicine. 2014.
2. Proebstle TM, et al. The European multicenter cohort study on cyanoacrylate embolization of refluxing great saphenous veins. Journal of Vascular Surgery: Venous and Lymphatic Disorders. 2015;3:1-7.

*Some patients may benefit from compression stockings post procedure.

8

VeClose Study Overview

Title	VenaSeal Closure System vs. Radiofrequency Ablation for Incompetent Great Saphenous Veins
Purpose	Demonstrate the safety and effectiveness of the VenaSeal Closure System for the treatment of lower extremity truncal reflux compared to RFA (ClosureFAST system)
Study Design	**US multi-center, randomized controlled IDE study.** The study takes a non-inferiority approach to effectiveness for anatomical closure at 3 months. 36 months effectiveness assessed and compared across groups.
Enrollment / Sites	242 (20 roll-in and 222 randomized) subjects enrolled at 10 study sites (Sept 2013)
Follow-up	Follow-up visits at 3 days post-procedure, 1, 3, 6, 12, 24 36, and 60 months.

Morrison N, Gibson K, McEnroe S, et al. Randomized trial comparing cyanoacrylate embolization and RF ablation for incompetent GSV (VeClose). J Vasc Surg 2015;61:985-94.

VeClose Primary Endpoint

Primary Endpoint	**Complete closure of the target vein at 3 months** after index procedure as judged by the core laboratory. Complete closure is defined as Doppler ultrasound examination showing closure along entire treated target vein segment with **no discrete segments of patency exceeding 5 cm.**

Morrison N, Gibson K, McEnroe S, et al. Randomized trial comparing cyanoacrylate embolization and RF ablation for incompetent GSV (VeClose).J Vasc Surg 2015;61:985-94.

Secondary Endpoints

Secondary Endpoints	Intraoperative Pain evaluation : Following procedure, self rated pain experienced during 2 phases of the treatment procedure on a 0-10 NRS • Phase 1: From initial local anesthesia injection at the access site to venous access with the micro-access catheter • Phase 2: From introduction of the RFA or CAC catheter to completion of vein treatment and device removal
	Ecchymosis at Day 3: Investigator assessment of ecchymosis along the treated area using a 0-5 point grading scale 0 - none 1 - involving <25% of the treatment area 2 - 25%-50% 3 - 50%-75% 4 - 75%-100% 5 - extension above or below the treatment segment

CAC, cyanoacrylate closure; NRS, numeric rating scale; RFA, radiofrequency ablation

Morrison N, Gibson K, McEnroe S, et al. Randomized trial comparing cyanoacrylate embolization and RF ablation for incompetent GSV (VeClose).J Vasc Surg 2015;61:985-94.

Additional Endpoints

Assessments related to venous disease severity:
- Change in VCSS scores
- Change in CEAP scores

Assessments related to QoL:
- Change in AVVQ scores
- Change in EQ-5D TTO scores

Comparison of adverse event rates related to target GSV

AVVQ, aberdeen varicose vein questionnaire; CEAP, clinical-etiology-anatomy-pathophysiology classification; GSV, great saphenous vein; EQ-5D, euroquality of life-5D; QoL, quality of life; TTO, time trade-off; VCSS, vein clinical severity score.

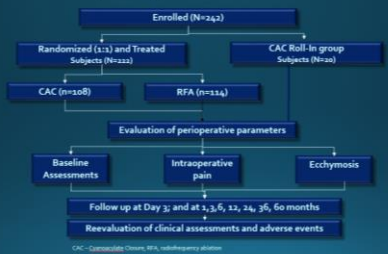
Morrison N, Gibson K, McEnroe S, et al. Randomized trial comparing cyanoacrylate embolization and RF ablation for incompetent GSV (VeClose).J Vasc Surg 2015;61:985-94.

VeClose - Sites & Enrollments

Site #	Site Name	PI	Location	# Enrolled	
				Roll-in	Randomized
11	Morrison Vein Institute	Morrison	Scottsdale, AZ	2	14
12	Vein Clinics of America	King, Hlavcek	Oakbrook Terrace, IL	2	19
13	Inovia Vein Specialty Center	Jones	Bend, OR	2	44
14	Lake Washington Vascular	Gibson	Bellevue, WA	2	58
16	Radiology Imaging Associates	Spencer	Greenwood Village, CO	2	4
17	GBK Cosmetic Laser Dermatology	Goldman	San Diego, CA	2	24
18	Prairie Education & Research Cooperative	Kolluri, Matos	Springfield, IL	2	9
19	Maryland Laser Skin & Vein Institute	Weiss	Hunt Valley, MD	2	17
20	Vein Center of Virginia/Sentara Vascular Specialists	McEnroe	Virginia Beach, VA	2	24
22	Venous Institute of Buffalo	Vasquez	Amherst, NY	2	9
				20	222
				242	

Morrison N, Gibson K, McEnroe S, et al. Randomized trial comparing cyanoacrylate embolization and RF ablation for incompetent GSV (VeClose). J Vasc Surg 2015; 61: 985-94.

VeClose Study Design



CAC – Cyanoacrylate Closure, RFA, radiofrequency ablation

Morrison N, Gibson K, McEnroe S, et al. Randomized trial comparing cyanoacrylate embolization and RF ablation for incompetent GSV (VeClose). J Vasc Surg 2015; 61: 985-94.

Demographics and Baseline Characteristics

Baseline Characteristics	CAC (N=108)	RFA (N=114)	P-value
Age (years)	49.0	50.5	0.34
Body Mass Index	27.0	27.0	0.95
Mean GSV diameter (mm)			
Proximal	6.3	6.6	0.15
Mid-thigh	4.9	5.1	0.28
Mean Treatment Length (cm)	32.8 (108)	35.1 (114)	0.17
Mean VCSS	5.5 ± 2.6	5.6 ± 2.6	0.99
Mean AVVQ	18.9 ± 9.0	19.4 ± 9.9	0.72
Mean EQ-5D TTO	0.935 ± 0.113	0.918± 0.116	0.29

Morrison N, Gibson K, McEnroe S, et al. Randomized trial comparing cyanoacrylate embolization and RF ablation for incompetent GSV (VeClose). J Vasc Surg 2015; 61: 985-94.

VeClose Pain Scores

	CAC (N=108)	RFA (N=114)	P-value
Tumescent Anesthesia Volume (mL)	Not applicable	272	-
Lidocaine Use During Procedure (mL)	1.6	2.7	0.1
Cyanoacrylate delivered, (mL)	1.2	N/A	-
Intraoperative pain			
During Vein Access	1.6	2.0	0.13
During Treatment	2.2	2.4	0.11

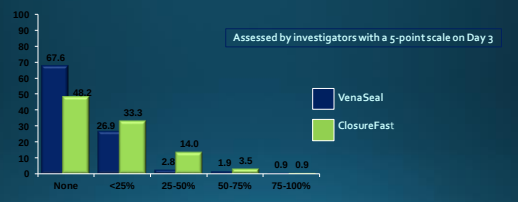
Morrison N, Gibson K, McEnroe S, et al. Randomized trial comparing cyanoacrylate embolization and RF ablation for incompetent GSV (VeClose).J Vasc Surg 2015;61:985-94.

Total Dose of NSAIDs and Narcotic Use in First 24 Hrs Assessed at Day 3

Medication Use		VenaSeal N (%)	RFA N (%)	P-Value
No medication		86 (79.6%)	90 (78.9%)	1.00
Narcotic	Hydrocodone	0	1 (0.9%)	1.00
NSAIDs	Ibuprofen	17 (15.7%)	22 (19.3%)	0.60
	Aspirin	1 (0.9%)	0	0.49
	Naproxen	1 (0.9%)	1 (0.9%)	1.00
	Other	3 (2.8%)	1 (0.9%)	0.36

Morrison N, Gibson K, McEnroe S, et al. Randomized trial comparing cyanoacrylate embolization and RF ablation for incompetent GSV (VeClose).J Vasc Surg 2015;61:985-94.

Secondary Endpoint : Ecchymosis at Day 3



Subjects treated with VenaSeal™ system had significantly less ecchymosis at Day 3 compared to RFA (p< 0.01).

Morrison N, Gibson K, McEnroe S, et al. Randomized trial comparing cyanoacrylate embolization and RF ablation for incompetent GSV (VeClose).J Vasc Surg 2015;61:985-94.

Primary Endpoint: Rate of GSV closure at Month 3

Proportion of closure	CAC (N=104)	RFA (N=108)	Roll-in (N=19)
Complete occlusion, n (%)	103 (99.0)	103 (95.4)	19 (100)
Incomplete occlusion, n (%)	1 (1)	5 (4.6)	0 (0)
No. of patients lost during follow up, n (total)	4 (108)	6 (114)	1 (20)

Complete closure defined as Doppler ultrasound examination showing closure along entire treated target vein segment with no discrete segments of patency exceeding 5 cm. This includes compressible segments with and without flow. Ultrasound exams used 2D imaging, color Doppler and pulsed Doppler

Morrison N, Gibson K, McEnroe S, et al. Randomized trial comparing cyanoacrylate embolization and RF ablation for incompetent GSV (VeClose). J Vasc Surg 2015; 61:985-94.

VeClose Primary Endpoint – Complete Closure

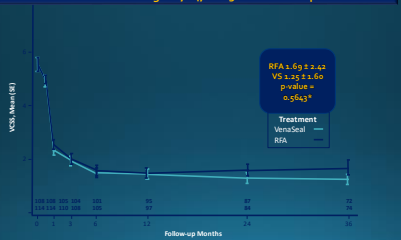
Timepoint	VenaSeal	RFA
Day 3	100% (108)	99.1% (114)
Month 1	100% (105)	87.3% (110)
Month 3*	99% (104)	95.4% (108)
Month 6	99% (101)	96.2% (105)
Month 12	96.8% (95)	95.9% (97)
Month 24	95.3% (86)	94% (84)
Month 36	**94.4% (72)**	**91.9% (74)**

94.4% closure rates, demonstrating long term durability at 36 months; and continued, non-inferiority results to RFA (P=0.005) through 36 months.

Complete closure based on clinical site assessment. The month 3 core lab assessment with LOCF rates are 93.1% for VSCS and 95.6% for RFA with non-inferiority p-value of <.0001.

36 Month - Venous Clinical Severity Score (VCSS)

VCSS demonstrated statistically significant improvement out to 6 months and sustained through 12, 24, and 36 month time points.

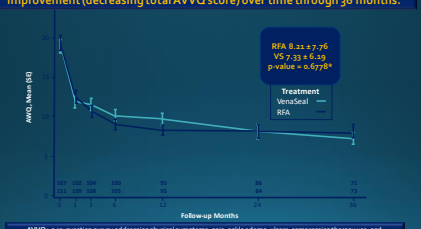


VCSS: an evaluative instrument that is responsive to changes in disease severity over time and in response to treatment

p-value comparing change scores between VSCS and RFA was based on repeated measures analysis of variance.

36 Month - Aberdeen Varicose Vein Questionnaire

Subjects experienced statistically significant improvement from baseline and improvement (decreasing total AVVQ score) over time through 36 months.

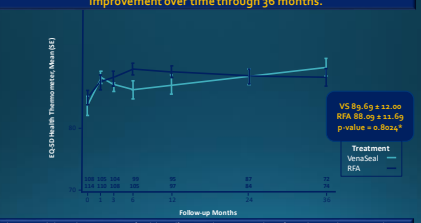


AVVQ: a 13-question survey addressing physical symptoms, pain, ankle edema, ulcers, compression therapy use, and limitations on daily activities are examined, as well as the cosmetic effect of varicose veins and social issues.

p-value comparing change scores between VSCS and RFA was based on repeated measures analysis of variance.

36 Month - EQ5D Results

Subjects experienced statistically significant improvement from baseline and improvement over time through 36 months.



The EQ-5D includes single item measures of: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression. Each item is coded using 3 levels (1 = no problems; 2 = some problems; 3 = severe problems).

p-value comparing change scores between VSCS and RFA was based on repeated measures analysis of variance

Adverse Events Reported between 12 and 24 Months

The majority of adverse events reported in the 12-24 month time period were determined to be unrelated to the treatment or the device across all groups.

Adverse Events Reported		Device Related		Procedure Related	
	# Reported	Not Related to the Device	Uncertain	Not Related	Uncertain
VenaSeal	8	6	2*	5	1*
RFA	4	4	0	4	0
Roll-In	2	2	0	2	0

*Erythema was reported in the medial thigh for 2 patients and a shin splint reported by 1 patient with VenaSeal. Etiology of these events could not be determined and/or directly related to treatment or device.

36 Month Safety - Adverse Events Reported

24-36 Month AE Device or Procedure Reporting	
Adverse Events Reported	Device/ Procedure Related
CAC	2*
RFA	0

*1. late onset of phlebitis, etiology unknown; 2. Scar (access site) device related

VenaSeal AE's from 0 to 36 months:

No reports of deep vein thrombus
No allergic events reported
No unanticipated adverse events
Most events occurred in the first 30 days, were mild and self-limiting
Delayed adverse events were minimal to non-existent

VeClose 36 Month Results Summary:

- **VenaSeal™ procedure resulted in reported 94.4% closure rates, demonstrating continued, non-inferiority compared to RFA (P=0.005) through 36 months.**
- **VCSS, AVVQ and EQ-5D outcomes demonstrated statistically significant improvement from baseline with sustained results over time; no difference between treatment groups out to 36 months.**
- **No reported DVT's, allergic reactions, or other SAE's in 36 months. Early events were mild and self-limiting; delayed events were uncommon.**
- **The VeClose RCT study, with its high level of clinical evidence and rigor continued to demonstrate the following for VenaSeal:**
  - **Safe, reliable, non-thermal, non-tumescent treatment option**
  - **Strong, consistent and durable results through 36 months**

Roll-in phase analysis of clinical study of cyanoacrylate closure for incompetent great saphenous veins

The objectives of this analysis were to report the efficacy and safety outcomes of the VeClose roll-in (training) group treated with CAC by physicians who had received device use training but had no prior treatment experience with the technique and to compare the outcomes with those from the randomized RFA and CAC groups.

Results:
Mean procedure time 3 min longer
3-month closure rate – 100%
Procedural pain, post-procedural QoL, adverse events similar to randomized group

Conclusions:
"Despite the physician's lack of prior experience, initial treatment with CAC leads to comparable efficacy and safety results to RFA and is associated with a relatively short learning period".

Kolluri R, et al. J Vasc Surg Venous and Lym Dis 2016;4:407-415.

WAVES Clinical Trial

Aim:
- Treatment of patients with large diameter veins (up to 20mm) and multiple incompetent vein segments in the same session

Methods:
- 50 pts with GSV, SSV, and/or AASV
- No adjunctive tributary Rx
- No compression post procedure
- RTC 1,4 weeks
  - Duplex, pain score, VCSS(r), AVVQ, return to work/normal activities

Results:
- numerical pain rating scale 2.2 ± 1.8
- All treated veins (48 great saphenous vein, 14 accessory saphenous veins, and 8 small saphenous veins) had complete closure
- Return to work/normal activities <1-2+ days
- Statistically significant improvement in VCSS, AVVQ
- Inflammation 20%

Gibson K, et al. Vascular 2016. Jan 1:1708538116651014. doi: 10.1177/1708538116651014. [Epub ahead of print]

Cyanoacrylate glue used to treat great saphenous reflux: Measures of outcome

Aim:
- Evaluate safety, efficacy, performance of endovenous cyanoacrylate ablate of GSV

Methods:
- Primary outcome – GSV obliteration up to one year
- Secondary outcomes – VCSS, AVVQ, SF-36,
- Diameter of GSV, treatment length, pre-treatment clinical severity of VV used to predict recanalization

Results:
- 57 GSVs in 29 pts
- Improved VCSS, AVVQ, SF-36 all improved at 1-month
- GSV closure rate 78.5% at 1-year
- No clinical recurrence at 1-year
- GSV diameter ≥ 8mm predictor of recanalization

Chan YC, Law J, Cheung G, et al. Phlebology 2017.32(2).99-106

Three-Year Follow-Up of First Human Use of Cyanoacrylate Adhesive for Treatment of Saphenous Vein Incompetence

Aim:
- Mid-term safety and efficacy of endovenous cyanoacrylate ablation of GSV

Methods:
- 38 patients
- Occlusion by duplex <5cms
- VCSS assessments

Results:
- 94.7% occluded by Kaplan-Meier analysis
- 2 failures, 4 partial recanalization
- VCSS improved
- 21.1% thrombus extension – no VTE

Almeida J, et al. Abstract. J Vasc Surg 2016;3(1):125.

Cyanoacrylate adhesive perforator embolization (CAPE) of incompetent perforating veins of the leg, a feasibility study

Aim:
- Explore feasibility of CAPE

Methods:
- 33 incompetent perforator veins (IPV) in 27 legs in C_3-C6 patients
- >0.34sec reflux
- ≥3mm diameter
- Occlusion thigh cuff to 70mmHg

Results:
- 76% occlusion at 3-months
- 24% persistent reflux
- 9% wound infection
- No DVT

Toonder IM, et al. Phlebology 29.49-54

Cyanoacrylate glue for the treatment of great saphenous vein incompetence in the anticoagulated patient

Aim:
- Case report

Methods:
- 73 y/o male on Warfarin for Afib – INR 2.3
- C4bS Ep As Pr
- Bleeding varicosities
- Reflux in deep venous system, SFJ, and GSV
- GSV 15 mm in diameter

Results:
- 6-months – significant edema and symptoms
- Duplex – GSV recanalized up to 7.2mm diameter
- Treated with foam sclerotherapy

Lane TRA, et al. J Vasc Surg Venous and Lym Dis 2013;1:298-300.

Ablation of the great saphenous vein with nontumescent n-butyl cyanoacrylate versus endovenous laser therapy (Turkish)

Aim:
- Comparison of NBCA with EVLA in ablation of GSV

Methods:
- Retrospective review of 339 non-randomized patients treated with NBCA or EVLA

Results:
- Avg procedure time 7min vs 18min (NBCA vs EVLA)
- 12-month occlusion rates 98.6% vs 97.3% (NBCA vs EVLA)
- Fewer adverse events (pigmentation/phlebitis) with NBCA

Koramaz I, et al. J Vasc Surg Venous and Lym Dis 2017 Mar;5(2):210-215

Nonthermal, Nontumescent Endovenous Treatment of Varicose Veins. (Turkish)

Aim:
- Safety and efficacy of cyanoacrylate adhesive for GSV occlusion

Methods:
- single-center prospective study of 62 pts
- Local anesthesia
- No NSAIDs
- Compression wrap for 1 day
- Successful occlusion <10cms recanalization

Results:
- 6-months, 90% occlusion, 3.2% subtotal occlusion, 6.5% no occlusion
- <16% phlebitis (exact incidence not specified)

Tekin A, et al. Ann Vasc Surg 2016;36:231-5

A prospective comparison of a new cyanoacrylate glue and laser ablation for the treatment of venous insufficiency (Turkish)

Aim:
- Prospective comparison of cyanoacrylate vs laser ablation

Methods:
- 310 pts non-randomized w/o adjunctive therapy
- Primary endpoint: occlusion
- Secondary endpoints: procedure time, pain, ecchymosis at day 3, changes in VCSS, AVVQ

Results:
- Procedure time, pain, and day 3 ecchymosis less with cyanoacrylate
- No paresthesia with cyanoacrylate, 2% with laser
- 1-month closure rates better with cyanoacrylate
- 12-month 95.8% cyanoacrylate, 92.2% laser
- VCSS, AVVQ improved similarly in both

Bozkurt AK, et al. Phlebology 2016;31(1S):106-13.


Thank you for your kind attention
Canyon Lake, Arizona
nickmorrison2002@yahoo.com

What's new in RF ablation for Superficial venous disease

Julian J Javier, MD, FSCAI.

Voluntary Assistant professor University of Miami School of Medicine.
Adjunct professor of Medicine Nova Southeastern University.
1168 Goodlette Frank rd. Naples, FL
Naples Cardiac & Endovascular Center
Naples, Florida

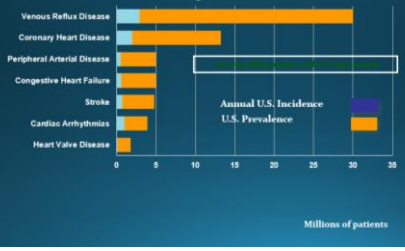
Disclosure Statement of Financial Interest

Within the past 12 months, I or my spouse/partner have had a financial interest/arrangement or affiliation with the organization(s) listed below.

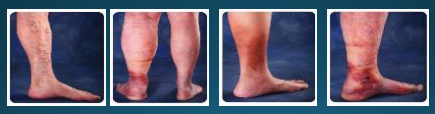
Affiliation/Financial Relationship	Company
• Grant/Research Support	• Company Names
• Consulting Fees/Honoraria	• Company Names
• Major Stock Shareholder/Equity	• Company Names
• Royalty Income	• Company Names
• Ownership/Founder	• Vascular Device Partners
• Intellectual Property Rights	• Company Names
• Other Financial Benefit	• Company Names

SCAI 2014 Las Vegas, NV | May 28-31, 2014 www.SCAI.org/SCAI2014

Prevalence and Etiology of Venous Insufficiency



Only **1.9** million of the more than **30** million Americans who suffer from venous insufficiency or CVI seek treatment[1,2,3]



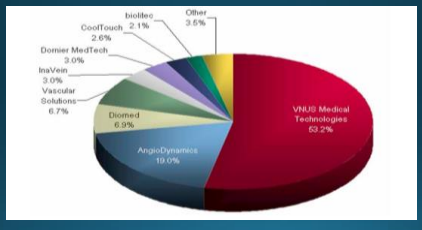
Photos courtesy of Rajabrata Sarkar, MD, PhD.

Treatments

- Surgery
  - Manually removes the vein segment from the leg
  - General anesthesia
  - Permanent scarring
  - Extended post-procedure discomfort
  - 2-3 weeks recovery

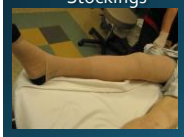
- Ablation Therapies
  - Relies on heat energy to burn and destroy vein segment
  - Tumescent anesthesia
  - Partial pain and bruising
  - Extended post-procedure discomfort
  - 2-3 days recovery

Leading Competitors in the Venous insufficiency Treatment Device Market



Ablation Techniques

Compression Stockings



Pain & Bruising

Tumescent Anesthesia

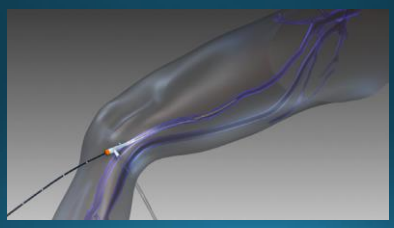
Why not use Thermal Ablation?

- It is time consuming.
- Delivery is tedious.
- Multiple injections, quite uncomfortable for patients.
- Post procedure pain and bruising
- Learning curve for novice operators

Thermal and non thermal ablation

Thermal	Non-thermal
Radiofrequency Covidien	MOCA
Radiofrequency FP-system	Varythema
WSWL/HSLA Laser	Cyanoacrilate
Steam Ablation	Vblock®
VEnclose	Balloon Occlusion Sclerotherapy

Radiofrequency



MOCA vs RF

- MOCA

14 day pain- 8.6 (100)
RTW-3.3 days
RT Activity-1.2 days
QoI - equal

- RF

14 day pain- 14.8 (100)
RTW-5.6 days
RT Activity-2.8 days
QoI-equal

van Eekeren et al. Postoperative pain and early quality of life after radiofrequency ablation and mechanochemical endovenous ablation of incompetent great saphenous veins. J Vasc Surg 2012.

Systematic Review and Meta-analysis of endovenous radio frequency, endovenous laser therapy and foam sclerotherapy

- Trial 1970-2007:
  - -29 EVLT
  - -32 RFO
  - -22 FS
- RFO worst short and long term safety compare to FS and EVLT
- Regarding phlebitis, DVT, parasthesias.
- FS higher recurrence then EVLT or RF

Conclusions:

EVLT, RFO, FS seem to be safe and effective modalities with good short and mid term

Luebke T, Brunkwall J J Cardiovasc Surg (Torino) 2008 Apri;49 (2)

Endovenous therapies of lower extremity varicosities meta- analysis

- Meta analysis of EVLT, RFA, FS and Surgery.
- Success at 3 years:
- EVLA (94%), followed RFA (84%), Surgery (78 %) FS (77%)

Conclusion:

EVLT and FS as effective as surgery

Van Den Bos R, Arends L, Kockbaert M, et al J Vasc Surg 2009, 49 230-239

Endovenous ablation (RF and Laser) and foam sclerotherapy vs. conventional surgery for Great Saphenous Vein varices. Cochrane Database Systematic review 2011) Oct 5;(10)

- 13 reports from five studies for a total of 450 pts included.
- Recurrence with RF no difference compare to surgery.
- Recanalization at 4 months > with RFA then with HL/S, none after 4 months.
- More Neo-vascualrization with HL/S compare to RF , not statistical difference.
- Less technical failure with RFA then with HL/S

Nesbit C, Eifel RK, Coyne P, Badi H et al

VeClose Trial comparing RFA to VenaSeal 24 month data

- 242 patients at 10 studies site 5.5 Venaseal 5.6 RF.
- Meant treatment length 32.8 cm Venaseal 35.1 cm on the RF.
- Complete occlusion 3 months 99% Venaseal, 94 % RF.
- At 24 months Closure rate 94 % Venaseal and 94 % RF group.
- On secondary end point Procedural pain was similar and quite low on both groups with pain score of 2.2 for Venaseal and 2.4 for RF.
- Use of NSAIDs was similar within the first 24 hours, interesting to note is that no pain meds use for 79.6 % of the Venaseal, and 78.9% of the RF.
- No DVT in either group

Kalluri R,

Risk factors associated with recanalization of incompetent saphenous veins treated with radiofrequency ablation catheter

A. Nayman[a,*], I. Yildiz[b], N. Koca[c], S. Deniz[d], M. Koplay[a], L. Oguzkurt[e]

The purpose of this study was to determine the occlusion rate of incompetent great saphenous veins (GSVs) and small saphenous veins (SSVs) treated with radiofrequency ablation (RFA) and individualize variables associated with recanalization.

Materials and methods

A retrospective review of 311 veins (256 GSVs and 55 SSVs) in 211 patients [177 women, 34 men; mean age, 45 years ± 12 (SD) (range: 18–75 years)] with incompetent GSVs and/or SSVs who were treated using new-generation RFA catheters was performed. The clinical results, occlusion rates, and variables associated with recanalization for the incompetent GSVs and SSVs were analyzed.

Results

No major complications were observed in the study population. Ten months after RFA, the occlusion rate was 89% (227/256) for GSVs and 91% (50/55) for SSVs. An increased pre-procedure diameter of the incompetent GSVs was associated with a higher rate of recanalization (OR: 0.825; 95% CI: 0.715–0.952) ($P < 0.05$). No significant differences in age, gender, and side of treated veins were found between patients with recanalization of treated veins and those without recanalization.

Conclusion

Our results show that pre-procedure diameter of the GSV is the single risk factor for recanalization after RFA.

Predictors of Recanalization of the Great Saphenous Vein in Randomized Controlled Trials 1 Year After Endovenous Thermal Ablation

European Journal of Vascular and Endovascular Surgery
Volume 52, Issue 2, August 2016, Pages 234–241

S.K. Van der Velden[a,*], M. Lawaetz[b], M.G.R. De Maeseneer[a], L. Hollestein[a], T. Nijsten[a], R.R. van den Bos[a],

Predictors of Recanalization of the Great Saphenous Vein in Randomized Controlled Trials 1 Year After Endovenous Thermal Ablation

- Medline search 2011 and 2014.
- Most important predictors of recanalization were clinical severity and veins diameter

Next Generation RF Ablation Technology

Product Features and Benefits

- Switchable heating length between 10 cm or 2.5 cm
  - Fast treatments with 10 cm vein sections
  - 2.5 cm for precise treatment of short vein sections

- Small 6F profile
  - Flexible, steerable, and easy to navigate
- Fast product setup and generator start up

RF Ablation Procedure time Comparison

	Typical 40cm thigh GSV vein	5cm Tributary plus 40cm GSV
Medtronic ClosureFast™ catheter	7cm heating element, seven 20-sec ablations	3cm element 3x, plus 3cm element 17x, total of twenty 20-sec ablations
Venclose EVSRF™ catheter	10cm heating element, five 20-sec ablations	2.5cm element 3x, plus 10cm element 5x, total of eight 20-sec ablations
	→ 28% faster with Venclose	→ 60% faster with Venclose

Summary

- New evolving technique are designed to eliminate the need for Tumescent anesthesia.
- Thermal remains as a safe and effective means of venous insufficiency treatment.
- Complex venous anatomy demands multiple tools available.

Thanks

Veins Hands On course: September 6-10 2017, Dominican Republic

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