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Varicose Vein Therapy: Endovenous Laser Ablation

Review

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Abstract – Endovenous laser ablation (EVA) is utilized in the therapy and the management of varicose veins from chronic venous disease. The fundamental sign for this treatment is disease that is refractory to conservative treatment with compression stockings. This activity audits the treatment of varicose veins with endovenous laser treatment and features the role of the interprofessional group being taken care of by patients that go through this method.

Targets:

- **Distinguish the indications of varicose vein endovenous laser treatment.**
- **Depict the procedure engaged in varicose vein endovenous laser treatment.**
- **Audit the expected complexities and clinical significance of varicose vein endovenous laser treatment.**
- **Frame interprofessional team techniques for further developing care coordination and correspondence to upgrade the care of patients that go through varicose vein endovenous laser treatment and improve results.**

Keywords – Varicose veins, Endovenous Laser Ablation.

I. INTRODUCTION

Varicose veins are superficial veins in the subcutaneous tissue that become enlarged upon standing and are a typical sign of underlying chronic venous disease. Chronic venous disease includes a spectrum, introducing as eczema, hyperpigmentation, telangiectasia, superficial thrombophlebitis, lipodermatosclerosis, atrophie blanche, and ulceration. Laid out risk factors incorporate age, family history, obesity, and previous pregnancy.[1] Other risk factors, for example, gender, smoking, history of injury to lower extremity, and occupations that require prolonged standing, have not shown strong and a reliable connection, and require further studies.[2] Symptoms of chronic venous disease incorporate leg heaviness, pedal swelling, and pain that can fundamentally lessen the quality of life.[3]

The pathophysiology of venous disease is complicated and ineffectively comprehended. What is known is that inflammation assumes a central role in the turn of events and progression of the disease. Mechanically, there is a hemodynamic dysfunction, for example, hypertension, that causes valvular reflux bringing about hemostasis or blood pooling in the lower limits. This sets off a feed-forward pattern of venous wall remodeling and local inflammation. It is accepted that high venous tensions cause shear stress, which is detected by the endothelial cells. Accordingly, growth factors, for example, vascular endothelial growth factor (VEGF), platelet-derived growth factor, and transforming growth factor-beta 1 (TGF-beta 1) are released and stimulate vascular

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smooth muscle cell proliferation.[4,5] likewise, endothelial cells increment the creation of adhesion molecules, which advance leukocyte attachment and transmigration.[6] The outcome is a disturbance of collagen homeostasis creating varicose veins, which are less elastic and unfit to keep up with structural conformation during high-pressure blood flow. Progression of the disease includes further VEGF and TGF-beta 1 mediated vascular remodeling with expanded leukocyte infiltration. Eventually, this pathology culminates in dermal changes and ulcer formation.[7] Taken together, valvular reflux gives off an impression of being the basic component that starts the cascade of inflammatory cytokines disrupting collagen homeostasis bringing about structural changes to the venous wall.

Chronic venous disease is classified in light of CEAP (clinical, etiologic, anatomic, and pathophysiologic) criteria:[8]

Refreshed 2020 CEAP classification guidelines are as the follows:

- C0: Without any visible or palpable signs of disease
- C1: Telangiectasia or reticular veins
- C2: Varicose veins
- C2r: Recurrent varicose veins
- C3: Edema is available
- C4: Changes in skin and subcutaneous tissue
- C4a: Pigmentation or eczema
- C4b: Lipodermatosclerosis or atrophie blanche
- C4c: Corona phlebectatica
- C5: Healed ulcers
- C6: Active ulcers
- C6r: Recurrent active venous ulcer

Etiologic characterization depends on congenital (Ec), primary (Ep), secondary (Es), or unknown (En). Es is additionally differentiated into intravenous (Esi) or extra-venous (Ese). Combinations of etiologic states can exist together. Anatomic classification is differentiated in light of the affected vein and laterality: superficial (As), perforator (Ap), deep (Ad), or unknown (An). Pathophysiology is defined by whether the reason is because of reflux (Pr), obstruction (Po), both (Pr, o), or neither (Pn).[9] In spite of the fact that there are various ways to deal with treatment going from conservative (compression stockings) to invasive (vein stripping) for varicose veins relying upon the severity of the disease, this article will focus on the utilization of endovenous laser ablation. The theory behind venous ablation is utilizing heat to damage the vein wall, which causes fibrosis and collapse of the vein. LASER, which means "light intensification by stimulated emission of radiation," is a device that focuses light energy. For endovenous laser ablation, a fiber optic laser is embedded into the vein and, when enacted, will transmit light energy to the laser tip that is dispersed radially by a prism and will heat the encompassing tissue.[10] Heat injury to the vein wall will make disruption to collagen, prompting fibrosis and collapse of the vessel. Tumescent anasthesia, which assumes a critical role in this methodology, is given before ablation to diminish intravenous blood volume through venous compression, make a barrier between laser and encompassing tissue, and provide local anasthesia. The methodology can be acted in an outpatient setting and doesn't need general anesthesia. Benefits of endo-removal incorporate rapid recuperation with return to work on average on 1 day and 96.7% of vein obliteration maintained at 3 and 5 years after the procedure.[11]

1. Anatomy and Physiology

Usually targeted/involved veins of the lower limit include:

- Great saphenous vein (GSV)
- Small saphenous vein (SSV)

- Saphenofemoral junction (SFJ)
- Inferior epigastric vein (IEV)

Table 1: Venous clinical severity score

Absence of venous disease is defined by a score of ≤3 and a score ≥8 defines severe disease.

Attribute	Absent (0)	Mild (1)	Moderate (2)	Severe (3)
Pain	None	Occasional	Daily not limiting daily activities	Daily interfering with daily activities
Varicose veins (>4 mm)	None	Few, scattered	Confined to calf or thigh	Involves calf and thigh
Venous edema	None	Limited to foot and ankle	Extends above the ankle but below knee	Extends to knee and above
Skin pigmentation	None	Limited to peri malleolar area	Diffuse over lower third of calf	Wider distribution above lower third with recent pigmentation
Inflammation	None	Limited to perimalleolar area	Diffuse over lower third of calf	Severe cellulitis or significant venous eczema
Induration	None	Limited to perimalleolar area	Diffuse over lower third of calf	Entire lower third of leg or more
Number of active ulcers	0	1	2	>2
Largest active ulcer size (cm)	N/A	Diameter <2 cm	Diameter 2-6 cm	Diameter >6 cm
Ulcer duration	None	<3 months	3-12 months	>1 year
Compression stocking	None	Intermittent use	Most days	Full compliance

2. Diagnosis

Among all chronic venous diseases, varicose veins represent the most widely recognized type of lower extremity vein problems with prevalence rates that change somewhere in the range of 5% and 30% [12,13]. Most patients visit outpatient clinics with lower extremity symptoms including edema, pain leg heaviness, and skin changes like dermatitis, sclerosis, ulceration, and convoluted and dilated superficial veins, which happen secondary to volume over-load in cutaneous veins because of valvular inadequacy and blood flow anomalies [14,15].Treatment is pointed toward eliminating venous reflux; thusly, duplex ultrasonography (DUS) is viewed as the highest quality level to affirm the diameter of the enlarged veins, venous reflux, the physical site of this anomaly, and the altered hemodynamics [12,16,17]. In any case, the consequences of DUS vary depending upon the operator's abilities, which serves as a limit of this imaging methodology. Processed tomography venography (CTV) utilizing three-dimensional (3D) reconstruction offers a several benefits for diagnosis and optimal treatment planning [16,18,19]. CTV is helpful to precisely outline varicose vein anatomy, especially in clinically challenging situations like in patients with

recurrent varicosities and gives a guide to direct the surgery [18,20]. Thusly, CTV is used for preoperative assessment of varicose veins. Some studies have shown that reflux diagnosed on preoperative DUS mirrors an expanded saphenous vein diameter [12,13,21]. Notwithstanding, a few reports have depicted the connection between the saphenous vein diameter and US-proven reflux in patients with varicose veins.

3. Indications

Patients with lower extremity venous disease ought to be assessed with duplex ultrasound. Initial treatment for varicose veins in patients with CEAP classification of C3 or less is conservative with compression stockings for 3 to a ha6 months. Notwithstanding, there stays a requirement for a high-quality clinical preliminary looking at the efficacy of compression stockings.[22] Failure of conservative treatment is an indication for interventional measures, incorporating ablation with a radiofrequency catheter or endovenous laser, foam sclerotherapy, or venous stripping. Endovascular ablation is appropriate for varicosities originating from the GSV or SSV.

4. Contraindications

- Acute deep vein thrombosis
- Arterial insuffiency
- Acute skin infection at the site of entry
- Obstruction of the deep vein where the target vein serves as collateral
- Pregnancy

One ought to proceed carefully in patients with post-thrombotic syndrome and venous reflux with superimposed blood vessel venous fistula. Imaging to evaluate the patency of the deep veins is critical.

5. Equipment

- Ultrasound (US) machine with probe cover
- Percutaneous venous access kit: lidocaine, a needle with syringe, guidewire, scalpel, dilator, and stitches
- Fiber-optic laser with proper eye protection and catheter sheath
- Tumescent anesthetic solution with injector pump. Maximum of 15 mg/kg of total lidocaine.[23]

6. Personnel

Clinical suppliers that carry out this technique range from vascular surgeons, pain management clinicians, interventional radiologists, and interventional cardiologists. Extra partners might be useful in using ultrasound imaging and positioning.

7. Preparation

All patients ought to have a pre-operative duplex ultrasound mapping of leg veins to distinguish the area of reflux, vein diameter, the velocity of reflux, and patency of vein. Reflux time greater than 500 milliseconds is thought of as abnormal. Ultrasound mapping can be utilized to uncover abnormal venous anatomy, the origin of venous varicosity, and perforating veins as well as to assess the deep venous system. This will help act as a a roadmap.

8. Technique

1. Place the patient in prone, reverse Trendelenburg position and place monitors for EKG and pulse oximetry. Identify cannulation access site on the leg, ordinarily below the knee. Prep with antiseptic.

2. Drape patient and cover ultrasound test with a sterile sheath

3. Gently sedate the patient.

4. Inject local 1% lidocaine superficial to the access site under US guidance. Access the vein with a needle. Thread the guidewire through the needle and advance to the saphenofemoral junction.

5. Remove the needle and replace it with a dilator. Utilizing a scalpel, make an entry point at the junction of guidewire and skin that permits the dilator to easily pass.

6. Replace dilator with catheter and advance to SFJ. Replace the guidewire with a laser fiber. Involving the US in longitudinal view, advance the laser tip up until 2 cm distal to the SFJ, guarantee that the IEV is pictured.

7. Place the patient in Trendelenburg position and infuse tumescent anesthesia utilizing an infusion pump into the perivenous fascia starting from the entrance site to SFJ. Normally, infusions are dispersed 3-5 cm separated.

8. Visualize under the US utilizing transverse view the GSV with the catheter at the center encompassed by hypoechoic tumescent anesthesia. Initiate the laser.

9. Withdraw fiber optic laser and catheter at a pace of 1-2 mm/s while affirming ablation with the US in the longitudinal view. Take care not to heavily compress the region superficial to the catheter.

10. Close percutaneous skin incision.

11. Return table to the neutral position. Monitor for any perioperative complications.[24]

9. Complications

Thrombosis: Endovenous health prompted apoplexy happens when a thrombus extends from the ablated greater saphenous vein into the deep femoral vein. It is differentiated into four kinds: type 1 at the junction of a superficial and deep vein; type 2 situated in deep vein with partial occlusion (<50%); type 3 occlusion (50% to 99%); type 4 complete occlusion. Occurrence of endovenous health prompted thrombosis was viewed as 1.4%, deep vein thrombosis was 0.3%, and pneumonic embolus was in 0.1% of cases.[25]

a) Hematoma and ecchymoses: These are recorded as complications of the procedure, however the effect on the patient is subjective depending upon expectations. Besides, the utilization of higher wavelength lasers has been related with diminished pain and ecchymoses because of better energy absorption by water and less by hemoglobin.[21]

b) Skin burns: Ablating superficial veins near the skin surface can cause full-thickness burns, yet the frequency of complication essentially diminishes to zero with better utilization of tumescent anasthesia. It tends to be treated with local wound care and observing for infection.

c) Nerve damage: GSV ablation can damage the saphenous nerve causing transient cutaneous paresthesia in the medial leg. SSV ablation can damage the sural nerve causing transient cutaneous paresthesia in the lateral foot. Most of nerve injuries can be avoided with cautious needle position under ultrasound direction and better tumescent anesthesia.[26]

d) Recurrence: Meta-analysis showed that the five-year recurrence rate for laser ablation of GSV was viewed as 36.6%, which is equivalent to radiofrequency ablation and conventional surgery.[27]

10. Clinical Significance

Varicose veins are brought about by ineffectively working venous valves and diminished elasticity of the vein wall obstructing flow and permitting the pooling of blood inside the veins. These veins start to pool and become engorged. Varicose veins influence up to 40% of adults and are more common in obese individuals and in multiparous women. Worsening varicose veins can give pain and can add to diminished quality of life. Endovenous laser ablation is a minimally invasive and well-tolerated method that can assist with treating varicose veins and improve venous flow.

11. Enhancing Medical care Team Results

Varicose veins emerging from chronic venous disease is an exceptionally prevalent disease that adds to significant pain , debility, and quality of life reduction. Many patients will experience the disease effects of this and seek treatment because of an absence of awareness. Teaching the interprofessional team in the classification of chronic venous disease and indications for therapy can assist motivate referrals for patients to seek therapy with a specialist, who can give a plenty of choices including endovascular ablation, which is a minimally invasive, immediate method that has been demonstrated to convey predictable outcomes with negligible complications. It is critical to know that this is chronic disease, and the procedure is in no way, shape or form a cure. Nonetheless, the physiologic and psychological advantages to the patient can't be put into words.

II. Conflict of Interest

All authors declare no conflicts of interest.

III. Author Contribution

Authors have equally participated and shared every item of the work.

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