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Varicose Vein Treatment: Radiofrequency Ablation Therapy

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Continuing Education Activity

Radiofrequency ablation is a minimally invasive technique for treating superficial venous insufficiency, which causes varicose veins and chronic venous disease. This activity describes the procedure and explains the interprofessional team's role in managing a venous disease patient who undergoes endovenous ablation therapy.

Objectives:

- Review the indications for the radiofrequency ablation procedure for varicose veins.
- Describe the technique of radiofrequency ablation procedure for varicose veins.
- Outline the potential complications of radiofrequency ablation procedure for varicose veins.
- Summarize the importance of collaboration among the interprofessional team to enhance care delivery for patients who undergo radiofrequency ablation procedure for varicose veins.

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Introduction

Venous disease has a very high prevalence among adults, ranging from 40% to 80%, and the highest prevalence is in Western countries.[1] In the United States alone, greater than 30% of adults are affected by chronic venous insufficiency and varicose veins. Chronic venous insufficiency can result in pain and loss of workdays and thereby result in significant morbidity.[2] Treatment of venous insufficiency includes noninvasive and invasive methods. Invasive methods include surgery and endovenous techniques. The most frequently used minimally invasive techniques include radiofrequency and laser therapy.

Anatomy and Physiology

Lower extremity varicose veins are enlarged subcutaneous veins that measure greater than 3 mm in diameter. The lower extremity venous system comprises superficial veins, perforators, and deep veins. Superficial veins are those that lie underneath the skin and are superficial to the muscles of the leg. The primary superficial veins of the leg are the great saphenous (GSV) and short saphenous (SSV). The GSV arises in the medial aspect of the foot and runs along the medial border of the tibia. It runs on the medial aspect of the thigh and drains into the saphenofemoral junction in the inguinal region. The saphenofemoral junction drains the superficial circumflex iliac, epigastric, and external pudendal veins. The anterior and posterior accessory great saphenous veins in the calf and thigh drain into the primary GSV. The thigh portion of the GSV may be duplicated in up to 20% of cases.[3][4]

The short saphenous vein, or the SSV, is a posterior superficial vein localized to the calf. It originates in the lateral aspect of the foot and drains most frequently into the popliteal vein, immediately distal to the popliteal fossa. The vein of Giacomini is an anatomical variant in which the SSV continues through to the thigh as a distinct branch tributary to drain in the GSV in the thigh or directly in the saphenofemoral junction.[3]

The deep veins in the leg run alongside the major arteries of the leg. The calf veins in the leg are paired and include anterior tibial, posterior tibial, peroneal, all of which join together to form the popliteal vein. The thigh veins include popliteal and femoral veins. The soleal veins generally drain into the posterior tibial veins. The gastrocnemius veins drain directly into the popliteal vein.[3]

Perforators include perforators of the foot, ankle perforators, perforators of the leg, perforators of the knee, perforators of the thigh, and perforators of the gluteal muscles. Perforator veins serve to connect superficial and deep veins. There are many groups of perforators, depending on the location. For example, perforators in the leg are medial, anterior, posterior, and lateral leg perforators. Medial leg perforators, in turn, are the posterior tibial perforators and paratibial perforators. The posterior tibial perforators connect the posterior accessory GSV with the posterior tibial vein. The para-tibial perforators connect the primary GSV with the posterior tibial veins. Similarly, there are 4 groups of perforators in the thigh, namely medial thigh, lateral thigh, anterior thigh, and posterior thigh perforators. In the medial thigh, the femoral canal perforators, and the inguinal perforators connect the main GSV to the femoral vein.[3]

Superficial and deep veins of the lower limb have unidirectional valves that help drain the leg against gravity towards the right heart. Venous insufficiency of a superficial vein or a perforator is defined as the presence of flow reversal greater than 500 milliseconds on ultrasound in the upright position with distal compression. For deep veins, namely the femoral and popliteal veins, reflux greater than 1000 milliseconds is considered significant. In general, proximal veins should be tested during increased intraabdominal pressure or via the Valsalva maneuver. Distal veins can be tested with distal compression by hand or pressure cuff.[2]

Indications

Symptomatic superficial insufficiency of veins greater than 3 mm in diameter that is refractory to compression stockings therapy in individuals greater than 18 years of age is an indication for treatment. Usually, this is limited to the GSV and SSV. Perforator veins can be treated if they are greater than 3.5 mm in diameter with greater than 500 milliseconds of reflux and the perforator happens to run beneath a healed or active venous ulcer.[2]

Symptoms generally include throbbing discomfort, burning pain, pruritus, leg swelling, leg heaviness, fatigue, and spontaneous bleeding from varicosities. Advanced venous disease may present as poorly healing ulcers. Chronic venous disease may present with skin changes such as eczema, corona phlebectatica, lipodermatosclerosis, or diffuse hyperpigmentation of the lower legs.[2]

Corona phlebectatica (ankle flare or malleolar flare) is a term that indicates short-sized veins occurring in a fan-shaped pattern in the medial or lateral aspects of the foot next to the malleoli.[5]

Lipodermatosclerosis describes thickened bound skin involving the tissues below the knee.[6]

Contraindications

Relative contraindications include an incompetent superficial vein diameter of less than 2 mm, history of extensive deep vein thrombosis (DVT) in the same leg, active superficial vein thrombosis in the vein to be treated, history of a prior surgical or endovenous treatment of the same leg, pregnancy, known malignancy.[7]

Other relative contraindications include more systemic conditions such as overall poor health, frailty, immobility, and known bleeding or clotting disorders.[8]

Equipment

Radiofrequency ablation (RFA) is a minimally invasive procedure approved by the FDA in 1999 to treat varicose veins. The commercially available radiofrequency catheters are built with a heating element at its tip that uses thermal energy to destroy the endothelium of the vein. The length of the heating element is variable based on the manufacturer.[7]

Personnel

Radiofrequency ablation is an image-guided, minimally invasive procedure that can be performed in the outpatient setting. It can be performed with local anesthesia and does not require general anesthesia. A performing operator, a nursing assistant, and a trained ultrasound technician are required for this procedure.[9]

Preparation

Antibiotic prophylaxis is not routinely recommended before or after the procedure.[10] Patients are generally placed in the supine position, and the affected leg is prepared and draped using sterile technique.

Technique or Treatment

Access to the refluxing superficial vein is obtained with a 16 or 18 F needle under ultrasound guidance at the lowest point of its incompetence. The point of access is generally limited to 15 cm distal to the knee joint. The radiofrequency ablation catheter is then advanced under ultrasound guidance and placed at least 2 cm distal to the saphenofemoral junction. Once the catheter is in place, a tumescent anesthetic solution is injected around the vein under ultrasound guidance along the entire course of the vein. The tumescent anesthetic solution usually contains epinephrine, bicarbonate, and lidocaine. An example of a tumescent anesthetic would be a combination of 0.5 mg adrenaline or epinephrine, 4.2 mg bicarbonate, and 35 ml lidocaine diluted in 500 ml 0.9 percent saline.

This insulates the surrounding soft tissue, nerves, and deep vessels from heat injury. It also helps compress the target vein, thereby increasing contact of the heating element on the RFA catheter with the vein walls. The RF generator is then activated, which results in the application of a segmental heat energy of 120 degrees Celsius. The RF generator is activated in 20-second intervals until the entire length of the vein is treated.

At the end of the procedure, hemostasis is achieved by manual compression at the site of venous access and catheter entry. Compression bandages and stockings are then applied on the treated leg for 1 to 3 days to reduce postprocedure bruising and tenderness. Patients are encouraged to walk after the procedure. Follow-up protocols vary by institution. In general, between 1 and 3 days, patients undergo repeat venous ultrasound. This ensures successful occlusion of the treated vein and confirms the absence of deep venous injury. The patient then undergoes a repeat clinical evaluation in 1 to 3 weeks.[7][9]

After radiofrequency therapy of varicose veins, compression stockings are recommended for continued regular use. The duration of compression stocking is guided by clinical judgment.[11]

Complications

Overall, the rate of adverse effects has been reported to be as low as 4.4% to as high as 40%. However, pain is the most common adverse effect, contributing to greater than 95% of the reported rates.[8] The rates of bruising and thrombophlebitis are around 10%. The access site infection rate is as low as 0 to 5%. The rate of major adverse events (eg, nerve injury, pulmonary embolism, DVT, etc), is less than 1%.[7][12]

Clinical Significance

In comparative studies, radiofrequency ablation has been shown to have the lowest rates of adverse events and complications. Patients also report greater symptom improvement and quality of life during follow-up, up to one year.[7]

[8]

Enhancing Healthcare Team Outcomes

Chronic venous disease has a high prevalence. However, it is under-recognized and therefore undertreated. Initial recognition begins at the level of the primary care physician or a primary care provider. Lower extremity venous stasis changes are often mistakenly treated for cellulitis or dermatologic conditions. It is important to refer the patient to an appropriate vascular specialist where definitive evaluation can occur. Vascular technologists trained in performing venous reflux studies should be involved in testing patients presenting with chronic venous disease. It is particularly important to follow testing protocols recommended by the Society of Vascular Surgery guidelines.[2]

The Society of Vascular Surgery and the American Venous Forum have developed guidelines for treating varicose veins, venous insufficiency, and chronic venous disease. The current guidelines were developed after an exhaustive review of the existing literature, including randomized trials, registries, meta-analyses, etc. The level of evidence for the use of Radiofrequency ablation in treating varicose veins has been graded as moderate by the Society of Vascular Surgery. [Level 2]

Review Questions

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