

Varicose Veins and Chronic Venous Insufficiency - A Current Review

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ABSTRACT

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Venous insufficiency syndromes allow venous blood to escape from its normal flow path and flow in a retrograde direction down into an already congested leg. Mild forms of venous insufficiency are often asymptomatic or uncomfortable, and cosmetically disfiguring, but severe venous disease can produce severe systemic consequences and can lead to severe morbidity. Mild symptoms include aching or throbbing pain, edema on dependency and "restless legs." Later chronic venous insufficiency leads to cutaneous and soft tissue breakdown leading to non healing ulcers.

Endovenous laser therapy is a thermal ablation technique that uses a laser fiber placed inside the vein to destroy the vascular endothelium.

RF ablation is a thermal ablation technique that uses a specially developed proprietary RF catheter placed inside the vein to heat the vessel wall and surrounding tissues. This tissue heating causes protein denaturation, collagenous contraction, and immediate closure of the vessel

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Venous system is a low pressure flow system meant to carry impure blood. Flow is maintained by many factors like negative intrathoracic pressure, pumping by the skeletal system and flow limiting valves. Failure of any mechanism, mainly by the failure of valves or obstruction of the system will lead to increase in the pressure which makes it a high pressure or high flow system. This lead to dilatation of the veins called as varicose veins. A more confusing but less discussed phenomenon is chronic venous insufficiency. Venous insufficiency syndromes allow venous blood to escape from its normal flow path and flow in a retrograde direction down into an already congested leg.

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Chronic venous insufficiency eventually produces chronic skin and soft tissue changes that begin with mild swelling. This eventually progresses discoloration, inflammatory dermatitis, recurrent or chronic cellulitis,

cutaneous ischemia, ulceration, and even malignant degeneration. Chronic nonhealing leg ulcers, recurrent phlebitis, and variceal bleeding are serious problems that are caused by venous insufficiency and can be relieved by the correction of venous insufficiency.

Mortality associated with varicose veins is almost entirely caused by venous thromboembolism.

Patients with varicose veins are at increased risk of deep vein thrombosis (DVT) because venous stasis and injury often cause superficial phlebitis that can pass through perforating vessels to involve the deep venous system. When treating a patient with varicose veins, the possibility of associated DVT must always be considered because the mortality rate associated with unrecognized and untreated thromboembolism is 30-60%.

Treatment history: Various methods of treating this problem were tried,^{1,2,3} but recurrence and cosmesis were major hazards. History starts in the BC era with crude surgical techniques. The Rindfleisch-Friedel operation of the early 1900s, is cutting multiple deep spiral wounds upto deep fascia with ligation of all the possible veins. The wound will be left behind for secondary granulation The Linton procedure was

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subfascial ligation of perforating veins.

The Friedrich Trendelenburg procedure, of 1800s, was a the interruption of the saphenous vein through a midhigh incision. This procedure was later modified by his own student Perthes, who advocated a groin incision and a saphenofemoral ligation. Several new approaches to stripping the greater saphenous vein (GSV) were introduced in the first few years of the 20th century. The Mayo stripper is an extraluminal ring that cuts the tributaries as it passes along the vein. The Babcock device is an intraluminal stripper with an acorn-shaped head that pleats up the vein as it pulls the vessel loose from its attachments. The Keller device is an internal wire used to pull the vein through itself, as is done today with perforation-invagination (PIN) strippers.

Chemical sclerosis of varicose veins was there since the late 1800s. Modern sclerosants with an acceptable risk profile first became widely available in the 1930s and have been used since that time both as a surgical adjunct and as primary therapy for varicose veins.

Stab avulsion using phlebectomy hooks was performed by Galen during the second century, and a similar procedure was used by others before him. The procedure came back into modern favor during the 1960s and has increased in popularity ever since.

The newest techniques for vein ablation use heat energy delivered to the endovenous wall by means of laser or by radiofrequency (RF) heating. These may be the first truly new approaches to vein treatment of the past 2000 years.

Anatomy of the venous system: The GSV originates on the medial malleolus as continuation of the venous arch. From the ankle, the GSV continues along the anteromedial aspect of the calf to the knee and into the thigh where it drains into the femoral vein. A normal GSV is typically 3-5 mm in diameter in the mid thigh. Many perforating veins may connect the GSV to the deep system at the femoral, posterior tibial, gastrocnemius, and soleal veins. Besides perforating veins, the GSV has numerous superficial tributaries as it passes through the thigh. The most important of these are the posteromedial and anterolateral thigh veins, found at the level of the mid thigh, and the anterior and posterior accessory saphenous veins at the level of the canal of Hunter in the upper thigh, where a perforating vein often connects the GSV to the femoral vein. Just below the SFJ, the GSV receives several additional important tributary veins. The termination point of the

GSV into the common femoral vein is called the saphenofemoral junction. The terminal valve of the GSV is located within the junction itself. SF reflux can occur at the terminal valve of the GSV, below the subterminal valve or even immediately below the junction. The small saphenous vein originates at the medial malleolus and has a lateral course, drains into popliteal vein at a variable point. This has different communication with long saphenous system which may be the cause of recurrence in many patients.

Problem: Venous disease is extremely common and increases with age, being present in more than half the population by age 65 years. The most common type is venous insufficiency, and the most visible manifestations are varicose veins and telangiectasias, with other cutaneous and soft tissue abnormalities developing over time. Most patients with venous insufficiency have subjective symptoms that may be very mild or very severe. Treatment aims to correct the underlying defect, removing or closing down points of reflux that can prevent venous blood from returning to the central circulation.

Etiology: Most varicose disease is caused by venous hypertension, but some people have an inborn weakness of vein walls and can develop varicosities even in the absence of elevated venous pressures. Prolonged standing leads to increased hydrostatic pressures that can cause chronic venous distention and secondary valvular incompetence anywhere within the superficial venous system. If proximal junctional valves become incompetent, high pressure passes from the deep veins into the superficial veins and the condition rapidly progresses to become irreversible.

Women are particularly susceptible to varicose disease because vein walls and valves periodically become more distensible under the influence of cyclic increases in progesterone. Pregnancy increases this susceptibility because circulating hormonal factors associated with pregnancy increase the distensibility of vein walls and soften valve leaflets. At the same time, the veins must accommodate a greatly expanded circulating blood volume. Late in pregnancy, the enlarged uterus compresses the inferior vena cava, causing further venous hypertension and secondary distension of leg veins.

Depending on the relative contributions of these mechanisms, varicose veins of pregnancy may or may not spontaneously regress after delivery. Treatment of existing varicose veins before pregnancy reduces the recruitment of other veins during pregnancy.

Pathophysiology: Normally the unidirectional valves in the veins regulates the direction of the blood ie blood flows from the superficial system to deep system and then to the system, It doesn't allow blood to flow from deep to superficial system. Perforating veins allow blood to pass from the superficial veins into the deep system.

Superficial venous valve is most commonly affected due to the effects of high pressure. When exposed to high pressure for a long time, superficial veins dilate so that their valves become incompetent. The problems of venous insufficiency are related to the venous pressure and to the volume of venous blood that is carried in a retrograde direction through incompetent veins.

Clinical: variceal bleeding, dermatitis, thrombophlebitis, cellulitis, and ulceration. Cosmetic symptoms are very common.

The venous history should also include the following elements:

- Onset of the disease
- Presence or absence of predisposing factors (eg, heredity, trauma to the legs, occupational prolonged standing)
- History of edema
- Previous treatment
- History of superficial or deep thrombophlebitis
- History of any other vascular disease
- Family history of vascular disease of any type

Physical examination findings

Venous evaluation is through inspection, palpation, percussion, and hand-held Doppler examination, purpose is to form a venous map that will decide the treatment. All diseased and dilated veins should be mapped in the standing position before treatment. Healthy veins typically are visibly distended only at the foot and ankle. Visible distension of superficial veins in other regions of the leg usually implies disease.

Darkened, discolored, stained skin is often a sign of chronic venous stasis, particularly if it is localized along the medial ankle and the medial aspect of the lower leg. Nonhealing ulcers in this area most likely are the result of underlying venous insufficiency. Skin changes or ulcerations that are localized only to the lateral aspect of the ankle are more likely to be related to prior trauma or to arterial insufficiency than to pure venous insufficiency.

Palpation is an important part of the venous examination. The entire surface of the skin is palpated lightly with the fingertips because dilated veins may be palpable even where they are not visible. Palpation helps to locate both normal and abnormal veins. After light palpation to identify superficial vascular abnormalities, deeper palpation helps to elucidate the causes and sources of the superficial problems. Superficial thrombophlebitis is to be looked carefully because it has a high incidence of deep vein thrombosis.

Perthe's maneuver

The Perthe's maneuver is the technique of examining the deep system whether it is patent or not. A tourniquet is placed over the proximal part of the varicose leg to compress any superficial varicose veins while leaving deep veins unaffected. When the patient walks or exercises varicose veins to be emptied, but if deep system obstruction exists, then paradoxical congestion of the superficial venous system and engorgement of varicose veins. If the Perthe's maneuver is positive and the distal varices have become engorged, the patient is placed supine with the tourniquet in place and the leg is elevated (Linton test). If varices distal to the tourniquet fail to drain after a few seconds, deep venous obstruction must be considered. These maneuvers are not consistently reliable.

Trendelenburg test

The Trendelenburg test can often distinguish patients with superficial venous reflux from those with incompetent deep venous valves.

The leg is elevated until the congested superficial veins have all collapsed. Direct pressure is used to occlude a varicose vein just below the SFJ or at another point of possible reflux from the deep system into the superficial varicosity. The patient stands with the occlusion still in place.

If the distal varicosity remains empty or fills very slowly, the principal entry point of high pressure into the superficial system has been identified. Rapid filling despite manual occlusion of the possible high point of reflux means that some other reflux pathway is involved.

Doppler auscultation

The physical examination as described thus far cannot differentiate dilated veins of normal function from true varicosities that carry venous blood in a retrograde

direction. Doppler examination is an adjunct to the physical examination that can show directly whether flow in a suspect vein is ante grade, retrograde, or to-and-fro.

Treatment is indicated whenever venous reflux produces secondary skin or subcutaneous tissue changes such as lipodermatosclerosis, atrophie blanche, ulceration, or hyperpigmentation. Treatment is also indicated for symptomatic varicose veins or symptomatic telangiectasias of any size, for bleeding varices, for truncal varices (whether symptomatic or not), and, if evidence of ongoing disease progression is present, for isolated tributary varices.

Contraindications:

1. Venous outflow obstruction
2. Bedridden patients
3. Deep vein thrombosis
4. Hyperthrombosis
5. Pregnancy

TREATMENT

Medical therapy: All modalities of treatment require a normally functioning deep system. Sclerotherapy, laser ablation, RF ablation, and surgical extirpation are the modern techniques used to ablate varicosities. Chemical sclerosis, often called Sclerotherapy, is the most widely used medical procedure for ablation of varicose veins and spider veins. In this procedure, a Sclerosing substance is injected into abnormal vessels to produce endothelial destruction that is followed by formation of a fibrotic cord and eventually by re-absorption of all vascular tissue layers. A thorough diagnostic evaluation is essential before treatment.

Problems of Sclerotherapy are

- a. Some sclerosants (eg, hypertonic saline) are highly caustic. Extravasation can lead to skin sloughing and a very poor cosmetic result.
- b. Inadvertent injection into an arteriovenous malformation (or directly into an unrecognized underlying artery) can cause extensive tissue loss or loss of the entire limb.
- c. Inadvertent injection of concentrated sclerosants into the deep system can cause DVT, pulmonary embolism, and death.

The most commonly used sclerosants today are Polidocanol and sodium tetradecyl sulfate. These agents

are preferred because they have a low incidence of allergic reactions, produce a low incidence of staining and other adverse cutaneous effects, and are relatively forgiving if extravasated. Polidocanol, the most forgiving sclerosing agent, was originally developed as a local anesthetic agent. Hypertonic saline in a 20% or 23.4% solution can be used as a Sclerosing agent. Saline is a naturally occurring bodily substance with no molecular toxicity, but the disadvantages of the agent make it unsuitable except in the hands of highly skilled practitioners.

The safety of Sclerosing agents in pregnancy has not been established.

Surgical therapy: Common surgical approaches are vein stripping with flush ligation of the SFJ and all tributaries, avulsion phlebectomy performed through microincision, endovenous RF thermal ablation, and endovenous laser thermal ablation. Smaller veins are surgically treated by microincisional phlebectomy, and residual telangiectasias are managed by Sclerotherapy.

Preoperative details: A careful history and physical examination, including continuous-wave Doppler, are essential to developing an appropriate diagnosis and treatment plan. All major reflux pathways are mapped using color-flow duplex ultrasound, and surface vessels to be removed are indicated with a skin marker.

A correct diagnosis of superficial venous insufficiency is essential. Veins should be treated only if they are incompetent and if a normal collateral pathway exists. Removal of a saphenous vein with a competent termination will not aid in the management of nontruncal tributary varices.

Endovenous laser

- Endovenous laser therapy is a thermal ablation technique that uses a laser fiber placed inside the vein to destroy the vascular endothelium.
- Seldinger over-the-wire technique is used to place a long catheter along the entire length of the truncal varix to be ablated. A bare laser fiber is passed through the catheter until the end protrudes from the tip of the catheter by approximately 2 cm, and the laser fiber tip is positioned at the SFJ just distal to the sub terminal valve. The position is confirmed by ultrasound and by use of the laser guide light.
- Under ultrasound guidance, dilute local anesthetic is injected around the vessel to be ablated until a halo of tumescence is seen along the entire length of the vessel, separating it from its fascial sheath.

- Firm pressure is applied to collapse the vein around the laser fiber, and the laser is fired with settings sufficient to cause irreversible thermal endothelial damage.
- The fiber and catheter are withdrawn approximately 2 mm, and the laser is fired again. This process is repeated along the entire course of the vessel.

Radiofrequency ablation

- RF ablation is a thermal ablation technique that uses a specially developed proprietary RF catheter placed inside the vein to heat the vessel wall and surrounding tissues. This tissue heating causes protein denaturation, collagenous contraction, and immediate closure of the vessel.
- A formal cutdown, simple stab incision with vein exteriorization by hook, or a Seldinger over-the-wire technique is used to place an introducer sheath into the truncal varix to be ablated.
- A special RF ablation catheter is passed through the sheath and along the vein until the active tip is at the SFJ just distal to the subterminal valve. The position of the tip is confirmed by ultrasound.
- Tumescence volumes of local anesthetic are injected in quantities sufficient to separate the vessel from the overlying skin and other delicate tissues along its entire length.
- Metal fingers at the tip of the RF catheter are deployed until they make contact with the vessel endothelium. RF energy is delivered through the metal catheter fingers and passes through the surrounding tissues; tissue heating occurs both in and around the vessel to be treated.
- Thermal sensors record the temperature within the vessel. Energy is delivered until the tissue temperature is just sufficient to ensure endothelial ablation.
- The RF catheter is withdrawn a short distance, and the process is repeated all along the length of the vein to be treated.

Ambulatory phlebectomy

- The stab-avulsion technique (ambulatory phlebectomy) allows removal of short segments of varicose and reticular veins through tiny incisions using special hooks developed for the purpose. This procedure is extremely useful for the treatment of residual clusters after saphenectomy and for removal of nontruncal tributaries when the saphenous vein

is competent.

- With the patient in a standing position, duplex ultrasound is used to map the locations of all refluxing vessels to be removed. The vessel locations are marked on the skin using an indelible marker.
- The leg is prepped and the patient is draped for the procedure.
- A microincision is made over the vessel using a tiny blade or a large needle.
- A phlebectomy hook is introduced into the microincision, and the vein is delivered through the incision.
- Using traction on the vein, as long a segment as possible is pulled out of the body, tearing it loose from its tributaries and other attachments.
- When the vein breaks or cannot be pulled any further, another microincision is made and the process is begun again and repeated along the entire length of the vein to be extracted.
- No ligatures are used in the procedure, and skin closure is not necessary.

Postoperative details: After treatment of large varicose veins by any method, a 30- to 40-mm Hg gradient compression stocking is applied and patients are instructed to maintain or increase their normal activity levels. Most practitioners recommend the use of gradient compression stockings after treatment of spider veins and after treatment of varicose veins. The value of compression stockings in this setting is widely accepted, but unproved.

Activity is particularly important after treatment by any technique because all modalities of treatment for varicose disease have the potential to increase the risk of DVT. Activity is a strong protective factor against venous stasis. Activity is so important that most venous specialists will not treat a patient who is unable to remain active following treatment.

Doppler evaluation is done after 3 weeks to look for any residual reflux which is to be tackled to avoid any late recurrence.

DVT and pulmonary embolism are the most serious potential complications after venous surgery, Sclerotherapy, or endovenous procedures. Strict enforcement of postoperative compression and ambulation are essential, and chemical prophylaxis is indicated for any patient with a prior history of venous thrombosis or with an unmodifiable risk factor.

END NOTE

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