Phlebectomy Techniques for Varicose Veins

Daniel F. Geersen, MPAP, PA-C*, Cynthia E.K. Shortell, MD

KEYWORDS

• Ambulatory phlebectomy • Stab phlebectomy • Microphlebectomy
• Microextraction • Stab avulsion • Removal varicose veins

KEY POINTS

- Ambulatory phlebectomy is the gold standard for removal of symptomatic residual veins after truncal reflux has been treated. This can be staged or performed concomitantly.
- Phlebectomy can be performed in a clinical or operative setting with local tumescent anesthesia to augment dissection and provides adequate pain management and hemostasis.
- Complications of phlebectomy are rare and can be minimized with appropriate risk management and proper patient selection.
- Although ambulatory phlebectomy is well known and the adopted preference of most practitioners, there are other options and new emerging techniques, such as transilluminated powered phlebectomy and cyanoacrylate closure.

HISTORY

Gaius Marius, Roman statesman, general, and 7-time consul, gained an unprecedented control of the Roman Army throughout the Mediterranean. He was passionately respected by his troops, often eating with them and sharing in their labors. He marched with them through the empire, through North Africa, into the Alps, and against the Germanic tribes and the Gauls of northern and western Europe.

His recurrent rise and falls from power were renowned throughout the "modern world." Less famous is his development of severe venous disease as a result of his campaigns and refusal to undergo treatment of his contralateral leg, once completing a phlebectomy without anesthesia. He is quoted as saying that "the cure is not worth the pain."

The description of venous disease and treatment is well documented. In 400 BC, Hippocrates was the first to conceptualize phlebectomy. He described several

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Department of Surgery, Division of Vascular and Endovascular Surgery, Duke University Medical Center, Box: DUMC 3538, Durham, NC 27710, USA
* Corresponding author. Clinic: 10207 Cerny Street, Suite 312, Raleigh, NC 27617.
E-mail address: daniel.geersen@duke.edu

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sequential punctures in the vein could be used to get rid of the "bad blood" that fed a venous ulcer. The *Ebers Papyrus* warned against treating the "Leg Serpents," describing death from presumed hemorrhage and/or infection.

Aulus Cornelius Celsus was the first surgeon to perform a phlebectomy by taking a blunt hook or cautery to destroy the veins and made large incisions with compressive bandages.[1]

Unfortunately, much of his writings were lost or destroyed, and the art of phlebectomy was lost for more than 5000 years until Robert Muller, a dermatology-trained phlebologist from Switzerland, rediscovered it. He was growing frustrated by the poor results of sclerotherapy on larger veins, and he began using small hooks from broken hemostats to remove the veins via small holes.

By 1956, Muller had refined his procedure and presented it to the French Society of Phlebology in 1967 and the International Congress of Phlebology in 1968. These presentations were not well received. He described them as "a total fiasco. Everybody agreed that it was a ridiculous method, after which I could have buried myself together with the invention."[2] It was a slow and steady group of disciples that continued the procedure and adopted it across the world and now the United States as the procedure of choice to remove these veins.[3] Today, these interventions are performed regularly on a growing population of venous disease sufferers.

AMBULATORY PHLEBECTOMY

Ambulatory phlebectomy, stab avulsion/phlebectomy, microphlebectomy, and microextraction are all interchangeable terms to describe this technique. It consists of a method by which the larger varicose veins are removed through small skin punctures and hooks specifically designed for this purpose. It is often performed in the outpatient setting using local anesthetic and tumescent anesthesia.

Tumescent anesthesia was originally developed by Klein[4] in 1987 for liposuction and was adopted by Cohn and colleagues[5] in 1995 to avoid the painful and time-consuming infiltration of local anesthetic and to reduce the risk of lidocaine overdose. This commonly contains saline, epinephrine, and lidocaine.

The authors commonly use the term stab phlebectomy and always use a tumescent anesthesia for these patients, often under general anesthesia.

The goals of therapy are to remove the residual or remaining large refluxing veins of the limb after ligation or ablation of the source of reflux. This provides an effective and economical way to provide complete treatment of the symptomatic residual veins with a good cosmetic result.

PREOPERATIVE ASSESSMENT

Upon evaluation of the patient, a complete history, including previous deep vein thrombosis (DVT), chronic edema, family history of venous insufficiency and venous thromboembolic disease, and surgical interventions, should be collected. Each patient's reflux should be identified with venous duplex, and if unilateral or deep system reflux is noted, consideration of pelvic congestion or May-Thurner should be included.

Patients with poorly controlled diabetes, hypercoagulable state, and arterial disease should be considered higher risk. Patients who are pregnant, have infection, or have severe edema should be delayed until these issues have been resolved.

Lipidermatosclerosis should be noted and quality of the skin assessed for potential wound complications. Discontinuation of anticoagulation, if possible, will reduce bruising and hematoma formation. The novel anticoagulants, such as dabigatran, rivaroxaban, and apixaban, are relatively easy to stop and restart. A period of 24 to 48 hours should be allowed between the last doses and intervention. Low-molecular-weight heparin (LMWH) bridging for warfarin should be considered in patients at high risk, previous cerebrovascular accident from atrial fibrillation, recurrent DVT, or pulmonary embolisms (PEs). The authors recommend patients completing anticoagulation for a full 3 months following a DVT or PE before engaging in a phlebectomy and withholding treatment. Anticoagulation can often be restarted 12 hours postoperativelyl.

TO STAGE OR NOT TO STAGE

There has been debate over concomitant phlebectomy with ligation or ablation, or whether a period of time following ablation of the truncal reflux should be pursued to give the patient an opportunity to avoid the invasive intervention. Monahan[6] has presented data demonstrating 13% of limbs treated by radiofrequency ablation alone had complete resolution, and on average, 34.6% of the veins that did not resolve reduced in size by 6 months. The concern with this in today's market is the need for quicker treatment resolution because insurance carriers are only allowing one treatment per lifetime per limb and limited sessions of sclerotherapy to be completed 6 months from initial ablation.[7] It is recommended to pursue concomitant treatment when the likelihood of complete resolution of the symptomatic varicosities is not likely, given the disease burden and diameter of the veins.

TREATMENT

Ambulatory phlebectomy can be performed in a variety of settings, including clinic, operating room (OR), or other ambulatory setting. It can be completed either alone or in conjunction with other procedures. Although it can be done bilaterally, if blood loss is a concern or patient tolerance of the procedure is in question, staged intervention is recommended.

The patient should have their veins marked in the preoperative area while standing using indelible ink. A nonstaining marker should be used because permanent markers have a risk of tattooing the skin postoperatively. The patient should be involved in the marking to assure all the veins of concern are addressed. Be aware of making sure the markings are not completely washed off with the skin preparation. A near-infrared imaging device or transilluminator can be used intraoperatively because these veins can shift after surgical positioning.[8] Although the authors do not use this device, there is some evidence this can speed up the intervention.[9]

Prophylactic antibiotics should be given, and the skin should be prepared by sterile technique. There have been case studies of necrotic fasciitis and need for extensive debridement and grafting from tumescent anesthetic administration and skin floral contamination.[10] Further thromboprophylaxis should be considered in all patients with a known hypercoagulable condition, or having extensive intervention with ligation, ablation, and stab phlebectomy. There is a paucity of literature on thromboprophylaxis for stab phlebectomy alone, but data for high ligation and stripping of the great saphenous veins (GSVs) show a benefit. Incidence of PE and DVT were higher in groups that did not receive prophylaxis in a study by Wang and colleagues.[11]

Although bleeding complications were higher in the group receiving LMWH, these complications were short lived. Patients should be counseled as to the risks and benefits of anticoagulation, and the authors will often administer prophylactic LMWH postoperatively or prescribe for several days after intervention prophylactic Xa inhibitors if the patient is at higher risk.

INTERVENTION

When the patient is brought to the OR, the patient's positioning should be aligned to best approach the ablation and/or cut down for ligation of the truncal refluxing veins. If not a concern, place the patient in the best positioning for the phlebectomy.

When having to perform both a GSV and a small saphenous vein (SSV) ablation, placing the patient in the supine position and then frog legging the limb to achieve exposure of the SSV can be used.

Choice of anesthesia is by practitioner and patient preference. Providing conscious sedation can be difficult because the patient may be incoherent and the limbs may be more difficult to control. It is suggested tumescent anesthesia always be used for these patients.

It was a dermatologist, J.A. Klein, who first described tumescent anesthesia as a mechanism to create a protective block of the epidermis, dermis, and subcutaneous tissues. The epinephrine causes enough prolonged vasospasm that the rate of systemic absorption of the lidocaine is reduced, permitting greater doses of lidocaine to be administered and prolonged therapeutic times with reduced risk of toxicity.

The pharmacokinetics of tumescent anesthesia results in peak plasma levels at 4 to 14 hours and lingering for up to 24 hours. With locally administered anesthetic, plasma concentrations begin to increase in 15 minutes and metabolization occurs within a few hours.[4,12]

Cohn and colleagues[5] described the use of tumescent anesthesia for phlebectomies in 1995. Infiltrating a dilute anesthesia with a long epidermal needle allows for greater administration of the vein segments and with fewer punctures. In addition, the tumescent helps isolate the vein for dissection and causes compression, leading to less hematoma and postoperative hemosiderin deposition with inflammation. Last, some investigators on the topic have postulated a reduction in infection as a result of the bactericidal properties of lidocaine.[13,14]

Administration of the tumescent can be with 60-cc syringes and long 22- to 25-gauge epidural needles or tumescent pump. The pump will facilitate larger volumes at a greater rate, and it is recommended to not keep the needle and catheter static because intraluminal volumes can be accidently administered quickly.

If the patient is undergoing an ablation or ligation before phlebectomy, it is suggested to perform the intervention in the following order:

1. Cannulate the truncal vein first, because the tumescence can cause significant vasospasm. If choosing to ligate the same vein due to larger diameters greater than 1.3 cm (to avoid windsock effect and recanalization), mobilize the catheter above the point of ligation to assist in the dissection. Pull the catheter distal to the suture before ligating.
2. If no ablation is required, ligate and cut down on the targeted vein or perforator as not to distort the surrounding tissues and obstruct ultrasound-assisted imaging.

3. Close the wound before tumescent administration to avoid loss of tumescence and increase the possibility of endovenous heat-induced thrombosis.
4. Tumesce the surrounding veins and perform ablation and stab phlebectomy. This can be performed simultaneously if 2 operators are present.

EQUIPMENT

The supplies required for the ambulatory phlebectomy in addition to those required for any cut down or ablation should include the following (Fig. 1):

1. Number 11 blade or 18-gauge needle
2. Phlebectomy hooks (practitioner preference)
3. Hemostats
4. 0.5-inch Steri-Strips
5. 60-cc syringe or tumescent pump
6. Fine 22-gauge spinal needle, 5 inch (micropuncture needle can be used if spinal is not available)
7. ABD bandages
8. Kerlix
9. Stretch wraps

PROCEDURE

If possible, place the patient in the Trendelenburg position. This position will assist in hemostasis. Once the tumescent is administered surrounding the previously marked varicosities, a stab incision or puncture should be made (Figs. 2 and 3). They should be made roughly 2 inches apart and oriented horizontally. Orient the stab sites that would favor the practitioner's dominant hand in a pulling fashion. For sites with little subcutaneous tissue, that is, patella or pretibial aspect of the leg, grasp the skin and tissue, allowing it to well, similarly to performing an injection. This should create enough space to cleanly puncture the skin and avoid hitting the osseous structures (Fig. 4).

To dissect the insertion site, the blunt-ended spatula found on some phlebectomy instruments or the hook itself can be inserted to dissect the tissues. Be careful not to

Fig. 1. Setup tray: included is all the necessary equipment for ligation and phlebectomy.

Fig. 2. Injecting tumescent anesthesia.

Fig. 3. Make incisions perpendicular to the vein keeping all horizontal. Place on surgeon's operative side for easy pulling.

Fig. 4. Pinch the tissue over a bony prominence to avoid stabbing other structures.

disrupt the tissues surrounding the thinner subcutaneous spaces and surrounding the superficial peroneal nerve. The saphenous nerve in the calf does closely follow the medial GSV, and the sural nerve likewise follows the SSV; dissection of the calf should be more conservative than in the thigh. The hemostat should not be inserted or used to widen the stab incisions. This can cause increased distortion of the tissues and increased scarring.

Patients should be instructed before intervention that some cutaneous neuropathy may result from this intervention.

Once the hook is inserted, the practitioner should move in a sweeping motion from deep to superficial to grasp the vein. This will be performed blind. The vein, which at times is resistant to pulling up, will come up, most commonly, as a loop. The veins should be grasped with a hemostat and then pulled in a gentle back and forth motion so as to not rip the vein quickly and maximize the length removed. An alternative method is light-assisted stab phlebectomy designed to reduce recurrence from missed veins and assist in quicker identification and removal of these (**Figs. 5** and **6**).[15]

On the other hand, the hemostat can be rotated like one would rotate pasta around a fork. Two hemostats are encouraged to be used with the first anchoring the vein to keep it from reentering the skin and the other to pull (**Figs. 7** and **8**).

It is encouraged to remove as much of the vein as possible to avoid thrombophlebitis afterward. If this is not possible due to the vein shredding when removed, attempt to disrupt the vein with the hook as much as possible. As long as one

Fig. 5. Catching the vein in the phlebectomy hook.

Fig. 6. Anchor the vein with a hemostat.

Fig. 7. Rock the vein back and forth to extract.

Fig. 8. A 2-surgeon team can easily be used in a larger phlebectomy case, reducing operative time.

removes or disrupts as much as possible, the patient should have an excellent result (Fig. 9).

The skin should then be cleaned and Steri-Strips applied. It is recommended to apply ABD dressings to absorb the higher volumes of tumescent and blood that can be seen in these cases postoperatively. Wrap the legs in Kerlix and then stretch bandages.

DISCHARGE

Postoperative hematoma formation is one of the known complications of the procedure and can be quite painful as well as result in pigmentation. Furthermore, patients and their families can be nervous about wound management and postoperative care. For these reasons, the authors are present in the post anesthesia care unit (PACU) to ambulate the patients and rewrap the leg. About 45 minutes postoperatively, the patient ambulates with the provider, and this provides assurance to the patient and their family and gives the provider an opportunity to express any hematoma before thrombosis.

The same type of dressing is reapplied in the PACU as the OR.

Provide the patient with a small amount of narcotic; typically 15 tablets of 5 mg oxycodone or similar medicine can be prescribed. Most patients do well with just acetaminophen and nonsteroidal anti-inflammatory drugs. If anticoagulation is indicated, prescribe and educate the patient on administration. After 2 days of wrapping the leg, a 20- to 30-mm Hg compression garment can be applied. This compression garment should be worn for a minimum of 2 weeks: 24 hours the first week and daily the second week.

The patient should ambulate frequently but elevate the leg at the level of the heart for the first several days. The patient should not push himself or herself, but most can return to work in 3 to 4 days. Follow-up ultrasounds should be scheduled 2 to 3 days postoperatively if ligation or ablation was performed simultaneously. If not, a 1-month follow-up can be scheduled. The Steri-Strips should

Fig. 9. Remove the residual wick to avoid poor skin healing and prevent chronic drainage.

be removed after 10 to 14 days. The patient should monitor for signs of infection and DVT or PE.

COMPLICATIONS

Complications with phlebectomy are rare. Although serious complications like DVT or PE have been documented, these are typically seen in patients who are nonambulatory postoperatively. The most common issue seen by the authors is skin allergy to the compression stocking, Steri-Strip adhesive, or skin preparation. These cases can range from mild to significant blistering and/or aseptic folliculitis. Other common complications include telangiectasial matting, hematoma formation, hemosiderin deposition, cellulitis, and neuropathy.[16,17]

Both Ramelet[16] and Olivencia[17] describe a full complement of outcomes as noted in the tabular material in later text. Ramelet published the complication rates of investigators, ranging from skin blistering being the most common and telangiectatic matting. The reports of blistering ranged from 1.3% to 20%. Sclerotherapy of this matting can be considered, although this typically results in similar formation of the blemishes. Cutaneous laser therapy may be the most appropriate treatment of this frustrating outcome.

Peripheral lymphoceles should be noted especially when forming rapidly and can be controlled with proper compression, although ambulatory drainage may be required. They are most common in the pretibial or popliteal spaces.

Certainly patients who have a predisposition to pigmentation, or matting, will have higher incidence of this and should be educated of this before intervention. Missed veins are less common but can easily be addressed with sclerotherapy afterward. Again, patients who are at risk for hypercoagulable state, that is, hormone replacement therapy, obesity, auto-inflammatory conditions like ulcerative colitis or lupus, and those who smoke or have to travel long distances home should receive prophylactic anticoagulation.[18,19]

Postoperative complications
Cutaneous
Skin blisters
Pigmentation
Scars
Contact dermatitis
Skin necrosis
Vascular
Hematoma
Phlebitis
Matting
Lymphatic pseudocyst
Deep vein thrombosis
Edema
Neurologic
Pain
Paresthesia

TRANSILLUMINATED POWERED PHLEBECTOMY

TriVex is a powered phlebectomy device and property of LeMaitre Vascular. It was developed by Greg Spitz when he used an orthopedic shaver and applied it to the removal of veins. It provides a transillumination and tumescent delivery with a powered phlebectomy system.[20] The concept is that by making 2 incisions, one on either side of the grouping of veins, rather than many incisions, this is quicker and less invasive.[21] The company claims faster intervention, better visualization, and a more complete vein removal.[22] Several studies are cited reporting 99.7% of patients claimed good outcomes and patient satisfaction. There were no recurrences at 3 months, and because of fewer incisions, this resulted in less postoperative pain and improved cosmetic results.[21,23]

Other studies showed no statistical significance in postoperative pain scores, and that in randomized trials there was no difference in cosmetic results.[24,25]

CYANOACRYLATE CLOSURE

VenaSeal is a nontumescent, nonthermal, nonsclerosant procedure that is the property of Medtronic. It uses an injector via a catheter that is placed in the superficial veins of the leg after a local anesthetic is administered. A cyanoacrylate glue is then injected into the veins and followed by ultrasound guidance using a few drops every inch or two. It currently has no procedure code and is not reimbursed by insurance. Patients pay out of pocket.[26]

Two studies, both industry funded, demonstrated that 94.3% and 88.5% of veins treated with VenaSeal glue remained closed after 2 years and 3 years, respectively.[27,28]

Although the market for this technology is for truncal reflux, the accessory veins are also treated commonly with the adhesive. Patients can still experience pain secondary to inflammation, but sites describe that it is unnecessary to use stockings, there is no neuropathy, and patients can resume regular exercise the day of the intervention.[29]

SUMMARY

Although the treatment of accessory veins with ambulatory phlebectomy is changing and new technologies are brought to bear, stab phlebectomy remains the gold standard for care of these patients. It continues to provide a very fulfilling result with excellent results and few complications.

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