

# Surgical management of the swollen lower extremity

Katherine Giuliano MD<sup>1</sup>, Bara Zuhaili MD<sup>2\*</sup>

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This review will summarize the workup, common etiologies, and treatment strategies for a patient presenting with the chief complaint of a swollen

lower extremity in the outpatient clinic or emergency department. It will focus on the surgical management of the various etiologies that can cause a swollen lower extremity.

**Key Words:** Swollen lower extremity; Chronic Venous disease; Lymphedema

## WORK-UP

The evaluation of a patient who presents with a chief complaint of a swollen leg or legs begins with a history and physical examination. History should include determining the chronicity of the swelling (acute versus chronic), any associated symptoms, and assessment of risk factors that could contribute to the various etiologies of a swollen extremity, including

hypercoagulability (i.e. pregnancy, use of hormonal contraceptives, malignancy history, recent surgery or travel, and history of inherited conditions such as antithrombin III deficiency) [1], lymphedema risk factors (including surgical history, malignancy and radiation history, and infectious exposures) [2], and medical comorbidities that could predispose to either systemic edema or chronic venous disease (Table 1).

**TABLE 1: Risk factors to assess during the history when assessing a patient with swelling of the leg(s).**

Hypercoagulability	Lymphedema risk factors	Medical comorbidities
- Malignancy	- Congenital lymphedemas (i.e. Milroy disease, Meige disease)	Risk factors for systemic edema
- Pregnancy	- Malignancy Treatment History, specifically history of surgical lymphadenectomy or Radiation therapy	- Congestive heart failure
- Use of oral contraceptives/hormone replacement therapy	- Prior extremity trauma	- Cirrhosis
- Recent surgery or trauma	- Infectious history, i.e. Filariasis (nematode <i>Wucheria bancrofti</i> )	- Nephrotic syndrome/renal disease
- Immobilization or recent travel		- Medications (i.e. minoxidil, thiazolidinediones, calcium channel blockers, docetaxel)
- Myeloproliferative disorders		Risk factors for chronic venous disease
- Rheumatologic disorders, i.e. lupus, antiphospholipid antibody syndrome		- Advanced age
- Hyperlipidemia		- Family history
- Diabetes Mellitus		- Obesity
- Smoking		- History of trauma
- Obesity		- Prior deep venous thrombosis
- Hereditary Hypercoagulable Conditions (such as Factor V Leiden, Protein C/S deficiencies, Antithrombin III deficiency, Dysfibrinogenemias, Plasminogen deficiency, Hyperhomocysteinemia)		- Pregnancy
		- Findings suggestive of ligamentous laxity (i.e. history of hernia surgery, flat feet)

Examination of the lower extremities should begin with a comparison between the two legs. Acute unilateral swelling with a difference in calf

circumferences is more suggestive of deep venous thrombosis (DVT) [3]. Chronic swelling (either unilateral or bilateral) is more suggestive of chronic

<sup>1</sup>Department of Surgery, Johns Hopkins University School of Medicine, Baltimore, Maryland

<sup>2</sup>Division of Vascular Surgery and Endovascular Therapy, Johns Hopkins School of Medicine, Medical Arts Building, Columbia, USA

\*Correspondence: Bara Zuhaili, Division of Vascular Surgery and Endovascular Therapy, Johns Hopkins School of Medicine, Medical Arts Building, Columbia, USA, Tel: 410 730 1988; E-mail: bzuhail1@jhu.edu

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venous or lymphatic disease, or, if bilateral, symmetric, and accompanied by edema elsewhere in the body, of an underlying medical disorder such as congestive heart failure or nephrotic syndrome. Examination should include assessment of pulses, sensation, and motor function and should also note the presence of pain, warmth, erythema or discoloration, skin changes including lipodermatosclerosis, dilated veins, and/or ulceration.

Laboratory testing should include a D-dimer if there is clinical concern for DVT. The imaging modality of choice for diagnosing DVT is compression ultrasonography [3]. To evaluate for systemic sources of edema, laboratory evaluation should include a pro-NBP to assess for heart failure, urinalysis or urine dipstick for protein, serum creatinine and blood urea nitrogen (BUN) to assess for renal pathology/nephrotic syndrome, serum albumin to assess for hypoalbuminemia driving edema, liver function tests to assess for cirrhosis, and thyroid-stimulating hormone to assess for thyroid disease and resultant myxedema. Chronic venous disease is diagnosed with the demonstration of venous reflux on venous duplex ultrasound, defined as reversed flow greater than 500 ms in superficial and deep calf veins and greater than 1000 ms in femoropopliteal veins [4]. Lymphedema is primarily diagnosed by history and physical exam, but can be confirmed with lymphoscintigraphy in cases of diagnostic uncertainty [2].

### CHRONIC VENOUS DISEASE

If a patient has been diagnosed with chronic venous disease based on symptoms and has failed to improve with conservative measures, there are several surgical management options. Lower extremity veins can be ablated with sclerotherapy, thermal ablation, or surgical excision. Sclerotherapy is the percutaneous injection of a chemical irritant into the offending veins, which causes endothelial damage and resultant sclerosis. It is primarily employed for telangiectasias, reticular veins, and small varicose veins, which can occur in the absence of venous reflux. It can also be used to treat perforator and saphenous venous reflux. Commonly used sclerosing agents include sodium tetradecyl sulfate, polidocanol, and hypertonic saline, and they can be formulated as liquids or foams. A Cochrane review of injection sclerotherapy included seventeen total randomized controlled trials with over 3,300 total patients and supported the use of sclerotherapy for treatment of varicose veins; overall, there were no significant differences in the efficacy of treatment between the different sclerosant agents, the dose, or the formulation [5]. Sclerotherapy treatment results in complete vein occlusion in approximately 87% of cases, with serious morbidity (i.e. pulmonary embolism or DVT) in less than 1% [6]. Other potential side effects and complications of sclerotherapy include visual disturbances, headache, thrombophlebitis, skin discoloration, and pain at the injection site [6].

Thermal ablation obliterates veins by generating heat that denatures proteins in the vein wall. This heat can be generated by light or radiofrequency and can, depending on the vein being treated, be applied directly to the skin or introduced transvenously [7]. In a meta-analysis assessing the outcomes of radiofrequency ablation, endovenous laser therapy, and foam sclerotherapy for treatment of varicosities, radiofrequency ablation was associated with inferior efficacy (lower rates of complete venous occlusion) and higher rates of complication (including phlebitis, DVT, and paresthesias) as compared to the other two modalities [8].

Surgical excision is primarily utilized in cases not amenable to treatment with one of the previously discussed minimally invasive treatment modalities, such as refractory or recurrent disease or varicosities with complication such as hemorrhage. This is because of the results of numerous studies, for instance as summarized by a Cochrane review of all studies that compared surgery versus sclerotherapy for treatment of varicose veins [9]. The authors concluded that there was not enough evidence to preferentially recommend either surgery or sclerotherapy for treatment, but found that sclerotherapy tended to have better outcomes at one year, whereas surgical outcomes were better at five years [9]. In saphenous vein stripping, a small transverse incision is made over the saphenofemoral junction, the great saphenous vein is divided with the proximal end ligated, a vein stripper is passed into the distal great saphenous vein and retrieved via another small incision through the skin, and the stripper is pulled

distally to remove the vein. Phlebectomy utilizes multiple small stab incisions to remove superficial varicosities and reticular veins.

Clinical practice guidelines from the Society for Vascular Surgery (SVS) and the American Venous Forum (AVF) recommend endovascular thermal ablation (rather than surgical stripping) for treatment of an incompetent great saphenous vein, phlebectomy or sclerotherapy for varicose tributaries, and foam sclerotherapy for incompetent saphenous vein.

### LYPHHEDEMA

Surgical therapy for lymphedema is only considered if conservative therapy, including compression dressings and physical therapy, is not effective, and the patient is experiencing significant symptomatology or morbidity. Microsurgical techniques aim to restore lymphatic connections and drainage by creating anastomoses between lymphatics/lymph nodes and veins or intact proximal lymphatics, although this technique is not commonly performed [2]. Other surgical options focus on debulking the excess tissue for symptom control. This can be accomplished with surgical excision of subcutaneous tissue, with or without the overlying skin. There is risk of recurrent lymphedema, as the underlying pathology has not been addressed [2,10]. Additional risks include infection, wound dehiscence, poor wound healing, and scarring [10]. Circumferential liposuction of the limb accomplishes a similar effect with removal of the excess subcutaneous tissue. This is performed with specialized suction-assisted liposuction cannulas adapted to remove the inflammatory adipose tissue associated with lymphedema [2]. The largest experiences with the technique are for upper extremity lymphedema but have shown good results at up to ten years of follow-up, with similar feasibility and good results in the treatment of lower extremity lymphedema [10-12].

### DEEP VENOUS THROMBOEMBOLISM (DVT)

Treatment of DVT is with systemic anticoagulation. Surgical management with thrombectomy is reserved for cases of phlegmasia cerulea dolens (pain, swelling, cyanosis, and edema of the extremity), massive iliofemoral DVT, or patients who fail therapeutic anticoagulation. Catheter-directed thrombolysis is also an option in these patients if the DVT is fresh, as suggested by symptom duration of less than 14 days [13]. Surgical thrombectomy for an iliofemoral DVT begins with a longitudinal inguinal incision for exposure and control of the common femoral vein, followed by a longitudinal venotomy at the level of the saphenofemoral junction. Thrombectomy is then performed with a balloon catheter, and venogram can be performed to confirm removal of all clot. Any identified iliac vein stenosis should be treated. The venotomy can be closed primarily [14].

### MAY-THURNER SYNDROME

In May-Thurner syndrome, the venous drainage of the lower extremity is mechanically compressed, causing symptoms. Most commonly, the left common iliac vein is compressed between the right common iliac artery and the underlying vertebral body. Hence, unilateral left lower extremity swelling is the most common presentation and can often be associated with a DVT in the left iliofemoral venous system [15]. In there is clinical concern for May-Thurner syndrome, diagnosis and treatment is with venography. In addition to visually assessing the caliber of the vein in multiple dimensions, venous pressures can also be measured above and below a suspected lesion [15]. Intravascular ultrasound (IVUS) also appears to have benefit in diagnosing lesions [16]. In patients who present with an acute DVT, treatment is with catheter-directed thrombolysis followed by stent placement [17,18].

Given the overall rarity of May-Thurner syndrome, most of the evidence supporting this recommendation comes from case series. The largest randomized clinical trial, the ATTRACT trial, was not specific to May-Thurner syndrome but included, in the intervention arm, iliac or common femoral vein stent placement in conjunction with catheter-directed thrombolysis for lesions causing 50% or greater narrowing of the diameter of the vein, robust collaterals, or a mean pressure gradient of more than 2

mm Hg. In this trial, patients with acute proximal DVT treated with catheter-directed thrombolysis (and venous stenting where appropriate) did not have lower risk of post-thrombotic syndrome and had higher risk of major bleeding as compared to patients treated with systemic anticoagulation alone.

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