Evaluation and Management of the Fat Leg Syndrome

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Learning Objectives: After studying this article, the participant should be able to: 1. Discuss the initial evaluation of a patient presenting with lower extremity enlargement. 2. Distinguish underlying medical conditions causing lower extremity enlargement, including lymphedema and lipedema. 3. Discuss appropriate management and treatment for patients presenting with these conditions.

Background: Given the epidemic of obesity in the United States, many patients will consult the plastic surgeon with complaints of lower extremity enlargement secondary to "fat legs." In addition to cosmetic disfigurement, some patients may suffer from underlying medical conditions that are responsible for their symptoms. Knowledge of these other causes, including lymphedema and a disorder of abnormal fat deposition known as lipedema, ensures appropriate management and/or surgical treatment for affected patients.

Methods: Initial evaluation for lower extremity enlargement should include a discussion of pertinent medical history and a focused physical examination for findings that might indicate a pathologic underlying cause. When indicated, patients should undergo additional testing, including radiologic studies, to confirm their diagnoses.

Results: For those patients found to have lymphatic dysfunction, conservative management, such as massage therapy, use of compression garments, and limb elevation, should be initially recommended. Excisional or suction-assisted lipectomy may be considered in patients who fail conservative therapy. More extensive consultation with the plastic surgeon is recommended for patients seeking aesthetic improvement in contour and shape of large legs without a specified underlying abnormality.

Conclusions: Patients with lower extremity enlargement may present to the plastic surgeon unsure of the specific cause of their deformity. A broad differential diagnosis exists for their presentation, which can be narrowed by using the common features and unique manifestations of the conditions. (*Plast. Reconstr. Surg.* 119: 9e, 2007.)

Lower extremity swelling can arise secondarily to multiple causes and may be difficult to diagnose accurately (Table 1). Systemic causes, such as congestive heart failure, hypoalbuminemia, kidney failure, protein-wasting nephropathy, and advanced hepatic disease, are usually apparent and recognized. Local causes, including lymphedema, chronic venous disease, lipedema, and deep vein thrombosis, may be more difficult to diagnose.

Particularly challenging is the patient presentation of lower extremity lymphedema and lipedema, and the patient with large limbs secondary to general obesity. The plastic surgeon should be able to distinguish accurately the simple case of fat legs from other clinical entities to ensure appropriate evaluation and treatment for the patient. Misdiagnosed patients may receive inappropriate or inadequate studies and/or treatment, thus exposing them to unnecessary risks and incorrect procedures and resulting in prolongation of symptoms. In this article, the typical presentations, findings, and management of these major causes of lower extremity enlargement are reviewed and an algorithm for diagnostic evaluation is presented.

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INITIAL EVALUATION

Initial evaluation of the patient with lower extremity enlargement should begin with a detailed history of the condition. The course of onset and

Table 1. Causes of Lower Extremity Swelling

Systemic causes
Increased capillary permeability (sepsis)
Congestive heart failure
Renal failure
Hypoalbuminemia
Protein-losing nephropathy
Drug-induced edema
Regional causes
Chronic venous disease
Deep vein thrombosis
Lipedema
Lymphedema
Postoperative edema
Cellulitis
Baker's disease
Cyclical and idiopathic edema
Increased capillary permeability (burns)
Myxedema

the presence of associated symptoms can be quite revealing of the underlying abnormality, particularly when the patient describes an unremarkable development of symptoms consistent with generalized obesity and weight gain. Given the high incidence of obesity (defined as a body mass index > 30) in the United States, the number of patients complaining of lower extremity enlargement that can be attributed to obesity-related changes is not uncommon. Patients may notice a gradual progression in the size of their legs and may be unaware of similar changes in other regions of their body as their weight increases. Patients with pathologic causes, however, will typically describe more dramatic presentations, such as leg swelling accompanied by pain, skin texture changes, or episodes of cellulitis. Any other significant medical history should also be elicited, with particular attention paid to history of malignancy, nodal dissection or other surgical procedures, and history of trauma.

Physical examination should include thorough assessment of any asymmetry between leg volumes, which can be determined by circumferential measurements of the limbs at several points along the limb, including the maximal diameters at the level of the calf, the thigh just superior to the knee, and the thigh-buttock junction. Any edema of the legs or feet should be noted, as should the texture and consistency of the edema when present. Dermal abnormality, such as peau d'orange skin changes, should also be documented.

The need for subsequent diagnostic evaluation is determined by relevant clinical findings. The patient's overall body habitus and the inability on physical examination to localize fatty tissue excess to a specific region should suggest generalized obesity as the cause of their condition. However, particularly in patients who are overweight but not yet obese and in cases where lower extremity enlargement is symptomatic beyond psychological distress, other pathologic conditions may be responsible and further workup is indicated. Lymphedema and lipedema, two related but distinct disorders leading to lower extremity swelling, have unique clinical features and findings on diagnostic testing and should be excluded as possible causes.

LYMPHEDEMA

Lymphedema refers to localized swelling, typically of an extremity, secondary to lymphatic dysfunction. Causes of the condition are typically classified as primary or secondary. Primary lymphedema is further subdivided according to age at onset. Milroy's disease, or congenital hereditary lymphedema, describes lymphedema that is present at birth and is associated with certain genetic endothelial cell receptor mutations.[1,2] Less common are familial lymphedema praecox (Meige's disease), which presents during puberty, and lymphedema tarda, which is the spontaneous onset of lymphedema in early adulthood. Secondary lymphedema is much more common and is typically secondary to malignancy or its treatment in the Western world, although the infectious disease filariasis is overwhelmingly responsible for cases of lymphedema worldwide.[3]

The classic characteristics of lymphedema and its distinction from lipedema are described in Table 2. Patients frequently report a history of prior cancer and subsequent surgical lymphatic disruption or radiation therapy. Swelling is typically unilateral, nonpainful, and may be associated with recurrent episodes of cellulitis. Although early-stage lymphedema may still be soft and pitting, by the time patients are accurately diagnosed and present to the plastic surgeon, the disease has frequently progressed to a state of fibrosis and

Table 2. Clinical Features of Lymphedema and Lipedema

Characteristic	Lymphedema	Lipedema
Sex	Both	Female
Family history	Rare	Common
Cellulitis	Occasional	Rare
Bilateral involvement	Occasional	Common
Foot involvement	Common	Never
Malleolar fat pad	Absent	Present
Nature of swelling	Firm	Soft
Pitting edema	Variable	Rare
Tenderness	Rare	Common

nonpitting edema (Fig. 1). Lower extremity lymphedema can often be diagnosed by the positive Stemmer sign,[4] in which the dorsal skin of the foot cannot be pinched because of the significant fluid accumulation in the subcutaneous tissues.

Although clinical presentation usually suggests lymphedema, the diagnosis is typically confirmed by lymphoscintigraphy (Fig. 2). This technique has largely supplanted the more invasive procedure of lymphangiography as a means of delineating lymphatic vessel function.[5] Computed tomography or magnetic resonance imaging may also be helpful in the initial evaluation if the diagnosis of lymphatic dysfunction is not readily apparent; findings include dermal thickening and fluid accumulation in the subcutaneous fat[6] (Table 3). Magnetic resonance imaging is typically recommended because of its high sensitivity in differentiating clinical causes.[7] On gross examination of excised lymphedema tissue, subcutaneous fibrous stranding is seen. Microscopically, chronic lymph stasis causes increased fibroblast and keratinocyte production, in addition to collagen deposition proliferation. Increased adipocyte deposition is also seen in these patients, which has been attributed to a physiologic response to a chronic inflammatory state.

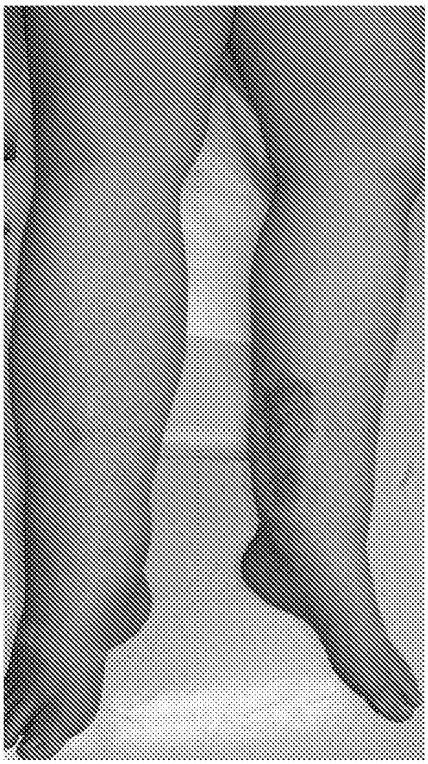

Fig. 1. Bilateral lower extremity lymphedema. The patient is a 40-year-old man who spontaneously developed bilateral lower extremity lymphedema 2 years before presentation. He had no previous history of surgical procedures to the groin or other predisposing risk factors aside from obesity. Conservative therapy with compression garment use and bandaging was recommended.

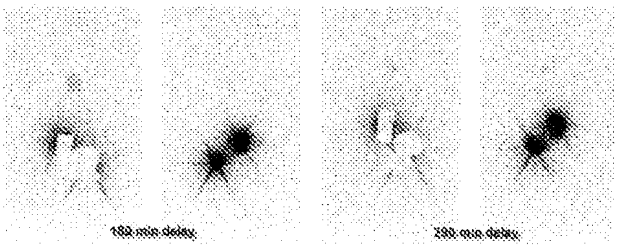

Fig. 2. Abnormal lymphoscintigram in severe bilateral lower extremity lymphedema from the patient described above. After tracer injection into the first dorsal web spaces of the feet, no evidence of lymphatic drainage from the injection sites into the lymph nodes of the lower extremities is seen at either 3 or 5 hours of delay.

Many cases of lymphedema are best managed conservatively, particularly if they are mild or moderate. Compression garments, massage therapy, manual lymphatic drainage, and exercise have all proven effective in case series.[8,9] Serial monitoring through circumferential measurements of the affected limb or the use of newer technologies such as bioimpedance[10] or perimetry can be useful in documenting clinical response to these therapies. Given the prolonged, and in many situations indefinite, course of treatment using conservative therapies, numerous surgical techniques have been developed as a means of "curing" lymphedema. Surgical debulking through skin and subcutaneous excision has been the most popular surgical approach and can provide good long-term benefits.[11] The use of suction-assisted lipectomy with subsequent continuous compression garment use has also been described, with excellent outcomes.[12–14]

LIPEDEMA

Lipedema refers to a syndrome of localized adipose deposition in the buttocks and lower extremities that is seen almost exclusively in women. It was first described by Allen and Hines in 1940,[15] who later characterized the condition as one of "fat legs and edema." In their series on 119 patients diagnosed with lipedema,[16] they reported that the adiposity was seen bilaterally, progressed gradually, and was accentuated by activity and warm weather. Many of their patients complained of significant aching and pain in their lower extremities, particularly below the knee. Although the majority of their patients were overweight, a

Table 3. Diagnostic Findings in Lymphedema and Lipedema

Test	Lymphedema	Lipedema
Lymphangiogram	Abnormal	Normal
Lymphoscintigram	Abnormal with delayed lymphatic flow, subdermal collateralization, dermal backflow	Normal, with mild lymphatic flow delay seen in some patients
CT scan	Calf skin thickening, thickening of the subcutaneous tissues, increased fat density, thickening of the perimuscular aponeurosis, honeycomb appearance caused by fibrous and edematous stranding of fat	Diffuse and homogenous lipomatous hypertrophy of subcutaneous tissue
MRI	Skin thickening, subcutaneous tissue thickening, honeycomb appearance	Normal skin thickness, increased fatty tissue

CT, computed tomographic; MRI, magnetic resonance imaging.

significant number were of normal weight and were found to have disproportionately enlarged lower extremities. In addition, those that were overweight reported no change in lower extremity size with dieting or weight loss.

The typical onset of presentation of signs and symptoms associated with lipedema is during or soon after puberty. A family history of "similar-appearing fat legs" is frequently elicited from the patient.[15,17] Patients describe progressive enlargement of their lower extremities with associated sensations of heaviness and discomfort. They also express significant frustration and embarrassment at the social stigma of the condition and have frequently attempted numerous diuretic, compressive, and dietary therapies to no avail. On physical examination, patients are found to have bilateral enlargement of the legs, thighs, and buttocks (Fig. 3). The skin is soft and the edema is typically nonpitting. The subcutaneous tissue excess begins abruptly above the malleoli, causing a region of sharp demarcation between normal and abnormal tissue at the ankle, leading to a ring-like deformity in contour (Fig. 4). This sparing of the feet is unique to lipedema among the various causes for lower extremity edema[18] and allows the physician to distinguish the condition from lymphedema, as the Stemmer sign will be absent in cases of lipedema (Fig. 5). This dramatic characteristic also allows for distinction between lipedema and obesity-associated large legs, which can be difficult to differentiate when evaluating the rest of the lower extremities (Fig. 6).

The diagnosis of lipedema can usually be made clinically, although patients frequently undergo more extensive radiologic evaluation as part of a workup for lymphedema or vascular disease. The distinguishing radiologic findings seen in patients with lipedema[6,7,19] are described in Table 3. Pathologically, the subcutaneous tissue seen in these patients is soft and lacks the fibrotic elements so frequently seen in patients with lymphedema. Histology reveals no specific abnormalities,[20,21] aside from edematous adipose cells with moderate hyperplasia.[22] One case series also described a high prevalence of microlymphatic aneurysms in affected limbs.[23]

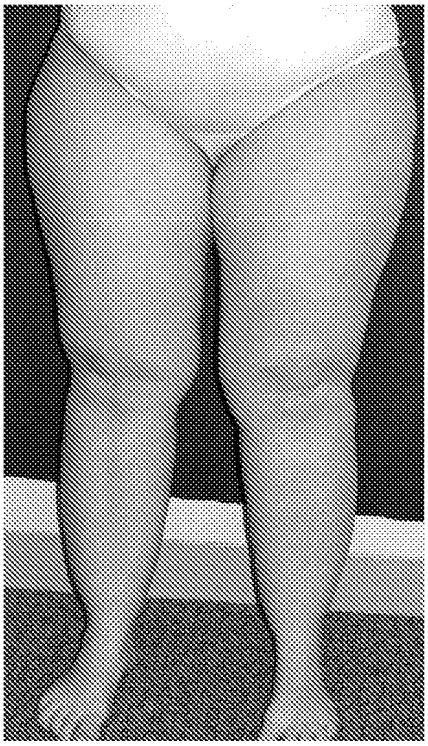

Fig. 3. Lower extremity enlargement consistent with lipedema. The patient is a 66-year-old woman who reported abnormal appearance to her legs and thighs bilaterally since the age of 5 years. She complained of chronic lower extremity pain, fatigue, and easy bruising. She had not worn clothing that exposed her legs throughout her life because of embarrassment at her condition. A prior lymphoscintigram showed normal lymphatic function.

Lipedema is a difficult condition to treat, particularly becasue patients have frequently been misdiagnosed and consequently received prior in-

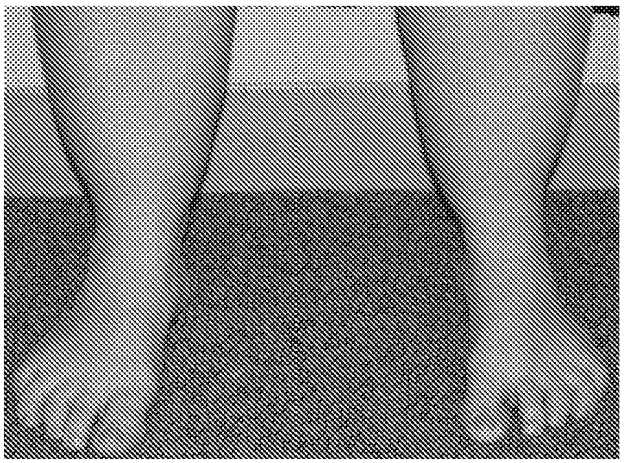

Fig. 4. Contour deformity of the ankle in lipedema. The excess subcutaneous fat seen in the lower leg ceases abruptly at the level of the malleoli, sparing the feet and leading to a ring-like appearance of the ankle.

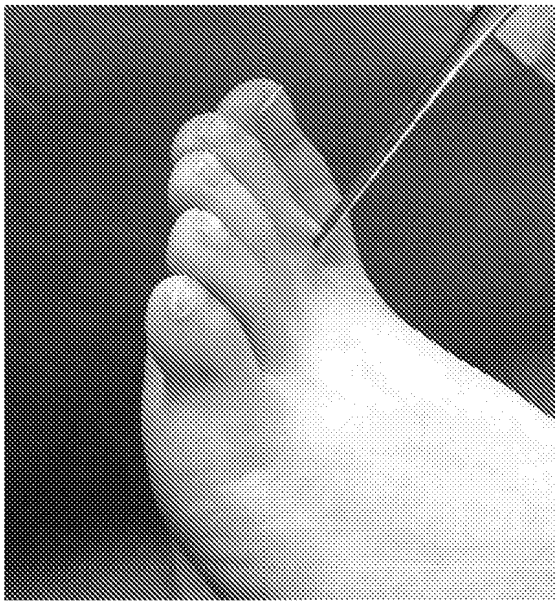

Fig. 5. Negative Stemmer sign in lipedema. The dorsal skin of the foot is easily elevated because of the absence of edema or fibrosis.

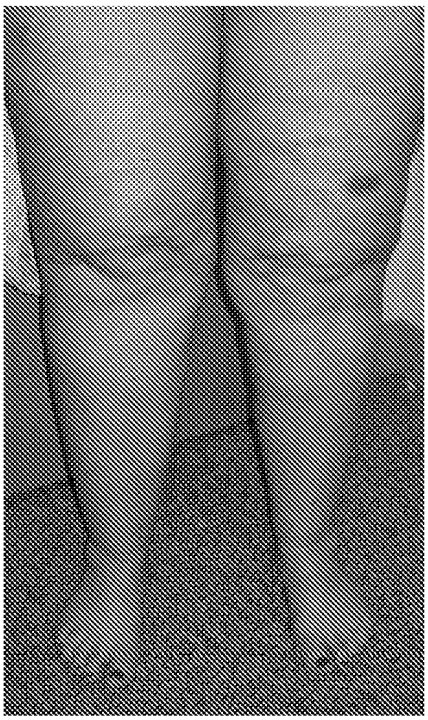

Fig. 6. Large lower extremities secondary to obesity. The patient is a 46-year-old woman who described 5 years of gradual enlargement of her lower extremities. She had a history of two gastric bypass procedures and had subsequently lost 75 pounds, although she was still quite overweight (body mass index of 29.3). A lymphoscintigram was performed to exclude spontaneous onset of lymphedema, which was negative. After further weight loss and plateau, the patient chose to undergo bilateral medial thigh lifts.

appropriate therapy. Although dietary and lifestyle changes may provide some improvement in the subset of obese patients, these efforts are usually ineffective. The use of compression garments has shown some success,[20] although this may be most effective in patients with long-standing lipedema who have developed subsequent secondary lymphedema caused by progressive mechanical insufficiency of the lymphatic system. Surgical therapy has traditionally involved surgical debulking procedures, which have shown varied postoperative outcomes,[17,24] although reports using suction lipectomy have been more promising.[17,25]

MANAGEMENT AND THERAPY

Based on clinical presentation, patients should undergo further evaluation when indicated to determine appropriate management and therapy. Patients who are suspected of having lymphedema should have lymphoscintigraphy testing to confirm lymphatic dysfunction or obstruction. Those with presumed venous abnormality should be referred for vascular surgery. When lipedema or fat legs secondary to obesity are suspected or diagnosed, further discussion with the plastic surgeon can be held to discuss potential surgical management.

When lymphoscintigraphy demonstrates abnormal lymphatic flow, thus confirming a diagnosis of lymphedema, initial conservative therapy involving compression bandaging and garment use should be prescribed. Patients found to have lipedema may be counseled on the use of these compressive tech-

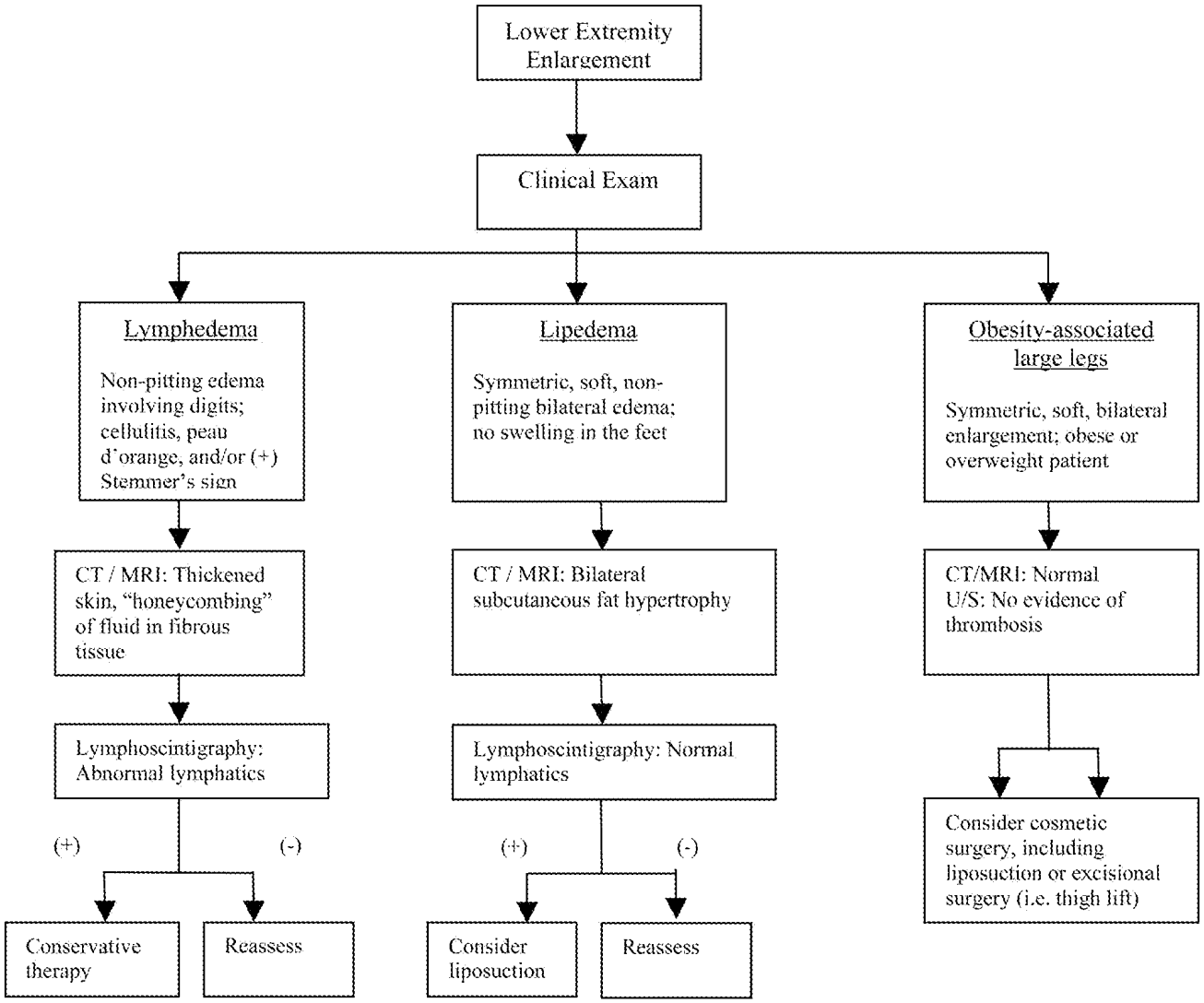

Fig. 7. Algorithm for evaluation and management of lower extremity enlargement.

niques as well, although affected patients should be advised that these therapies will likely not be particularly effective and that surgical treatment through excisional and/or suction-assisted lipectomy may be required for more significant improvement. Those patients with fat legs associated with obesity should be counseled on modifying their lifestyles and be given the option of future cosmetic procedures if they are able to achieve sufficient weight loss to become better surgical candidates, which is typically considered after patients have lowered their body mass index below 30.

CONCLUSIONS

Patients with lower extremity enlargement may present to the plastic surgeon having been given one of many diagnoses that may or may not accurately represent their condition. Using key differences in the clinical presentations of the causes allows for the most effective and efficient management; an algorithm to guide this process in managing lymphedema, lipedema, and obesity-related large lower extremities is presented in Figure 7. Knowledge of the common clinical features of these conditions and their unique radiologic manifestations ensures appropriate management for affected patients and shapes surgical decision-making and planning.

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DISCLOSURES

None of the authors has a financial interest in any of the products, devices, or drugs mentioned in this article.

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