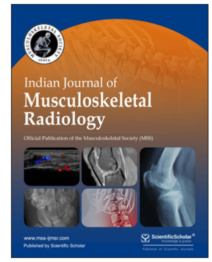
www.mss-ijmsr.com

Indian Journal of Musculoskeletal Radiology



Pictorial Review

Imaging of the Unilateral Swollen Painful Lower Leg: Deep Vein Thrombosis Mimics

K. Paramesparan[1], Aamer Iqbal[2], Amit Shah[1], Rajesh Botchu[2]

[1]Department of Radiology, University Hospitals of Leicester, Leicester, Leicestershire, [2]Department of Musculoskeletal Radiology, Royal Orthopedic Hospital, Birmingham, West Midlands, England.

***Corresponding author:**
Dr. Rajesh Botchu,
Department of Musculoskeletal Radiology, The Royal Orthopedic Hospital Bristol Road South Northfield, Birmingham, UK.

drbrajesh@yahoo.com

Received : 30 July 19
Accepted : 05 August 19
Published : 18 August 19

DOI
10.25259/IJMSR_15_2019

Quick Response Code:

ABSTRACT

The presentation of unilateral leg swelling is commonly encountered clinical practice, with deep vein thrombosis (DVT) often raised as the main diagnosis. Not infrequently, and at times unexpectedly, a different pathology can be encountered. It is important to be aware of other causes of the unilateral swollen leg to avoid unnecessary anticoagulation and potential missed diagnosis. This article provides a systematic approach, with a review of the imaging characteristics, of the most common etiologies that can cause unilateral leg swelling mimicking a DVT.

Keywords: Deep vein thrombosis, mimics, swollen leg

INTRODUCTION

A non-traumatic unilateral painful swollen leg is a common presentation in clinical practice and deep vein thrombosis (DVT) must be excluded.[1] However, up to 75% of clinically suspected cases of DVT often have alternative diagnoses.[2] Using a diagnostic sieve, these “DVT mimics” will be discussed as musculoskeletal, infective, vascular, and neoplastic causes [Figure 1].

DEEP VEIN THROMBOSIS

Lower limb DVT has an estimated incidence in the general population of 5 cases per 10,000 with the incidence increasing in advancing age.[3] If a DVT is left untreated, clot propagation leading to pulmonary embolism can occur in up to 60% of patients with an associated mortality of 30%.[4] Acute thromboses result in distended veins, which are substantially larger than the accompanying artery. Doppler imaging demonstrates an echogenic thrombus within a non-compressible vein. Doppler imaging should be performed to confirm venous obstruction [Figure 2].

MUSCULOSKELETAL

Baker’s cyst

Synovial cysts and popliteal cysts, also known as Baker’s cysts, are commonly encountered non-vascular popliteal masses identified on the ultrasound (US) and magnetic resonance imaging (MRI). In the adult population, they are often associated with knee joint pathology, posterior knee pain, knee stiffness, and popliteal fossa swelling. Patients usually present with fullness in the

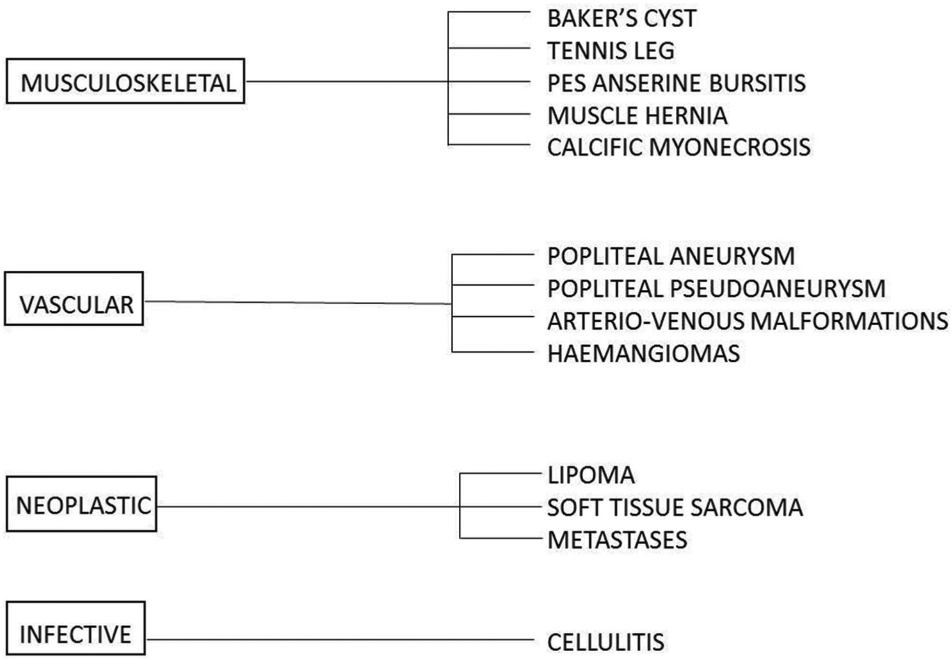


Figure 1: Diagnostic sieve of "deep vein thrombosis mimics."

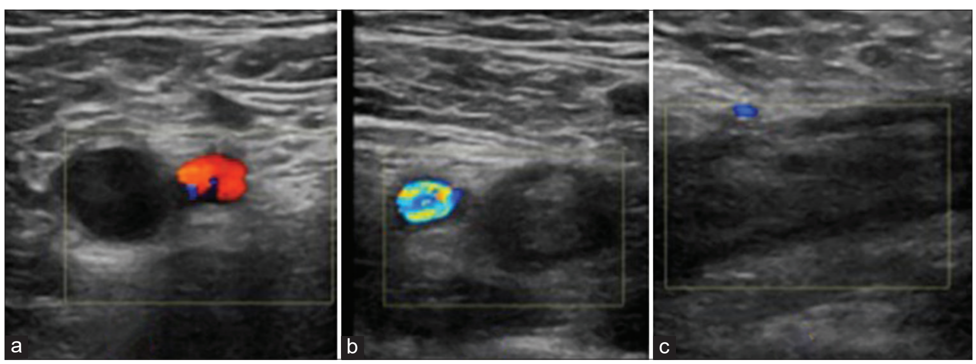


Figure 2: Color Doppler ultrasound of the right (a) and left (b and c) common femoral vein (CFV). A = Transverse view of the normal compressible right CFV with no filling defect. B = Abnormal left CFV with echogenic thrombus in the CFV which is non-compressible and no color flow. C = Longitudinal view of the echogenic thrombus occupying the CFV in keeping with a deep vein thrombosis.

popliteal fossa which can mimic the symptoms of a DVT. The prevalence rates of these cysts have been reported to range up to 49% on US when performing a DVT scan of the lower extremity.[5] Of particular importance is that dual pathology of both a baker's cyst and DVT has been reported in up to 3% of cases as a result of enlargement and compression.[6] Classically, Baker's cysts are described as fluid-filled cystic lesions that do not contain a true synovial lining.[7] The cyst contains synovial fluid, which is typically gelatinous in consistency. They are located posteriorly the knee as a fluid filled sac with a neck arising from the interspace between the medial head of gastrocnemius muscle and the semimembranosus tendon. Underlying complications or arthropathy in the knee can affect the morphology of the Baker's cyst and can mimic a more aggressive lesion. Fluid tracking down the intramuscular fat planes indicates recent leakage. US is good at delineating a fluid-filled popliteal mass with posterior acoustic enhancement. In some instances, an intrinsic anechoic speckling is demonstrated. US can demonstrate a neck arising from the medial head of gastrocnemius-semimembranosus tendon interspace. This has a "talk bubble" configuration [Figure 3] in the transverse plane. There is a lack of Doppler flow unless an infective or inflammatory process has occurred [Figure 4]. When Doppler flow is present, or there are solid components, further imaging with MRI is usually indicated. Features typically demonstrate a high T2-weighted (T2W) signal intensity (SI) mass in the gastrocnemius/semimembranosus

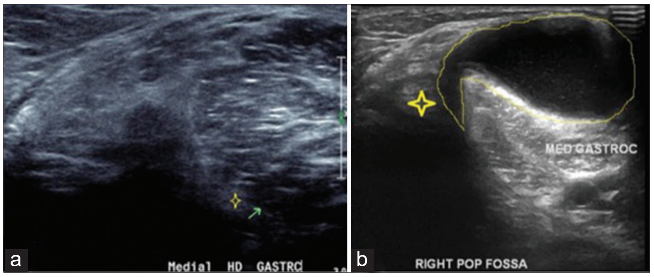


Figure 3: Transverse ultrasound image of the right popliteal fossa demonstrating a Baker's cyst. Image (a) depicts a normal popliteal fossa with the medial head gastrocnemius marked by the green arrow and the adjacent semimembranosus tendon (yellow star). Image (b) demonstrates a cystic structure arising between the medial head gastrocnemius and semimembranosus tendon (yellow star) in a characteristic "talk bubble" configuration (yellow outline).

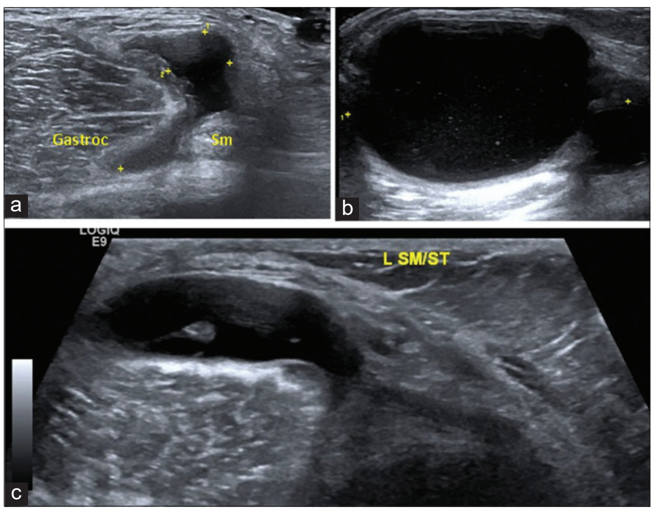


Figure 4: Transverse ultrasound of the left popliteal fossa in three different patients (a-c) demonstrating a fluid-filled structure arising between the heads of the medial head gastrocnemius (gastroc) and the semimembranosus (Sm) tendon in keeping with a Baker's cyst. ST (Semitendinosus).

bursa. T2-W hyperintense fluid within the intermuscular fat planes in addition to a Baker's cyst indicates rupture with leakage [Figure 5]. Complicated Baker's cysts may demonstrate wall thickening, hemorrhage, loose bodies, and intracystic debris which make diagnosis difficult and tend to be misinterpreted for a sinister lesion. The presence of a beak-like extension between the medial gastrocnemius head and semimembranosus tendon is a key feature in distinguishing a Baker's cyst from a DVT. A ruptured Baker's cyst with extension in the posterolateral direction [Figure 6] is a benign entity and can ultimately lead to a clinical picture identical to that of a DVT. For simple cysts, approximately two-thirds of patients benefit from treatment through image-guided aspiration and injection of steroid.[8]

Tennis leg

Tennis leg is caused by an isolated rupture of the medial head of the gastrocnemius muscle, usually at its distal musculotendinous junction. Tears in this muscle and its tendon are also included under the term "tennis leg."[9] Of note, a secondary DVT can occur as a complication. Tennis leg commonly occurs in the fourth to sixth decades of life, occurring more frequently in male athletes with poorly conditioned muscles.[10] US demonstrates fluid tracking deep to the medial gastrocnemius and superficial to the soleus muscles, most prominent at the level of the myotendinous junction [Figure 7]. Disruption of the normal pennate pattern of the medial gastrocnemius muscle near its interface with the soleus and plantaris muscles may be present. An anechoic effusion frequently represents a hematoma, and US findings can vary depending on the time of the scan and the severity of the muscle rupture. The injury can be graded from a sprain (Grade I) to complete muscular rupture (Grade III). MRI fluid sensitive sequences demonstrate high signal deep to the medial gastrocnemius and superficial to the soleus muscles [Figure 8]. A focal area of muscular disruption along

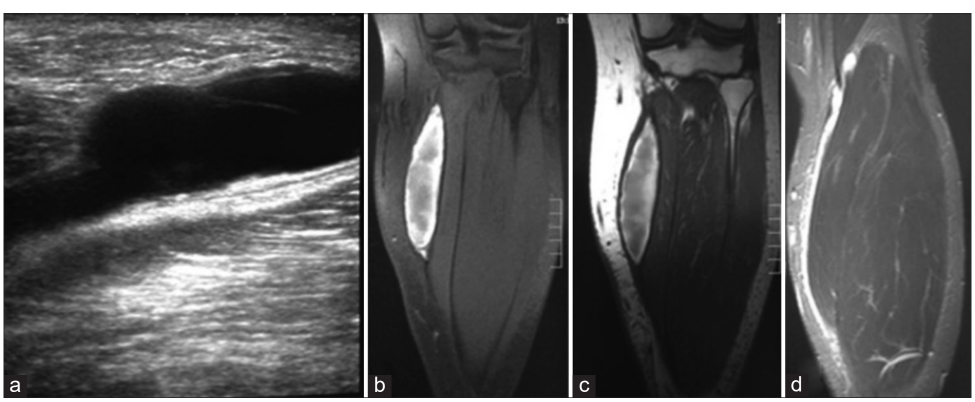


Figure 5: (a) Longitudinal ultrasound image, (b) coronal T1 fat-saturated magnetic resonance (MR), (c) coronal T2 MR and (d) coronal short tau inversion recovery MR demonstrating a ruptured Baker's cyst. Fluid is seen tracking around the medial border of the medial head gastrocnemius.

the deep aspect of the medial head of the gastrocnemius, with associated edema of the muscle, is usually noted. It is critical to distinguish tennis leg from DVT, as treatment with anticoagulation is capable of increasing the hemorrhage within the affected medial gastrocnemius muscle and inevitably results in an adverse outcome for the patient.[11] Leg elevation, compression, and non-steroidal pain relief are advised as initial first-line treatment. Interval US scanning can be used to review the healing process.

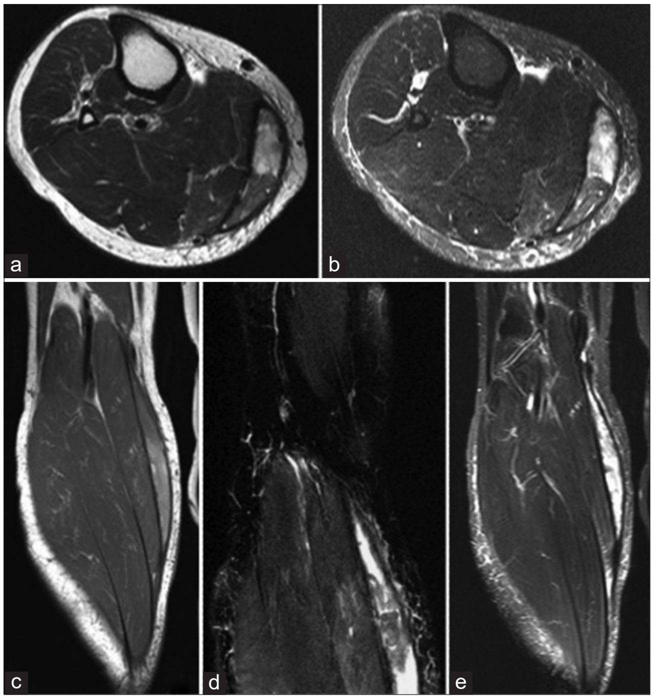


Figure 6: Axial T1 (a) and short tau inversion recovery (STIR) (b) magnetic resonance imaging (MRI) with coronal T1 (c) and STIR (d and e). The patient in Figure 12 underwent a subsequent MRI after clinical review, which confirmed a thick-walled mixed high and low signal intensity collection medial to the medial head gastrocnemius in keeping with a ruptured Baker's cyst with internal hematoma.

Pes anserine bursitis

The combined insertion of the Sartorius, gracilis, and semitendinosus tendons as they pass around the posteromedial aspect of the proximal tibia is referred to as the pes anserine, reminiscent of a "goose's webbed foot." The pes anserine bursa lies between the trio of these tendons and the deeply located semimembranosus tendon at the level of the knee joint. It is one of 13 bursae observed around the knee and does not communicate with the joint itself. Repetitive motion results in friction between the medial tibial condyle and pes anserine tendons, thus developing bursal inflammation and a painful swollen knee. Anserine bursitis is more common in overweight females with OA of the knees.[12] Typical symptoms include swelling and tenderness in the medial aspect of the knee with pain on palpation in the anatomical site of pes anserine insertion. US findings can vary, but most cases demonstrate a well-defined anechoic fluid collection with posterior acoustic enhancement deep to the pes anserine tendons below the medial knee joint. MRI can show a lobular fluid signal mass with well-defined thinly marginated borders between the tendons of the pes anserine and proximal medial tibia [Figure 9]. There may be associated tenosynovitis of the tendons of the pes which are distinctly demonstrated on axial MRI.

Muscle hernia

A muscle hernia is a focal protrusion of muscle or part of muscle through its investing fascia. The most common

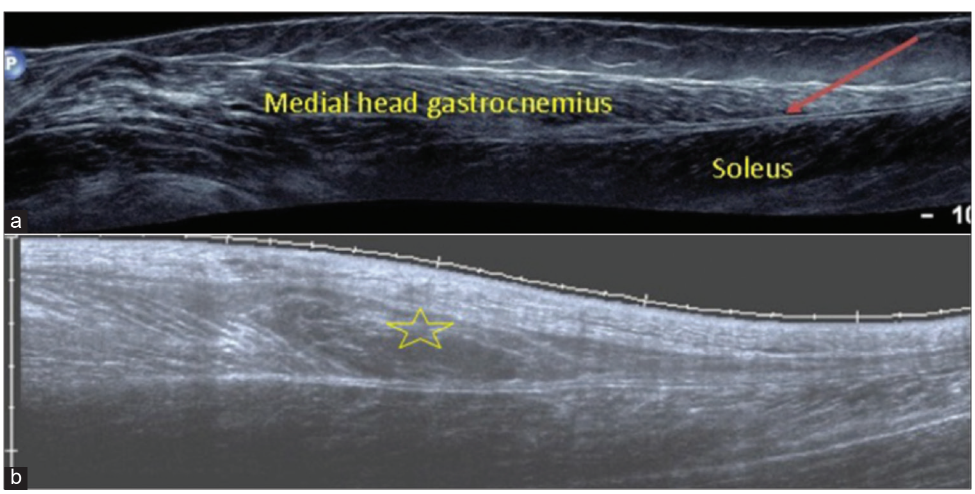


Figure 7: Panoramic ultrasound images of the triceps surae. Top image (a) demonstrates normal musculature with the medial head gastrocnemius seen superficial to the deeper soleus muscle. A thin double echogenic line between the two is the plantaris muscle (red arrow). The bottom image (b) demonstrates an irregular hypoechoic area (yellow star) in the medial head gastrocnemius at the myotendinous junction represent muscle injury and hematoma in keeping with a tennis leg.

location is the lower limbs, in particular, the tibialis anterior muscle. The sudden forced contraction causes herniation of the muscle through a myofascial defect. The muscular herniation can be potentiated by sporting activities, increased intra-compartmental pressures, patients with a history of muscular hypertrophy, or chronic exertional compartment syndrome.[13] The hernia can also occur at the site of perforating vessels and nerves, particularly in patients with congenital weakness in the muscular fascia.[14] Muscle hernias, while rarely encountered, are actually considered to be quite common. Patients often present with a soft tissue mass or swelling with tenderness, features similar to that of a DVT. One can often identify a patent accompanying vessel, which helps with the diagnosis. Imaging features on both US and MRI usually demonstrate a focal defect

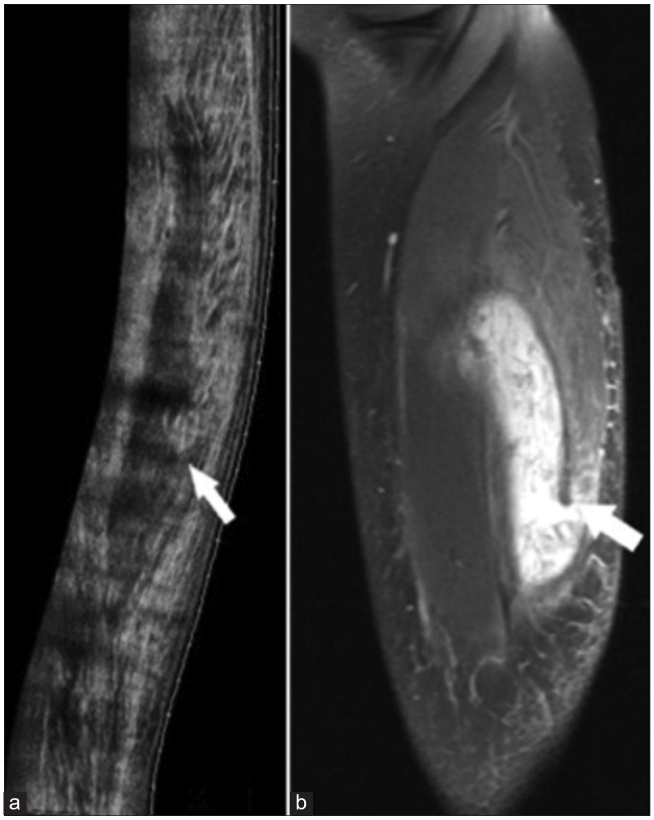


Figure 8: (a) longitudinal panoramic view of the medial gastrocnemius muscle demonstrating a muscle tear at its myotendinous junction (arrow) in keeping with a tennis leg corresponding short tau inversion recovery (STIR) MR sagittal (b).

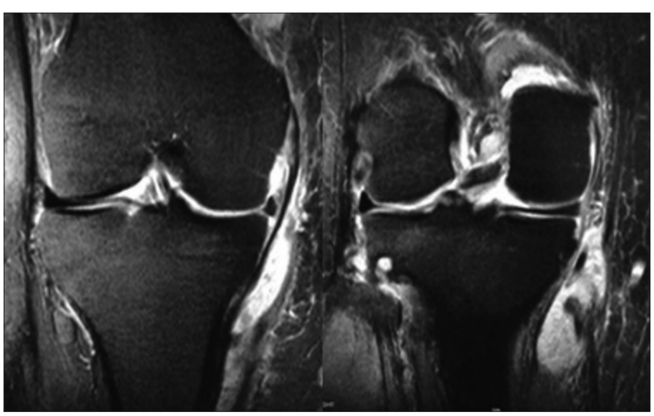


Figure 9: Coronal short tau inversion recovery magnetic resonance images of the knee demonstrate a fluid collection with surrounding edema (white arrow) just deep to the pes anserine and superficial to the medial collateral ligament in keeping with pes anserine bursitis.

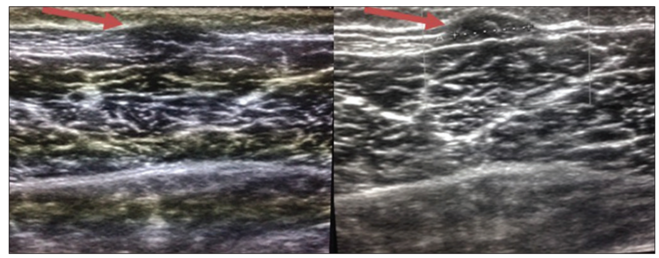


Figure 10: Longitudinal ultrasound image of the anterior tibialis muscle demonstrating focal protrusion of muscle through a fascial defect (red arrow), which is more conspicuous on the second image with muscle contraction.

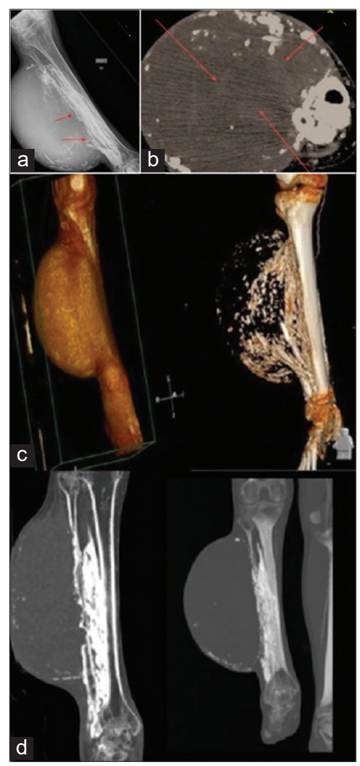


Figure 11: (a) Plain film of the lower leg with the erosion of the fibula with a large soft tissue lesion. (b) Axial computed tomography with peripherally calcified soft tissue mass with intralesional high density (arrows). (c) 3D reconstructions. (d) 3D reconstruction demonstrating numerous collaterals around the soft tissue lesion.

in the investing fascia with or without muscle protrusion [Figure 10]. The muscle herniation can be an intermittent or constant process and a mushroom-like an appearance where the herniated muscle overlaps the fascial defect is key to the diagnosis. On MRI can often be normal as the patient is in the supine non-contracted position. The majority of muscle hernias requires no treatment or is conservatively treated by tight stockings. In a select few patients, particularly athletes necessitate a surgical intervention.[15] Closure of the fascial defect may result in compartment syndrome and is best avoided.

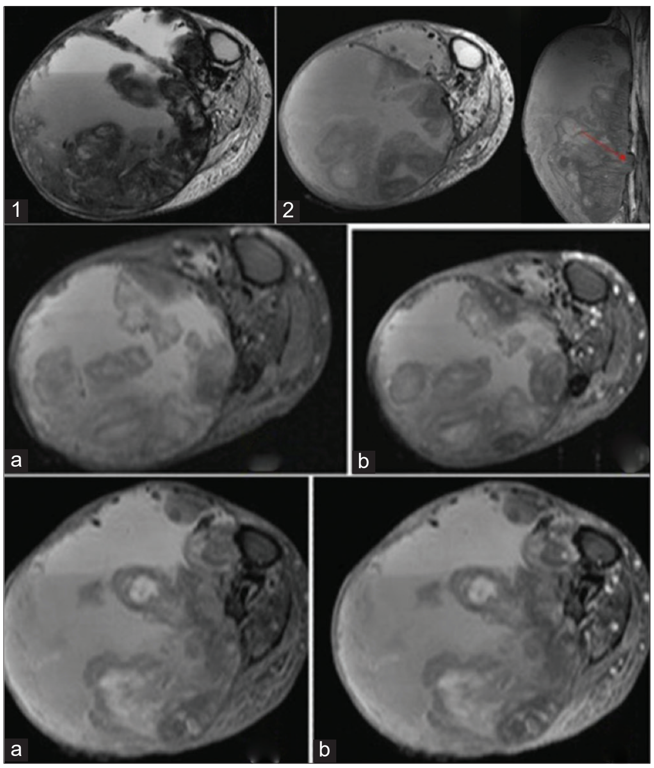


Figure 12: (1) Axial T2 magnetic resonance with fluid-fluid levels and frond-like low signal areas. (2) Axial T1 with hyper and hypointensities within the lesion. Fibula erosion demonstrated (red arrow). (a) Pre-contrast images. (b) post-contrast images.

Calcific myonecrosis

This is a rare soft tissue disorder, which can mimic the symptoms and presentation of a DVT. Although the exact pathophysiology is unknown, the condition is stipulated to arise secondary to compartment syndrome or post-trauma related necrosis and fibrosis.[16] This subsequently results in repeated intralesional hemorrhage with calcification and mass formation. The mass, although rare, is more often found in the lower limbs and as with other space-occupying mass lesions can cause disease expansive compressive venous effect to mimic the symptoms of a DVT. The typical presentation is the occurrence of a fusiform mass one of the lower leg compartments after a long time after a traumatic event. The compartmental compression elevates the local blood flow and is favorable conditions for disease enlargement.[17]

Initial US of the swelling may demonstrate a mass with hypoechoic areas casting an acoustic shadow (depicting calcification) and a heterogeneous echogenic lesion with both necrotic and soft tissue components. Increased Doppler neo-vascularity may also be demonstrated. The characteristic key appearances are on plain radiograph and cross-sectional computed tomography/MRI [Figure 11]. Fusiform masses with sheet-like calcification and pressure erosions are some of the features that can steer diagnosis toward calcific myonecrosis [Figure 12].

Biopsy should be completely avoided secondary to the high complication risk and likely conversion of necrotic tissue into an abscess. Surgical excision with flap reconstruction can be considered as curative management for those patients that are symptomatic.

VASCULAR

Popliteal aneurysm

True aneurysms of the popliteal artery are common accounting for 70% of all peripheral aneurysms. These aneurysms are produced secondary to focal enlargement

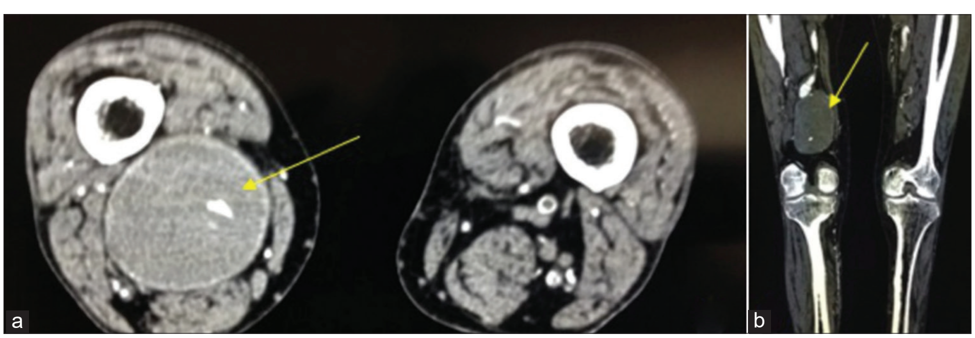


Figure 13: Computed tomography axial (a) and coronal reformat (b) demonstrating a right popliteal aneurysm (yellow arrow) which is completely occluded with thrombus.

of the vascular lumen due to intrinsic abnormalities of the arterial wall. A luminal diameter of >7 mm is the advised standard used to define an aneurysmal popliteal artery.[18] Both aneurysms and pseudoaneurysms may mimic DVT due to the compression of the adjacent nerves and soft tissues. US and arterial phase multidetector CT will demonstrate enlargement of the popliteal artery lumen [Figure 13]. MRI has the added benefit of demonstrating hyperintense thrombus on T1-weighted imaging within the aneurysmal sac with differing layers of blood products [Figure 14].

Popliteal pseudoaneurysms

Popliteal artery pseudoaneurysm is much rare in comparison accounting for 3.5% of all popliteal aneurysms.[19] They are formed by disruption of arterial wall integrity resulting in a contained leakage of blood into the adjacent soft tissues. There is a persistent communication between the artery and the pseudoaneurysm cavity. Pseudoaneurysm development has multiple causes and is usually sequelae of penetrating trauma. Other causes include local infection, pathology related to bone tumors or iatrogenic etiology, for example, endovascular intervention or secondary to orthopedic

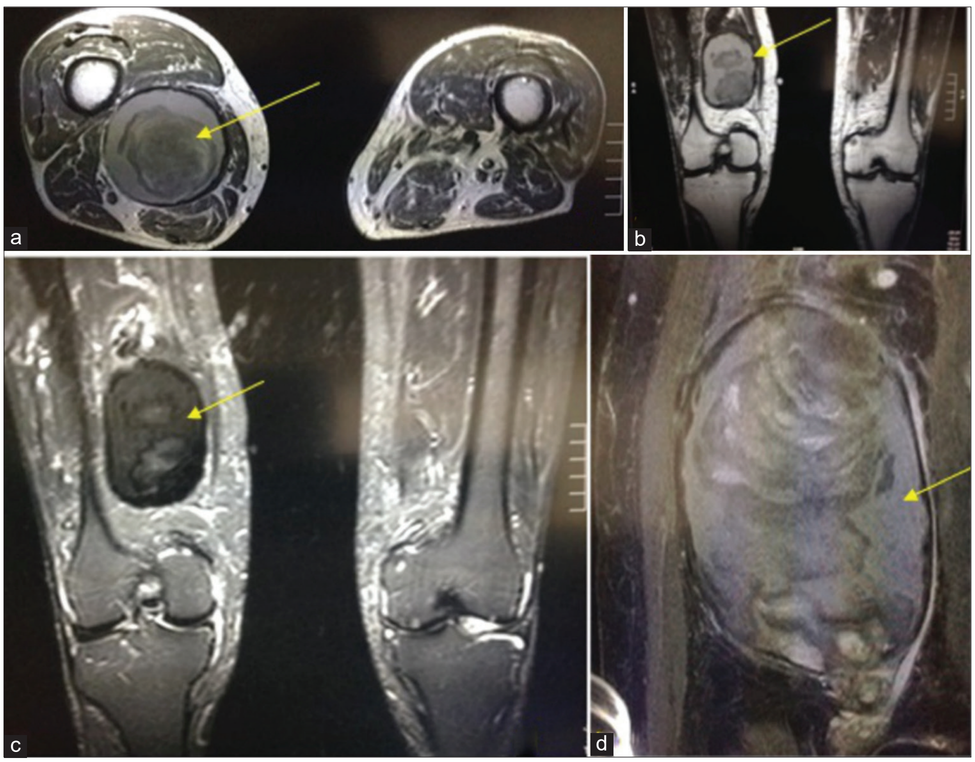


Figure 14: Magnetic resonance axial (a) and coronal T1 (b), coronal short tau inversion recovery (STIR) (c) demonstrating an occluded right popliteal artery which contains hyperintense T1 mural thrombus with central low signal material in keeping with chronic blood products. Image (d) is a STIR coronal image demonstrates layers of differing blood products within the aneurysm.

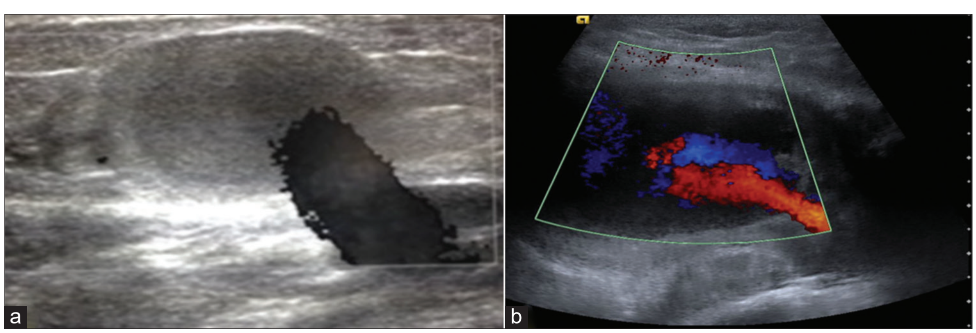


Figure 15: Transverse ultrasound image (a) of the popliteal artery demonstrating a jet of blood flowing into a thrombosed pseudoaneurysm secondary to trauma. (b) Ultrasound demonstrating the turbulent forward and backward flow where a characteristic Ying-Yang sign may be seen on color flow Doppler.

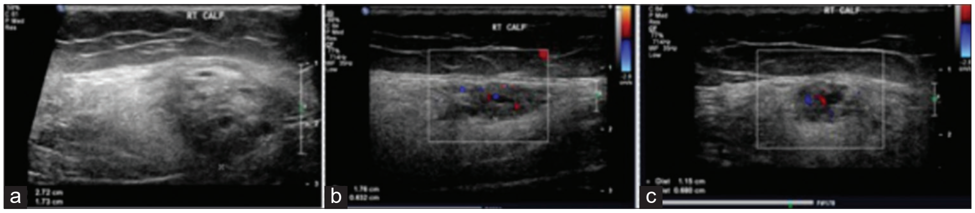


Figure 16: Ultrasound images demonstrating a heterogeneous intramuscular mass with cystic areas (a). There is hypervascularity on color Doppler imaging (b). Appearances are in keeping with a vascular lesion (c).

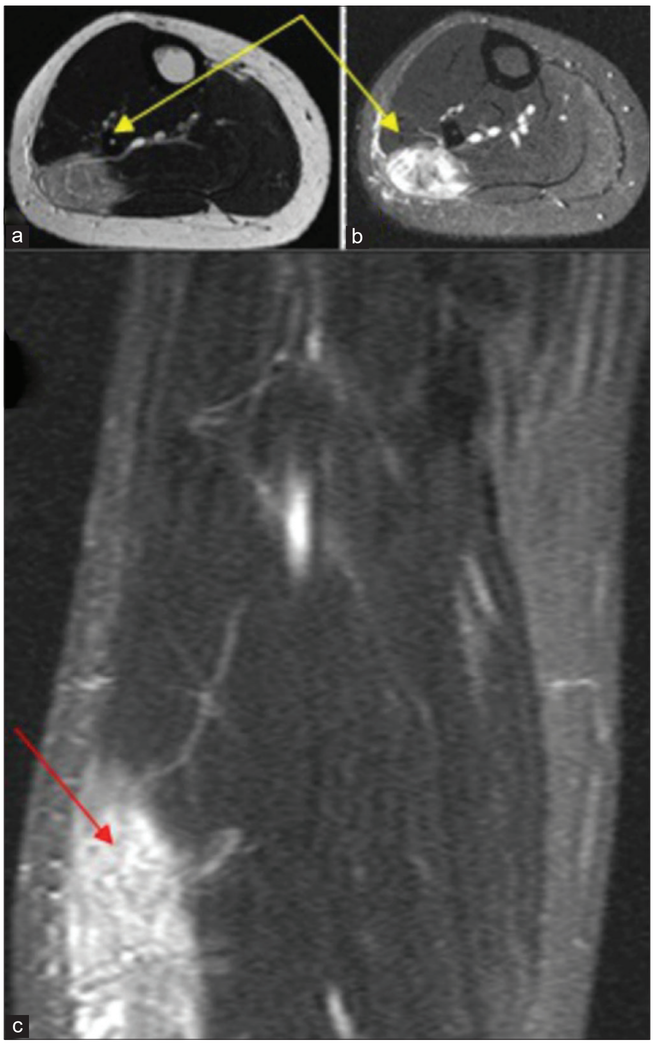


Figure 17: Axial T2 (a) and short tau inversion recovery (STIR) (b) and coronal STIR (c) magnetic resonance images demonstrating a hyperintense T2 lesion (colored arrows) in the lateral aspect of the soleus muscle with prominent "feeder" arteries.

surgery. The clinical examination usually reveals a diameter difference between the two lower limb extremities with a pulsatile mass on the affected leg. US demonstrates a fusiform or saccular arterial enlargement, often with laminar thrombus within it [Figure 15]. Doppler vascularity is functional in identifying a mixed biphasic signal described as the "ying-yang" sign [Figure 16] within the pseudoaneurysm sac. A communicating tract and neck are identified as an underlying artery.

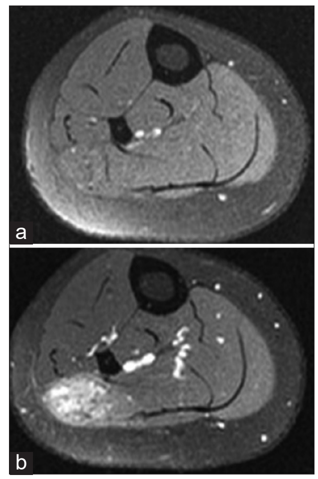


Figure 18: Pre (a) and post (b) contrast axial T1 fat-saturated axial Magnetic resonance images. This demonstrates the lateral soleus intramuscular arteriovenous malformations with intense enhancement after the administration of IV gadolinium.

Arteriovenous malformations

Arteriovenous malformations (AVMs) are congenital and represent a wide range of lesions usually confined to the muscles and subcutaneous tissues. Clinical history and examination can often underestimate the size and nature of these lesions, and imaging plays a crucial role in characterization for appropriate treatment of these lesions. Classification is historically based on the flow characteristics of vascular malformations with separation into low flow or high flow lesions.[20] AVMs are composed of a feeding artery and a draining vein with a nidus of multiple dysplastic vascular channels. US demonstrates a hypoechoic serpiginous compressible vascular mass [Figure 16]. On MRI and AVM are high T2W SI masses with channels of the signal void with post-contrast enhancement [Figures 17 and 18]. High signal on T2 imaging in the muscles suggests atrophy. Gradient echo sequences demonstrate "blooming" artifact in the presence of calcification, phleboliths, scarring, and deposition of hemosiderin.

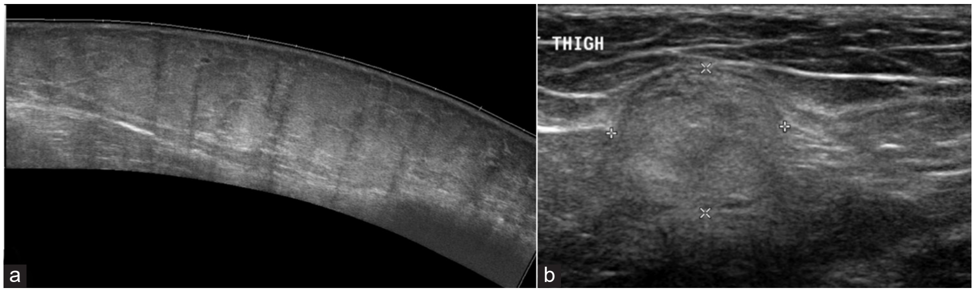


Figure 19: (a) Panaromic image of the lower leg demonstrating a superficial subcutaneous fatty lesion, which is isoechoic to the surrounding, fat and is compressible. No aggressive imaging features demonstrated in keeping with a superficial lipoma. (b) Transverse ultrasound image of an intramuscular lesion which is echogenic typical for an intramuscular lipoma. Due to its location, an magnetic resonance imaging should be performed to characterize it.

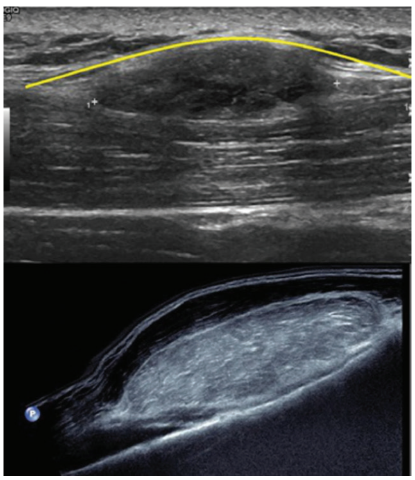


Figure 20: Top image: Sagittal ultrasound image of the lower leg demonstrating a hypoechoic lesion, which is deep to the deep fascia (yellow curvilinear line). The patient went on to have a subsequent magnetic resonance (MR), and the lesion followed fat signal on all sequence in keeping with a deep lipoma. Bottom image: A large hyperechoic lesion deep to the muscle abutting the underlying fibula in keeping with a deep lipoma (proven on MR – images not shown).

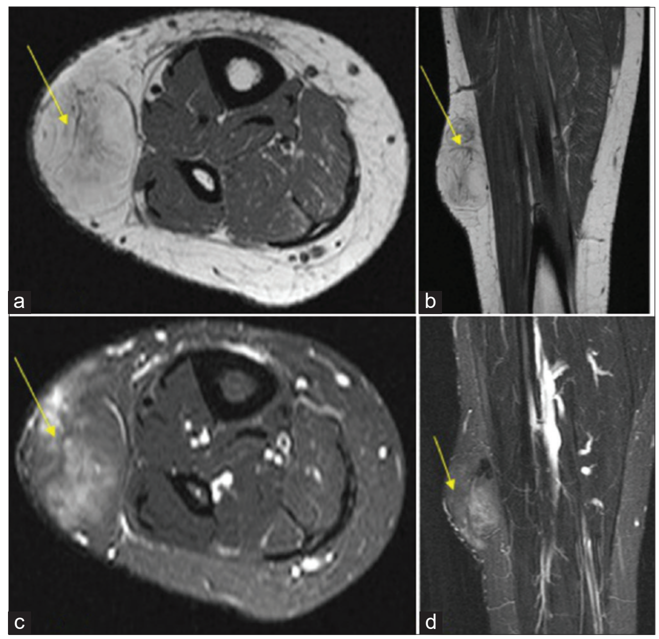


Figure 21: Axial T1 (a), coronal T1 (b), short tau inversion recovery (STIR) axial (c), and STIR coronal (d) magnetic resonance images of the lower leg demonstrating a subcutaneous fat signal lesion with incomplete suppression. Excision biopsy confirmed a liposarcoma.

Hemangioma

Hemangiomas are benign vascular tumors, which develop during infancy and childhood. The lesion consists of cellular hyperplasia with rapid proliferation in its early stages of development, later followed by involutional changes. On examination, a soft tissue hemangioma may represent a compressible mass causing limb swelling with bluish discolorations of the skin. Deeper hemangiomas can occupy adjacent tissues and even scallop or destruct bone. US usually demonstrates a well-defined homogeneously echogenic mass. The lesion is hypervascular on color Doppler imaging and demonstrates both arterial and venous waveforms. On MRI, T1W imaging demonstrates a fatty mass with intralesional signal voids in keeping with vascular channels. Hemangiomas are iso to hypointense relative to skeletal muscles with foci of the high signal corresponding to adipose tissue or slow-flowing blood. Both short tau inversion recovery and fat-suppressed T2-W imaging demonstrate hyperintense vascular regions within the lesion.

NEOPLASTIC

Lipoma

A lipoma is classified as fat-containing benign, encapsulated soft tissue tumor representing nearly 50% of soft tissue masses. They are the most common mass noted in the subcutaneous tissues and typically originate at deeper sites where adipose tissues are present.

The majority of lipomas that are discovered are asymptomatic and however are known to cause symptomatic venous flow

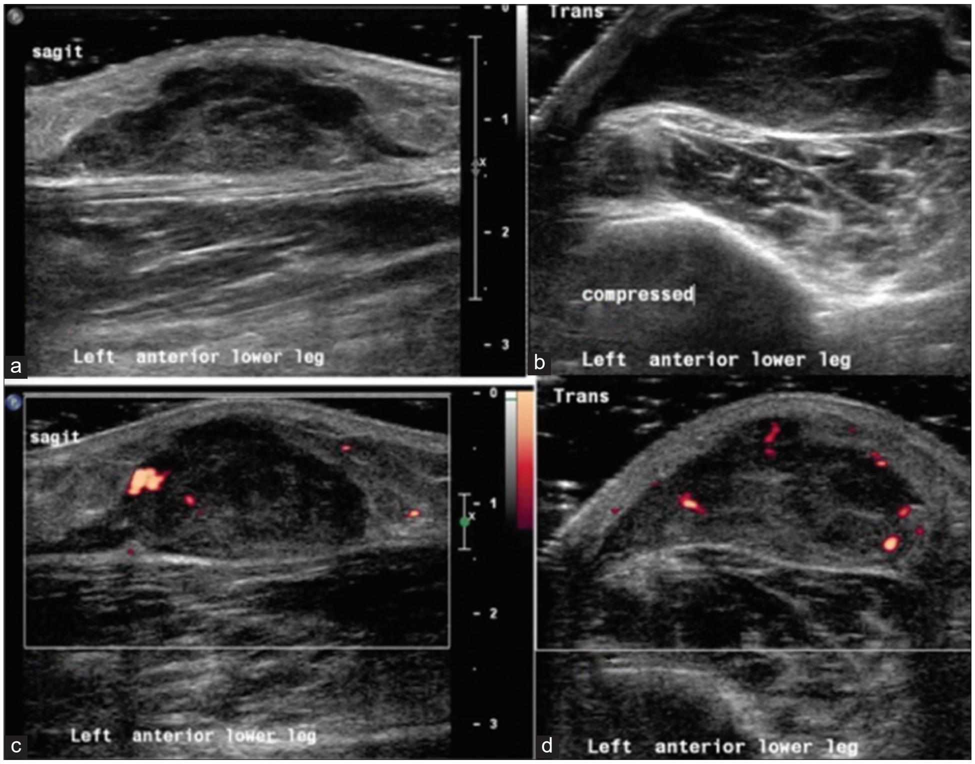


Figure 22: Longitudinal (a), axial (b) ultrasound image of a subcutaneous lesion that presented with a painful lower leg swelling. The heterogeneous lesion was non-compressible and with neovascularization (c and d). This aggressive-looking lesion was histologically confirmed to be a myxofibrosarcoma.

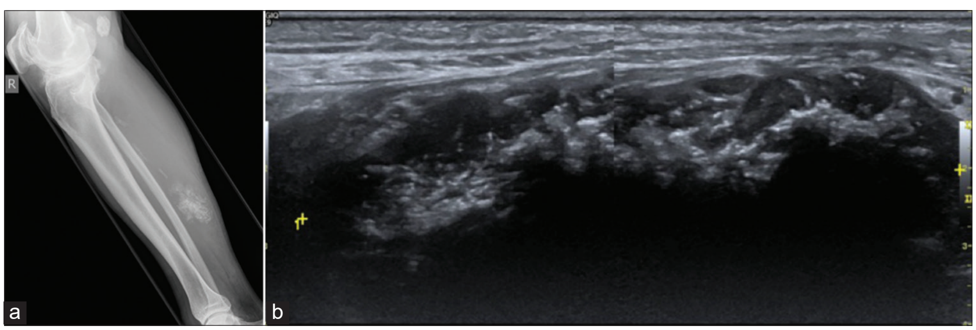


Figure 23: (a) Lateral radiograph of the patient in confirming calcification in the mass in the posterior aspect of the calf. (b) Extended field of view longitudinal ultrasound of the right calf demonstrates a hypoechoic mass with intralesional calcification, located within the soleus muscle.

obstruction due to its compressive nature or originate from a vessel wall and cause intraluminal flow impedance.[21] Lipomas that develop in the femoral or popliteal regions and are contained within a non-expandable sheath produce a compressive effect to the venous flow and result in leg swelling and exhibit symptoms similar to a DVT.

Imaging modalities will demonstrate a lesion that follows the subcutaneous fat signal.

On US, imaging will demonstrate a mass with well-defined borders but importantly an echotexture similar to that of subcutaneous fat [Figures 19 and 20]. The echogenicity of the lesion is variable as follows:[22] Hyperechoic – 29%, isoechoic – 22%, hypoechoic – 29%, and mixed echogenicity – 20%. In addition to the above findings, the lesion should also demonstrate compressibility without posterior acoustic enhancement and no flow on color Doppler sonography. If the lesion is not encapsulated, then it can be difficult to identify and differentiate the mass from the normal surrounding fat. In these selected cases, one can perform an MRI of the area to confirm the presence of fat [Figure 21].

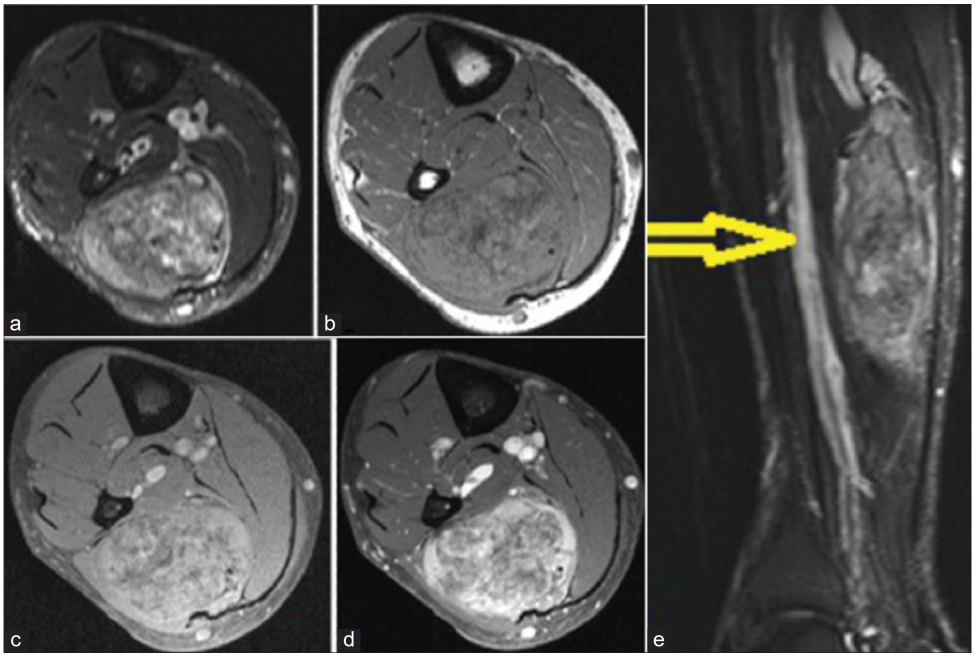


Figure 24: Axial short tau inversion recovery (STIR) (a), T1 (b), pre-contrast T1 FS (c) and post-contrast T1 FS (d) and STIR sagittal (e) of the patient in Figure 23 demonstrate a large enhancing solid soft tissue mass with central necrosis and diffuse calcification within the medial belly of the soleus muscle with an adjacent dilated deep vein (yellow arrow). A biopsy confirmed chondrosarcoma.

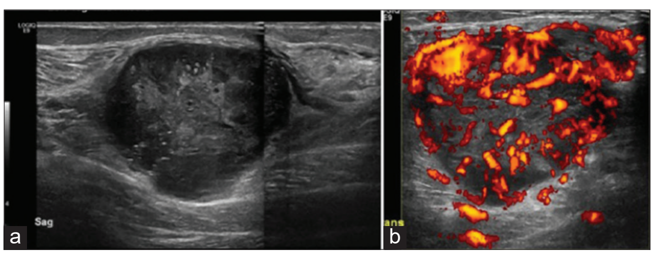


Figure 25: Extended view sagittal ultrasound image (a) of the lower leg demonstrating a large heterogeneous soft tissue lesion with marked hypervascularity on power Doppler imaging (b) subsequent biopsy confirmed a malignant fibrous tumor.

Soft tissue sarcoma

A soft tissue sarcoma (STS) is an aggressive malignant tumor arising from connective (mesenchymal) tissue that is not bone. Classification is based according to its type rather than its anatomical origin. The STS has a pattern of growth centrifugally from a single focus. Clinical features of a malignant STS are; a soft tissue mass, increasing in size, >5 cm in size, deep to the deep fascia, with or without pain.[23] As with any mass lesion, secondary compressive effects of the STS on adjacent vessels can occur and mimic the symptoms of a DVT. In young patients, without a significant DVT risk factor, one should consider STS as they can be found in up to 17% of patients with recurrent DVT.[24]

Imaging features depend on the type of tumor and the variability of the cystic, fatty, necrotic, calcification, and myxoid components [Figures 22-26]. General principles of an aggressive mass should be applied to imaging. US features of a large heterogeneous hypoechoic mass, well encapsulated, within the deep (subfascial) tissues with adjacent destruction, can suggest the concerning appearance of a STS. A well-defined, intratumoral anechoic or hypoechoic area on US may represent the presence of myxoid tissue. Necrosis is depicted by poorly defined hypoechoic areas. Calcifications within a lesion are discrete intratumoral echogenic foci with acoustic shadowing. Hemorrhage is ill-defined intratumoral echogenic areas without acoustic shadowing. The presence of a disorganized hypervascular pattern on color Doppler imaging can also be a key imaging finding from prompt referral [Figure 26].

Metastasis

Metastasis presenting as a soft tissue mass in the lower limb is relatively uncommon. The primary tumor origin presents as follows: Skin > Lung, breast > kidney, colon, and rectal. In up to 13.5%, the primary site of origin is unknown. The location of metastasis is not known to correlate with the primary tumor location. It can be difficult on occasions to distinguish metastasis from STS on imaging alone. The following features help differentiate metastasis from STS.

- Metastasis is smaller and less well-defined than STS
- Metastasis demonstrate a more prominent peritumoral edema

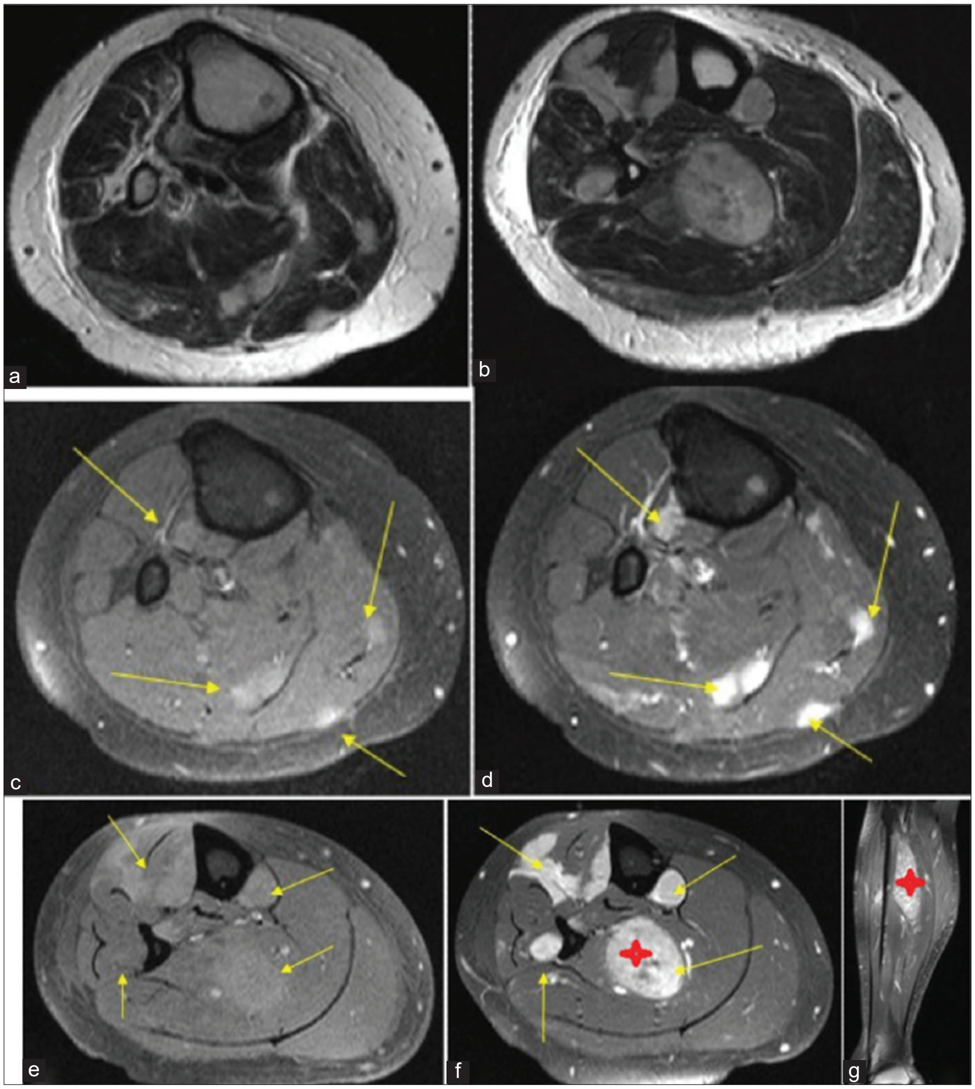


Figure 26: Axial T2 images (a and b) demonstrating multiple hyperintense well-defined intramuscular lesions. Pre-contrast T1 FS images (c and e) and corresponding post-contrast T1 FS images (d and f) demonstrate intensely enhancing masses throughout the lower leg (arrows) with a large lesion in the soleus muscle (red star)(f and g). The patient was known to have adenocarcinoma of the colon.

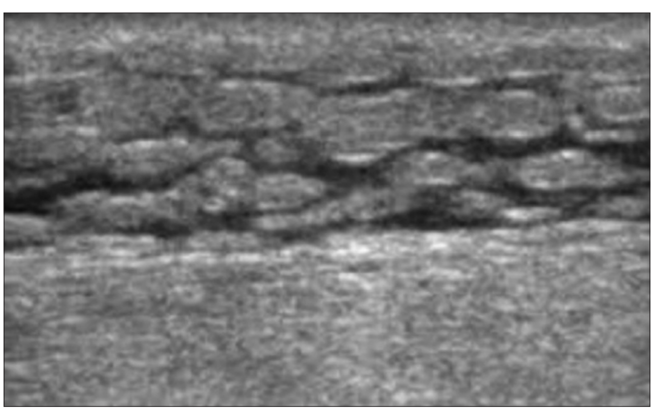


Figure 27: Ultrasound image of the subcutaneous fat demonstrating the "cobble appearance" of edematous fat. The fluid is interdigitating between the fat globules. Septic versus aseptic fluid cannot be distinguished on imaging.

- The appearance of gross disseminated disease will suggest metastasis over solitary STS
- If a primary has been confirmed then metastasis is much more likely than a synchronous STS.

Imaging features of metastasis are non-specific and range from a well-defined to infiltrative mass [Figure 26]. If an unknown primary is present, then histological confirmation with biopsy is prudent to ensure appropriate management.

INFECTIVE

Cellulitis

Cellulitis is an inflammatory disorder of the skin and subcutaneous tissues secondary to infection with a predilection for the lower limbs. Superficial cellulitis

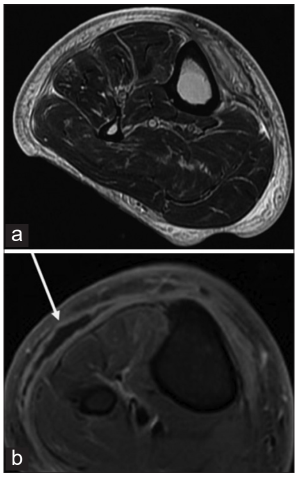


Figure 28: Axial T2-weighted magnetic resonance (a) demonstrating increased T2 signal throughout the subcutaneous fat and perifascial edema in keeping with cellulitis, a focal rim enhancing collection (white arrow) is seen in the post-contrast T1 FS axial image (b) represents a subcutaneous abscess. No air seen to suggest necrotizing fasciitis.

is depicted by an acute infection of the dermis and subcutaneous tissues with predisposing factors such as poor health, venous stasis, skin laceration, obesity, diabetes, and immunosuppression. Clinical presentation is usually a swollen erythematous lower leg(s) with pain. When the diagnosis is suspected, it is predictable that US DVT exclusion is requested followed by characterization of the cellulitis.[4]

Imaging cannot differentiate aseptic from the septic fluid. On US, the features of cellulitis are "cobble-stoned" appearance of the subcutaneous fat secondary to fluid accumulation in the subcutaneous tissues with interdigitation of the fat lobules. A hyperechoic diffuse swelling of the subcutaneous tissues of the affected region can also on occasions be noted [Figure 27]. cross-sectional imaging (CT and MR) is helpful in differentiation between superficial and deep components of cellulitis. On MRI T1W imaging, there is swelling and hypointensity with increased reticulation of the subcutaneous fat. On T2W imaging, there is diffuse hyperintensity of the subcutaneous tissues and patchy edema of the adjacent tissues [Figure 28]. Associated regional lymphadenopathy can also direct the diagnosis toward an infective cause.

CONCLUSION

DVT of the lower limb is a preventable cause of mortality and morbidity with its presentation in up to two-thirds of patients being non-specific in the context of the painful unilateral swollen leg. Vigilance is required, as not infrequently, a range of other pathologies is diagnosed instead. One needs to be aware of other causes that can mimic the clinical presentation of a DVT to avoid misdiagnosis and inappropriate treatment. We have presented a variety of pathologies using an anatomical sieve to aid the radiologist to consider the relevant differential diagnosis.

Declaration of patient consent

Patient's consent not required as patients identity is not disclosed or compromised.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Hansrani V, Khanbhai M, McCollum C. The diagnosis and management of early deep vein thrombosis. Adv Exp Med Biol 2017;906:23-31.
2. Hull R, Hirsh J, Sackett DL, Taylor DW, Carter C, Turpie AG, *et al.* Clinical validity of a negative venogram in patients with clinically suspected venous thrombosis. Circulation 1981;64:622-5.
3. Fowkes FJ, Price JF, Fowkes FG. Incidence of diagnosed deep vein thrombosis in the general population: Systematic review. Eur J Vasc Endovasc Surg 2003;25:1-5.
4. Hamper UM, DeJong MR, Scoutt LM. Ultrasound evaluation of the lower extremity veins. Radiol Clin North Am 2007;45:525-47, 9.
5. Ward EE, Jacobson JA, Fessell DP, Hayes CW, van Holsbeeck M. Sonographic detection of Baker's cysts: Comparison with MR imaging. AJR Am J Roentgenol 2001;176:373-80.
6. Langsfeld M, Matteson B, Johnson W, Wascher D, Goodnough J, Weinstein E, *et al.* Baker's cysts mimicking the symptoms of deep vein thrombosis: Diagnosis with venous duplex scanning. J Vasc Surg 1997;25:658-62.
7. Burk DL Jr., Dalinka MK, Kanal E, Schiebler ML, Cohen EK, Prorok RJ, *et al.* Meniscal and ganglion cysts of the knee: MR evaluation. AJR Am J Roentgenol 1988;150:331-6.
8. Handy JR. Popliteal cysts in adults: A review. Semin Arthritis Rheum 2001;31:108-18.
9. Harwin JR, Richardson ML. "Tennis leg": Gastrocnemius injury is a far more common cause than plantaris rupture. Radiol Case Rep 2017;12:120-3.
10. Bright JM, Fields KB, Draper R. Ultrasound diagnosis of calf injuries. Sports Health 2017;9:352-5.
11. Bianchi S, Martinoli C, Abdelwahab IF, Derchi LE, Damiani S. Sonographic evaluation of tears of the gastrocnemius medial head ("tennis leg") J Ultrasound Med 1998;17:157-62.
12. Pompan DC. Pes anserine bursitis: An underdiagnosed cause of knee pain in overweight women. Am Fam Physician 2016;93:170.
13. Nguyen JT, Nguyen JL, Wheatley MJ, Nguyen TA. Muscle hernias of the leg: A case report and comprehensive review of the literature. Can J Plast Surg 2013;21:243-7.
14. Braunstein JT, Crues JV 3rd. Magnetic resonance imaging of

hereditary hernias of the peroneus longus muscle. Skeletal Radiol 1995;24:601-4.
15. Miniaci A, Rorabeck CH. Tibialis anterior muscle hernia: A rationale for treatment. Can J Surg 1987;30:79-80.
16. Ukon Y, Tanaka T, Nagata S, Hagizawa H, Imura Y, Tamiya H, *et al.* Calcific myonecrosis mimicking soft tissue sarcoma: A case report. Oncol Lett 2018;15:7909-13.
17. O'Dwyer HM, Al-Nakshabandi NA, Al-Muzahmi K, Ryan A, O'Connell JX, Munk PL, *et al.* Calcific myonecrosis: Keys to recognition and management. AJR Am J Roentgenol 2006;187:W67-76.
18. Wright LB, Matchett WJ, Cruz CP, James CA, Culp WC, Eidt JF, *et al.* Popliteal artery disease: Diagnosis and treatment. Radiographics 2004;24:467-79.
19. Megalopoulos A, Siminas S, Trelopoulos G. Traumatic pseudoaneurysm of the popliteal artery after blunt trauma: Case report and a review of the literature. Vasc Endovascular Surg 2006;40:499-504.
20. Flors L, Leiva-Salinas C, Maged IM, Norton PT, Matsumoto AH, Angle JF, *et al.* MR imaging of soft-tissue vascular malformations: Diagnosis, classification, and therapy follow-up. Radiographics 2011;31:1321-40.
21. Acheson A, McIlrath E, Barros D'Sa AA. Pelvic lipoma causing venous obstruction syndrome. Eur J Vasc Endovasc Surg 1997;14:149-50.
22. Inampudi P, Jacobson JA, Fessell DP, Carlos RC, Patel SV, Delaney-Sathy LO, *et al.* Soft-tissue lipomas: Accuracy of sonography in diagnosis with pathologic correlation. Radiology 2004;233:763-7.
23. Useche JN, de Castro AM, Galvis GE, Mantilla RA, Ariza A. Use of US in the evaluation of patients with symptoms of deep venous thrombosis of the lower extremities. Radiographics 2008;28:1785-97.
24. Emori M, Naka N, Hamada K, Tomita Y, Takami H, Araki N, *et al.* Soft-tissue sarcomas in the inguinal region may present as deep vein thrombosis. Ann Vasc Surg 2010;24:951, e7.

How to cite this article: Paramesparan K, Iqbal A, Shah A, Botchu R. Imaging of the Unilateral Swollen Painful Lower Leg: Deep Vein Thrombosis Mimics. Indian J Musculoskelet Radiol 2019;1(1):27-40.