

## Soft Tissue Pseudotumors: A Pictorial Review

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DOI: [10.36347/sjams.2021.v09i05.009](https://doi.org/10.36347/sjams.2021.v09i05.009)

| Received: 26.03.2021 | Accepted: 04.05.2021 | Published: 14.05.2021

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### Abstract

### Review Article

Several pathological entities can present clinically as a soft tissue mass. These tumor- mimicking lesions, also known as pseudo-tumors, can be defined as clinically palpable masses or lesions that have tumor-like appearances on imaging. The advances in cross sectional imaging (ultra-sound, CT and MRI) play an important role in the correct evaluation of soft tissue pseudotumors. That means that in a growing number of situations, we can accurately determine not only the usual information of tumor size and topography, but often the exact nature of the tissue, almost always identifying whether a lesion is aggressive or not. Recognizing soft tissue pseudotumors on imaging may prevent more invasive actions and additional anxiety to the patients. In this pictorial essay we aim to provide a review of common soft tissue conditions which may mimic malignant tumors by classifying them into categories using an anatomical sieve.

**Keywords:** Musculoskeletal system, soft tissue pseudo tumors, ultrasound, imaging.

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## INTRODUCTION

A wide range of tumour-like conditions of the soft tissues may be encountered in clinical practice or when patients undergo radiologic examinations. A systematic approach is needed to rule out differential diagnosis and achieve a definitive diagnosis, it involves clinical history, physical examination, anatomic location and imaging. The advances in cross sectional imaging (ultra-sound, CT and MRI) play an important

role in the correct evaluation of soft tissue pseudotumors. In this pictorial essay we review some of the most frequent benign soft tissue conditions which may mimic malignant tumors and thus lead to unnecessary biopsies and great anxiety to the patients.

For classification purposes, we divided benign soft tissue pseudotumors into categories. (Table 1)

**Table 1: Pseudo-tumors categories**

Muscle related pseudo-tumors	Hematomas Abscess Accessory muscles Myositis ossificans Muscle herniation
Tendon related pseudo-tumors	Tendon rupture Tenosynovitis
Synovium related pseudo-tumors	Synovial cysts Bursitis
Skin related pseudo-tumors	Cellulitis Morel-Lavallée lesion
Vascular related pseudo-tumors	Aneurysms and pseudoaneurysms
Neural related pseudo-tumors	Morton's neuroma

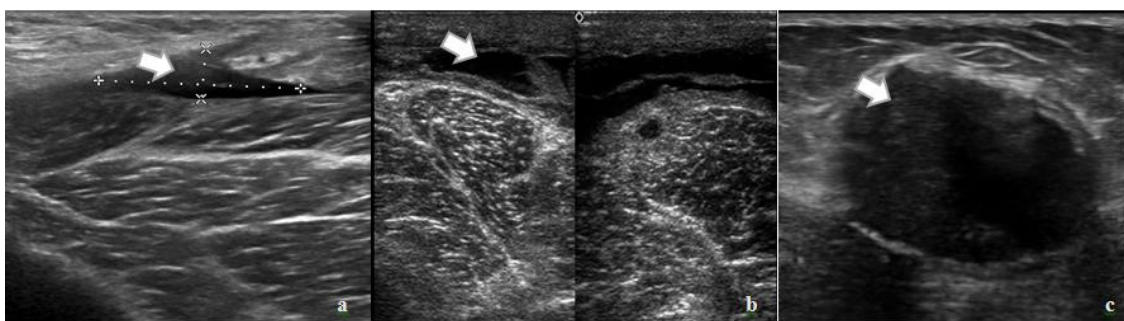
Other pseudo-tumors	Lymph nodes Tumoural calcinosis Foreign body granuloma reaction Mucoid cyst
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**Muscle related pseudo-tumors**  
**Hematomas**

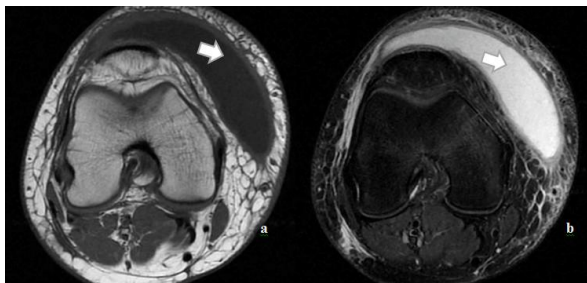
Hematomas are localized collections of blood within a contained space, outside a vessel wall. They are often associated with traumatic muscle injury, muscle strain and contusions. Hematomas are very common and account for 5% of soft tissue masses [1]. They can mimic aggressive tumoral lesions.

On ultrasound, the echostructure of the hematoma changes over time: although relatively echogenic at first, the contents gradually become almost entirely liquid usually starting at the periphery and progressing

towards the center. In the chronic phase, it may appear as a calcified mass[2].MRI appearances can be variable and dependent on the stage of the hematoma at the time of imaging. Fluid-fluid levels may be seen and the T1signal varies from hyperintense to hypointense depending on the levels of methemoglobin and hemosiderin. There should be no enhancement on post-contrast imaging. If hematoma is considered as the diagnosis, it is prudent to follow up these patients clinically or with imaging to ensure gradual resolution over time, which can take at least 3 months [3].



**Fig-1: Ultrasound of post traumatic hematomas during different stages**  
a. Acute hematoma  
b. Subacute hematoma  
c. Chronic hematoma



**Fig-2: Chronic hematoma.**

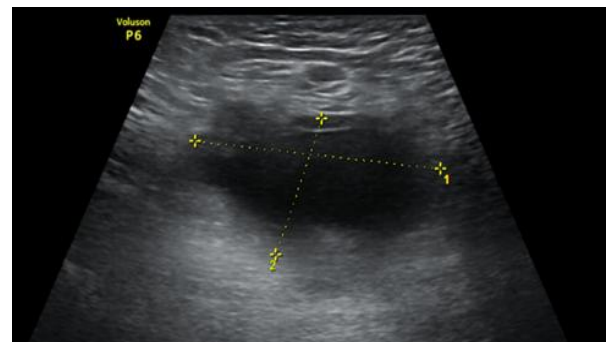
Axial T1 weighed (a) and axial T2 weighed (b) MR images.

Mass of the anteromedial face of a posttraumatic knee. MRI performed 1 month after the trauma shows a well-limited oval lesion above the aponeurosis with T1 hyposignal and T2 hypersignal

**Abscess**

These can be seen in a context of general infection or secondary to local traumas (injections in drug users), and are facilitated by a state of immunodeficiency. The content is usually fluid, often with a few areas producing low amplitude internal echoes, and they are sometimes scattered with clearly visible septa. They are enclosed in a thick capsule and are avascular. Sonography is useful to guide punctures for bacteriology sampling and drainage [4].

MRI will demonstrate a thick, irregular-walled low T1-weighted signal intensity and high T2-weighted signal intensity collection.



**Fig-3: Abscess.**

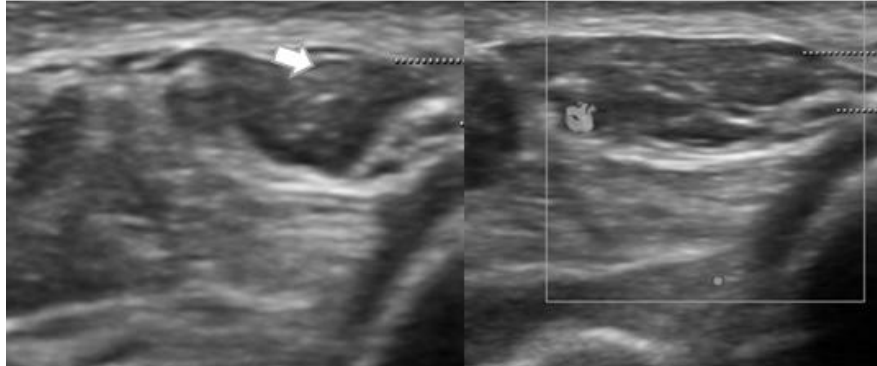
Mass of the anterior aspect of the thigh without inflammatory signs. Ultrasound shows a collection with echogenic content with posterior reinforcement. Bacteriological analysis concluded to a tuberculous origin.

**Accessory muscles**

These are anatomical variations that can be observed with variable frequency. It is either a simple muscle bundle supernumerary included in the original muscle, or a true supernumerary muscle as is the case

with the extensor manu brevis. These muscles are usually asymptomatic, However, in several cases symptoms are caused by mass effect on adjacent structures such as nerves, vessels, or tendons [5]. Ultrasound allows you to make the diagnosis and look

for possible vascular compression. MRI can also accurately demonstrate the presence of an accessory muscle and help differentiation from other soft-tissue masses.

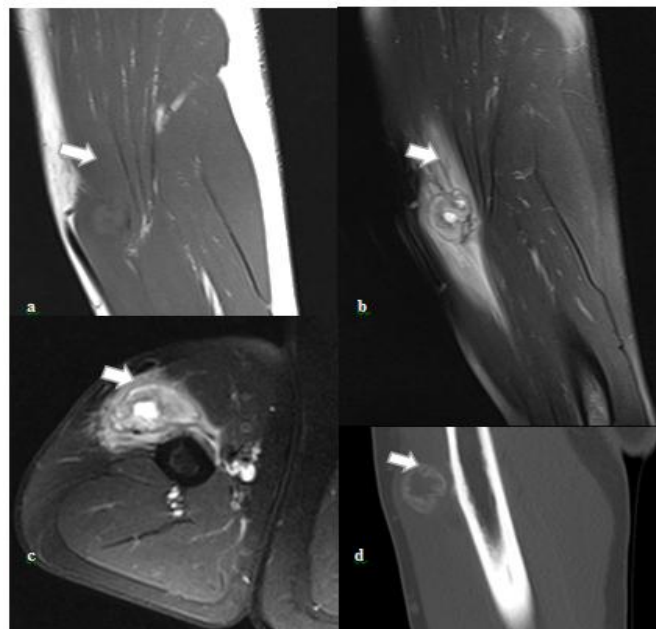


**Fig-4: Accessory muscle**  
Mass of the ulnar edge of the wrist. Ultrasound shows the muscular nature of the mass in relation to an accessory muscle: Adductor of the 5th finger.

**Myositis ossificans**

Myositis ossificans is a distinct muscle-related entity that usually results from trauma. It is characterized by a soft tissue mass that develops characteristic heterotopic peripheral calcification-ossification over a period of 6 to 8 weeks post trauma. CT scanning is usually the best imaging modality, since it demonstrates the peripheral mineralization at an

earlier stage. MRI findings are variable, and depend on the chronicity of the lesion. After 5 to 6 months there are chronic appearances of diffuse ossification and mature bone formation with MR signal approximating that of marrow without associated oedema. It may be difficult to differentiate the lesion from a malignancy such as osteosarcoma or synovial sarcoma without the history of trauma [6].



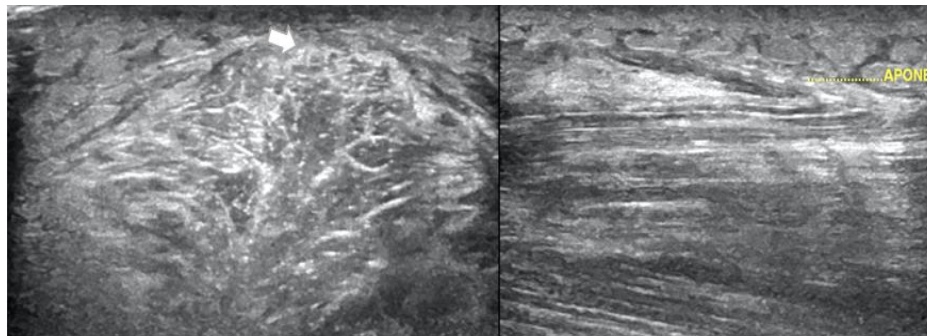
**Fig-5: Myositis ossificans.**  
Sagittal T1 weighed (a) and sagittal T2 weighed (b) axial contrast enhanced T1 (c) MR images. Coronal CT image, bone window(d).

Mass of the lateral face of the arm. MRI shows a discreet T1 hypersignal mass, surrounded T2 hypersignaledema and is enhanced after contrast. CT shows calcifications in a ring away from the bone.

**Muscle herniation**

Commonly due to posttraumatic myofascial defects. They are usually asymptomatic and present as a palpable mass that accentuate during muscle contraction. MRI is not essential for the diagnosis.

Musculoskeletal ultrasound is the modality of choice in the evaluation of suspected muscle hernia, since it allows dynamic evaluation of the mass. We note the crossing of a fascia dehiscence by a contingent of muscle fibers[7].



**Fig-6: Muscle herniation**

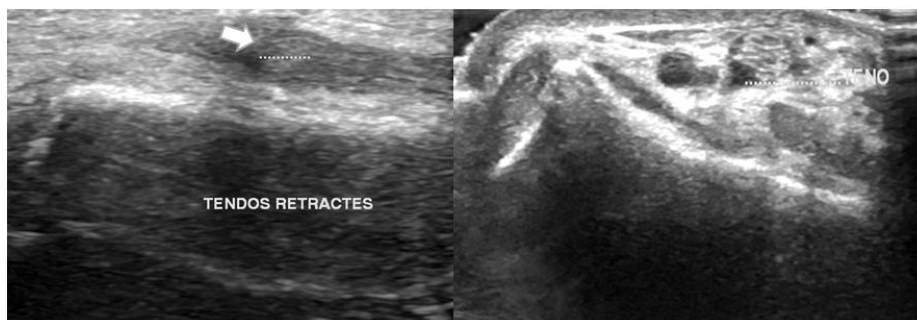
Soft mass of the anterolateral aspect of the leg following an old trauma. Ultrasound shows a dehiscence of the superficial fascia (arrow) with muscle fibers crossing through it.

**Tendon Related Pseudo-Tumors**

**Tendon rupture**

Tendon tears usually occur after an eccentric muscle contraction. Ultrasound examination shows a contraction of the retracted tendon muscle in the form of a globular mass, as opposed to non-contractile scar

fibrous tissue. Dynamic analysis is important to the diagnosis. The rupture typically occur near the musculotendinous junction, and MRI can help in identifying and categorizing it as partial or complete tear thus influencing the prognosis[8].



**Fig-7: Retracted tendon rupture.**

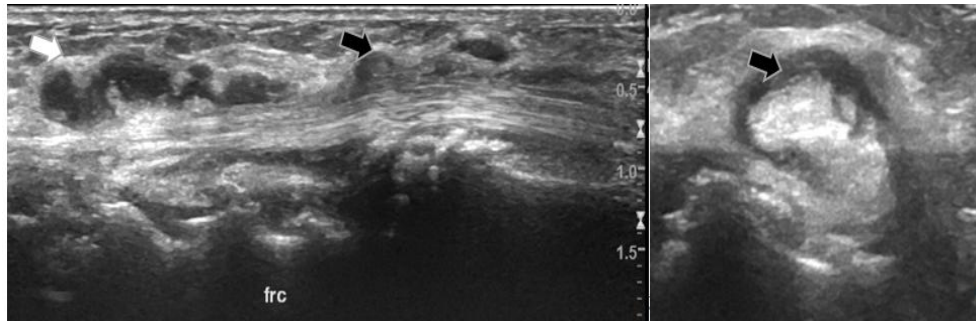
Mass of the anterolateral part of the wrist following an old open sutured trauma. Ultrasound shows a rupture with retraction of the tendons of the first ray of the dorsal face of the wrist (arrow).

**Tenosynovitis**

Tenosynovitis is the inflammation of the tendon and the surrounding synovial sheath. Frequent locations are the radial tenosynovitis also referred to as "De Quervain", and the tenosynovitis of the flexors of the fingers or toes.(9)

MRI is considered the most sensitive imaging modality for early detection of tenosynovitis the MR imaging findings in tenosynovitis are nonspecific. Imaging typically demonstrates tendon thickening along with enhancing synovium. The inflammatory signal changes in the tendon sheath are usually correlated with oedema in the surrounding soft tissues.

Ultrasound findings are the loss of the parallel aspect and convex deformation of the tendon edges with color Doppler hyperemia.



**Fig-8: Tenosynovitis of the flexor carpi radialis**

Mass at the radial edge of the carpus Effusion at the level of the flexor carpal tendon sheath (white arrow) with regular thickening of the sheath (black arrow).

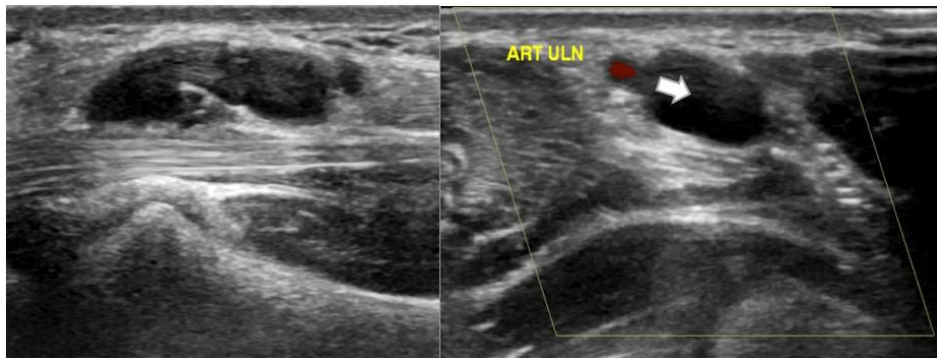
**Synovium related pseudo-tumors**

**Synovial cysts**

It's a diverticulum of the synovium that lines the joints, which is fluid-filled and varies in size from minimal to significant. Synovial cysts are common and are usually found in the wrist and the knee. The diagnosis of synovial cysts can be refined by ultrasound in the presence of a polylobed anechoic mass connected to a joint space by a pedicle. The echogenicity of the

cyst may increase in case of an infiltration or hemorrhage [10].

They may have a unilocular or multilocular MR appearance, with signal intensity similar to joint fluid. However, in complicated cases, they may resemble a soft tissue mass and a contrast enhanced MRI would be needed to differentiate them from cyst like lesions.



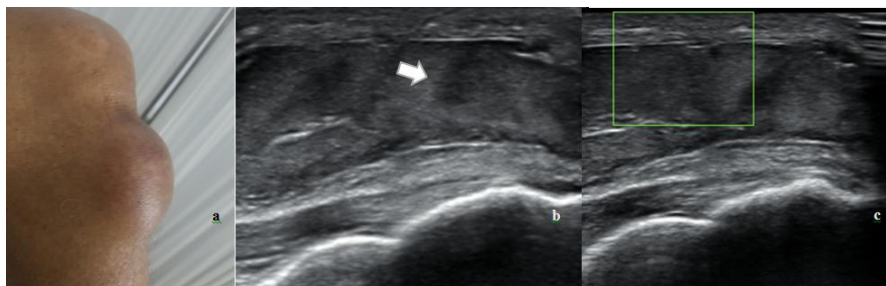
**Fig-9: Synovial cyst.**

Lenticular mass at the level of the palmar face of the 4th ray. Ultrasound shows a small lesion well limited depending on the sheath tendon with anechoic content and with posterior attenuation (arrow).

**Bursitis**

A bursa is a synovial-membrane-lined fluid-filled sac located between bones and tendons and/or muscles and around joints. These can become inflamed and distended secondary to trauma, autoimmune disorders, infection and iatrogenic causes, Bursitis can be revealed by the appearance of a mass. And this is

particularly the case for superficial bursitis of the elbow and knee [3]. The ultrasound usually shows a hypoechoic or even anechoic formation with posterior attenuation with a possible color Doppler vascularization. MRI images show hypointense T1 and hyperintense T2 lesions that are enhanced by contrast.



**Fig-10: Infra patellar bursitis**

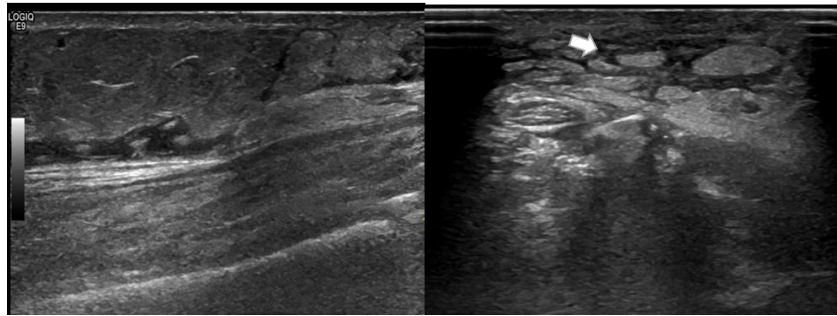
**Fig 10:** Anterior knee mass (a), the ultrasound shows a well-limited pre-patellar cystic lesion (b), with non-vascularized echogenic content in color Doppler (c).

**SKIN RELATED PSEUDO-TUMORS**

**Cellulitis**

Cellulitis can be diagnosed clinically and imaging is usually required only to evaluate the extension to deep tissues. On ultrasound, cellulitis presents as an echoic thickening of the subcutaneous

tissue with hypoechoic spans mimicking the aspect of a paved road. On CT, it also presents itself as a dense infiltration of the subcutaneous fatty tissue[11]. MR imaging is considered as the modality of choice for providing the best diagnostic approach for musculoskeletal infections in general. In this case we note an infiltration within the fatty tissue that appears hypointense in T1 and hyperintense in T2 and is enhanced after contrast injection.



**Fig-11: Cellulitis**

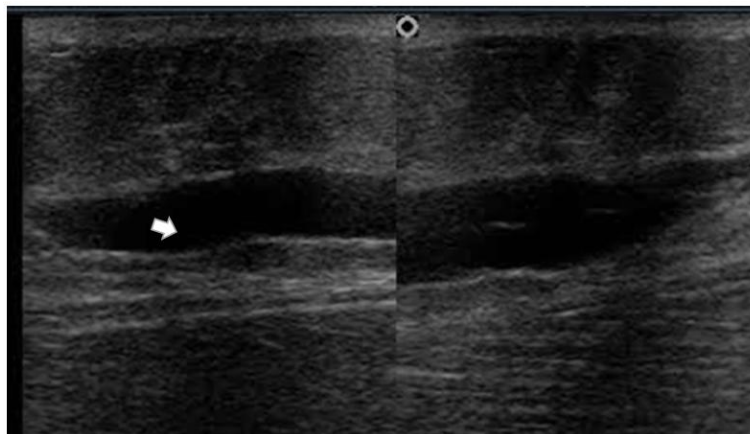
Extensive swelling of the leg with inflammatory skin signs. Ultrasound shows echogenic subcutaneous tissue thickening crossed by hypoechoic spans creating the appearance of a paved road (arrow).

**Morel-Lavallée lesion**

The Morel-Lavallee lesion (MLL) occurs secondary to a blunt force degloving injury typically in the proximal thigh and pelvis causing separation of the hypodermis from the underlying fascia. The created space between the subcutaneous fat and underlying fascia fills with the haemo-lymphatic fluid and becomes surrounded by granulation tissue. This forms a fibrous capsule further preventing reabsorption of the collection leading to formation of a pseudotumour [3]. On ultrasound, it usually appears as an oval hypo-anechoic

area, most often homogeneous but sometimes heterogeneous, located between the hypodermic fat and the underlying fascia.

MRI appearances depend on timing of imaging and complications. MLLs follow fluid SI internally except for fat nodules and blood products. The fibrous pseudocapsule is hypointense on all sequences. Post-contrast nodular or peripheral enhancement may be seen with granulation tissue, inflammation, or infective complications.



**Fig-12: Morel-Lavallée lesion.**

Post traumatic mass of the lateral aspect of the thigh. Ultrasound shows the presence of an anechoic collection located between the hypodermic fat and the underlying fascia (arrow).

**Vascular related pseudo-tumors**

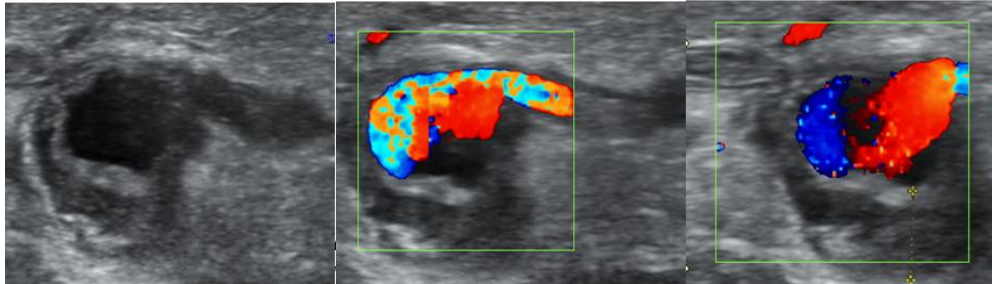
**Aneurysms and pseudoaneurysms**

Aneurysms can be classified as ‘true aneurysms’ when all three layers of the arterial wall are abnormally dilated or ‘false aneurysms’

(pseudoaneurysms), which are due to a defect in the arterial wall related to trauma or (mycotic) infection. A peripheral aneurysm or pseudoaneurysm may mimic a mass of soft tissues, particularly when it is not pulsatile. The aneurysm is usually well-limited,

lobulated or elliptical and displaces adjacent muscles. Popliteal artery aneurysms (PAA) are the most common peripheral aneurysm accounting for 80% of extremity aneurysms. Doppler imaging has made distinguishing them straightforward. It demonstrates, except in rare cases of almost complete thrombosis, linear blood flow within true aneurysms, and swirling blood flow within pseudoaneurysms, in which another finding is communication between the “mass” and the arterial

lumen [12]. MRI findings are highly variable depending on its size and morphology, the presence of residual or recanalized lumen, turbulence, thrombi and subacute and chronic hemorrhagic phenomena. In chronic cases, a laminated MR appearance is consistent with multilayered thrombus, occasionally, rim-like calcifications may also be depicted and may complicate MR interpretation.



**Fig-13: Pseudoaneurysm of the ulnar artery**

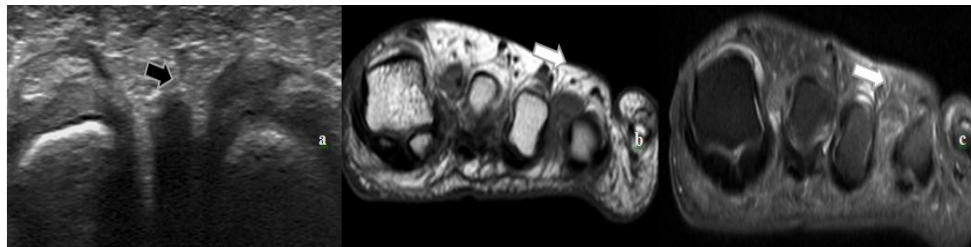
Pulsatile mass at the ulnar edge of the wrist. The ultrasound shows a saccular hypoechoic formation at the expense of the ulnar artery with the ying-yang sign.

### Neuralrelated pseudo-tumors

#### Morton's neuroma

Morton's neuroma is a scarring fibrosis of an intermetatarsal plantar nerve. It is most likely secondary to repeated microtrauma of the common interdigital nerve by the transverse metatarsal ligament and is most often found between the 3rd and 4th interdigital space [13].

On ultrasound, it appears as a bulbous and roughly oval formation that is hypoechoic, with indistinct margins, seen on longitudinal views to be positioned between the two nerves that are involved. On MR imaging, a Morton's neuroma classically appears as a teardrop shaped mass in the intermetatarsal space. The mass is usually isointense to muscle on T1-weighted images, and hypointense to fat on T2-weighted images. Lesions can show variable enhancement after gadolinium administration.



**Fig-14: Morton's neuroma**

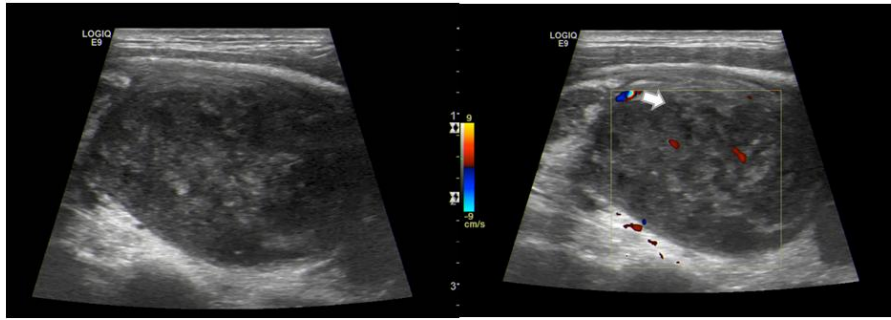
On ultrasound (a): Hypoechoic interruption of the 3rd interdigital space (a) (black arrow) On MR: Hyperintense in T1 weighted images (b) and hypointense in T2 (c) (white arrow).

### Other pseudotumors

#### Lymph nodes

In general, benign forms of regional lymphadenitis may demonstrate clinical and imaging findings that may be interpreted as soft tissue tumor. Identification of the normal MR appearance of the lymph node fatty hilum aids in the differential diagnosis.

A normal lymph node on ultrasound appears ovoid, with a long longitudinal axis, a homogeneous hypoechoic stroma and a vascularized echogenic hilum. The visualization of the vascularized hilum in echo-Doppler mode is a reliable sign of normality. The loss of those characteristics is what defines a lymphadenopathy. Correlation of imaging findings with clinical and laboratory examinations is also imperative [6].



**Figure-15: Lymphadenopathy**

Cervical swelling Ultrasound showed a roughly rounded heterogeneous echogenic formation, without individualization of the central hilum with anarchic vascularization (arrow).

**2. Tumoral calcinosis**

Tumoral calcinosis (TC) is a benign disorder characterized by the non-osseous calcification of peri-articular soft tissues and mainly presents in large joints (hips, elbows, shoulders). Plain film radiographs typically reveal well-defined, large, multi-lobulated, amorphous, cloud-like densities within the soft tissue with radiolucent septae. CT makes it possible to better characterize the lesion and to clarify the relationship

with the musculo-aponeurotic and bone structures. MRI fluid sensitive imaging will demonstrate high signal in the cystic areas, peripheries and adjacent oedema with lower signal representing solid calcium. Fluid-calcium levels may be seen in keeping with due to different states of calcium, known as the ‘sedimentation sign’ [14].



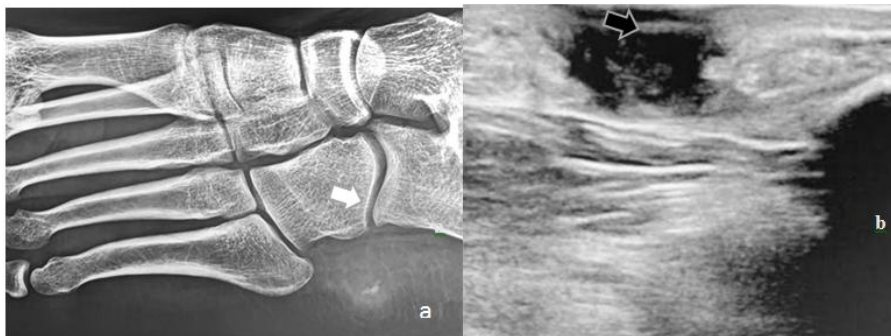
**Fig-16: Tumoral calcinosis.**

CT scan of the right shoulder in bone (a) and soft tissue (b) windows. Heterogeneous calcified mass lesion the soft tissues of scapular region with multiple hyperdense fluid levels representing layered "milk of calcium"

**Foreign body granuloma reaction**

Foreign body-induced soft-tissue masses are most often ten found adjacent to the area of trauma and skin laceration. Radiographs, CT, ultrasound and MRI can help identify the foreign object depending on its

origin (wood, glass, rock..). On ultrasound the foreign bodies are within an inflammatory granuloma, this is of a generally well limited hypoechoic range, with peripheral vascularization [6].



**Fig-17: Inflammatory granuloma due to a foreign body**



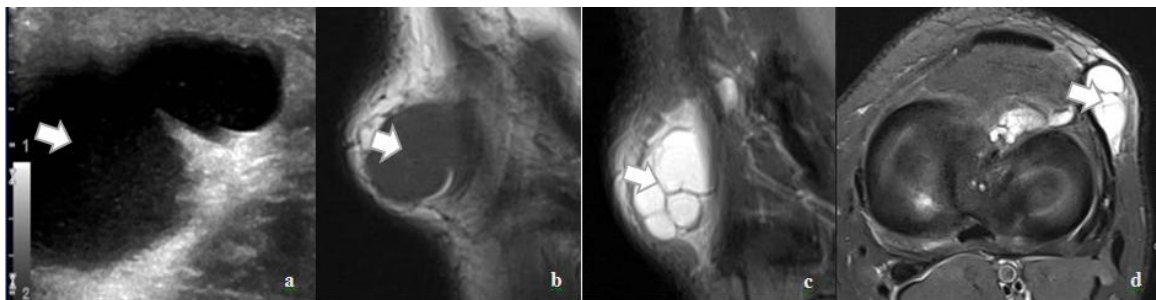
**Fig 17:** Mass on the medial side of the foot following inoculation of a foreign body. The standard x-ray (a) shows the presence of an opacity in the soft parts of the midfoot (white arrow). Ultrasound (b) shows the presence of a sub-aponeurotic hypoechoic collection with a foreign body within it (black arrow).

**Muroid cyst:**

Cystic cavity containing a thick muroid, colorless or xanthochromic substance. There are three

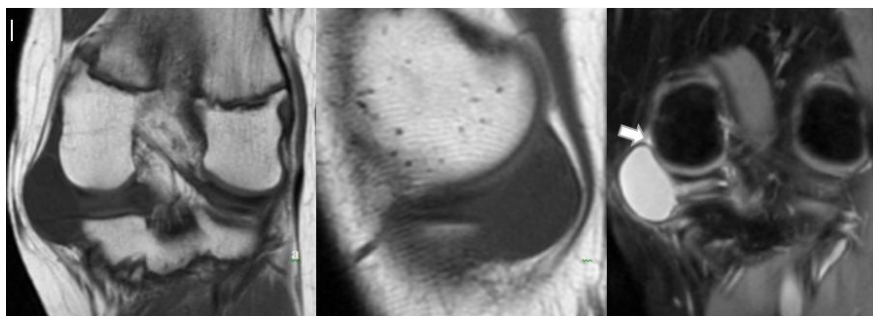
types of muroid cyst depending on the location, intra-articular, intraosseous and para-articular muroid cysts. The ultrasound shows when the cyst is accessible an anechoic, hypoechoic or even echogenic formation with posterior reinforcement.

On MRI we have a fluid collection that's hypointense in T1 weighted images and hyperintense in T2. It's bordered by a thin fibrous tissue appearing hypointense in all the sequences [15].



**Fig-18: Muroid cyst of the Hoffa fat**

Mass of the lateral aspect of the knee Well-defined multiloculated cystic lesion on the lateral face communicating with hypoechoic Hoffa fat with echogenic content on ultrasound (a) (arrow), On MRI :in T1 hypointense (b), in T2 hyperintense (c, d) (arrow).



**Fig-19: Meniscal muroid cyst**

Mass of the medial aspect of the knee Well-defined cystic lesion that communicates with a meniscal fissure, this lesion is hypointense in T1 (a, b) and hyperintense in T2 (arrow).

**CONCLUSION**

Soft-tissue pseudo-tumors are often encountered in daily radiologic practice. The vast array of benign and malignant entities can make lesion diagnosis difficult for the radiologist. By using clinical history, lesion location, characteristics on radiographs and MR images, the radiologist can develop an appropriate diagnosis. When a soft-tissue lesion is indeterminate on the basis of clinical and imaging features, a biopsy should be considered.

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