Doc, I've got a small lump: Ultrasound imaging features of superficial small soft tissue masses

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Learning objectives

- To review the spectrum of ultrasound findings of the most commonly founded small soft tissue masses, smaller than 5 cm, which arise from the dermis to the underlying muscle with no apparent explication.
- To emphasize imaging key features that can help in the main differentials.

Background

Superficial soft-tissue masses are common in clinical practice.

The radiologic evaluation of soft tissue masses has changed within the last two decades. In the past, these lesions were managed by clinicians, and in many cases the treatment was directly surgical.

With the expansion and the development of radiologic imaging, radiologists have had to become familiar with these entities.

It is known that high resolution ultrasound, is a non-invasive, readily available, and relatively inexpensive modality without ionizing radiation. The changes in ultrasound technology, resulting in improved resolution, have impacted the utilization of musculoskeletal ultrasound and have made sonography an important tool for musculoskeletal diagnostic procedure.
In daily practice it is commonly used as the first study in patients with small lumps, as it is able to differentiate a lot of benign tumors (superficial lipoma) and tumor-like lesions (cysts, ganglia, foreign bodies) from potentially malignant lesions.

Imaging findings OR Procedure details

For the sake of clarity, in this exhibit the most common small soft tissue masses have been divided in three groups: cystic lesions, solid lesions with specific imaging findings and solid lesions with non-specific imaging findings.

1. Cystic lesions

1.1. Ganglion (Fig.1)

Ganglions are cystic lesions filled with gelatinous fluid. They are usually located near, and in some cases communicating with, a joint or tendon sheath. The origin of these masses is uncertain.

They present as small hard masses with no clear age predilection. Their diagnosis is based on clinical evidence.

Ultrasound shows a well-defined, anechoic soft tissue structure with posterior acoustic enhancement. It may be loculated and contain, in a large lesion, multiple internal septations. The connection to the joint-capsule or tendon sheath is often very flimsy and sometimes even not depicted. No internal flow on color Doppler sonography is noted with ganglion cysts.

Anechogenicity, posterior acoustic enhancement, and sharp delineation cannot always be demonstrated in a small cyst. The wall is usually thin and regular. In recurrent or long-standing lesions a thicker wall and intraluminal echoes can be visualized.

Ultrasound offers the advantage, over other imaging techniques, that it can differentiate a small, compressible joint effusion from a small ganglion cyst which does not collapse under compression. A frequent location is the dorsal and volar aspect of the wrist, the
finger and the peroneal compartment. Aspiration followed by a short immobilization period is one method of conservative treatment.

1.2. Bursitis (Fig.2)

Bursae are small fluid-filled sac lined by synovial membrane, which are found in an anatomically predisposed location. Their function is to avoid friction between two adjacent structures, and in normal conditions contain a small amount of lubricating, mucinous fluid. Normally is not appreciated on ultrasound, or is seen only as a thin hypoechoic space in its typical location.

Bursitis is an inflammation of a bursa, usually due to chronic mechanical friction and results in abnormal accumulation of fluid. However, it can be caused by a variety of systemic disorders, such as rheumatoid arthritis, gout, hydroxyapatite and calcium pyrophosphate deposition diseases, and can also appear under septic conditions.

Superficial bursitis appears clinically as a painless lump, due to fluid distension or hypertrophy of the synovial membrane. When bursitis is secondary to infection or gout, bursal swelling is typically painful and associated with skin warmth and erythema due to local inflammatory changes.

Bursitis appears in ultrasound as a well-defined hypoechoic structure of variable echogenicity. In a simple bursitis, there may be just anechoic fluid, with or without septa. In chronic bursitis, frequently there is bursal wall thickening, with internal debris of variable echogenicity. The echogenic contents may even mimic a solid mass.

1.3. Epidermal Inclusions Cyst (Fig.3)

Epidermal inclusion cysts also referred to as sebaceous, epidermoid, epidermal, infundibular or keratin cysts, are benign subcutaneous cysts formed by the migration of epidermal cells within the subcutaneous tissue. They are true epithelially lined cysts, filled with a mixture of keratin and lipid-rich debris. Epidermal inclusion cyst can be congenital or acquired, but commonly are iatrogenic resulting from mechanical obstruction, scarring or inflammation. Lesions can take place anywhere, but are most commonly found in the face, neck and trunk, in active and young people, without sex differences.

Clinically, epidermal inclusions cysts present as slow-growing, freely movable lumps beneath the skin.

The ecography shows a ovoid or spherical, solid, hypoechoic well-defined, mass with internal echoes resulting from the presence of debris, posterior acoustic enhancement,
and absence of flow on color Doppler sonography. Small extension into the dermis corresponding to their small opening that communicates with the skin can be noted.

Typically, unruptured epidermal cysts are well-defined round or ovoid lesions of high signal intensity on T2-weighted MR images. In many cases, T2-weighted images show variable low-signal components within epidermal cysts.

On T1 weighted images lesions appear as nodular and well-defined with intermediate-low or high signal intensity. They are homogeneous or poorly heterogeneous.

Gadolinium-enhanced MR images showed central nonenhancement and peripheral thin rim enhancement.

2. **Solid lesions with specific imaging findings**

2.1. **Lipoma (Fig.4)**

Lipoma is the most common soft tissue tumor and comprises nearly half of all benign mesenchymal tumors. It is usually a well-circumscribed, encapsulated mass, composed of mature adipose tissue, not distinguishable histologically from normal fat.

They occur most commonly in the subcutaneous tissue and rarely in the deep soft tissue. Generally affects patients in the fifth to seventh decade of life, more frequently in obese persons. There is no clear sex predilection, and are more common in the fifth and sixth decades.

Subcutaneous lipomas are most frequently found in the trunk, shoulder, neck and upper arm, with a predilection for the extensor surface, but they are unusual in the hand and foot. The less common deep lipomas occur most commonly in the chest wall and deep soft tissue of the hands and feet.

Superficial lipoma manifests itself usually as a compressible, palpable, slowly growing, painless soft-tissue mass, not adhered with the overlying skin.

At ultrasound examination, lipomas have a wide range of appearance. The most frequent sonographic appearance of lipoma is that of an elliptical, homogeneous and well-defined mass parallel to the skin surface, containing multiple echogenic lines without internal vascularization.

Lipomas are in general homogeneously hyperechoic. In lipoma variants, echogeneity can be variable: isoechoic and hyperechoic forms can be mixed up within one lesion but never combined with thick connective-tissue septa. All lipomas have in common that
they are generally not detectably vascularised and have no or only thin inner septs. If the above criteria are not met, the lesion should undergo MRI and guided biopsy. Occasionally a distinct echogenic capsule can be identified. Although many lipomas have a well-circumscribed appearance with an identifiable thin capsule, a significant proportion have ill-defined borders blending imperceptibly with the surrounding subcutaneous fat, and require comparison with the contralateral side to detect possible asymmetry of fat tissue.

Although lipomas are well vascularized, this feature may not be readily apparent on ultrasound owing to vascular compression caused by the distended adipocytes, and they are invariably avascular on power Doppler images.

2.2. Lymph Node (Fig.5)

In thin patients, finding a lymphatic normal node can trigger medical consultation and require an echographic study. It is not a challenging diagnosis, since its findings and features are typical.

The fact defensive medicine practice is becoming generalised, together with the patient's anxiety, make it a frequent cause of consultation in radiology services.

Palpable benign lymph nodes are usually have an groinal or cervical location, and are observed as an oval hypoechoic mass with echogenic hilum without hypervascular pattern. If the echotexture of the nodule is preserved and hypervasculature is noted, an inflammatory lymphadenopathy may be suspected.

2.3. Benign Peripheral Nerve Sheath Tumor (Fig.6)

Benign nerve sheath tumors are subdivided into two separate morphological groups with different histopathological characteristics: schwannoma (also known as neurilemoma or neurinoma) and neurofibroma.

2.3.1. Schwannoma

Schwannomas represent approximately 5% of benign soft-tissue neoplasms. They can occur at all ages, though is more frequent in the third and seventh decades. Schwannomas are benign, slowly growing neoplasms. They originate in a nerve and are composed exclusively of Schwann cells in a collagenous matrix.

On ultrasound, schwannomas are usually seen as a solid, ovoid, typically hypoechoic mass. Internal cystic cavities provide easier sound-through transmission. Schwannomas
rarely show an inner swag-like texture pattern and often present with admittedly tiny inner pseudocysts as additional pathognomonic special features. Posterior signal reinforcement is seen in 50% of cases. Schwannomas are usually eccentric in relation to the nerve axis. A schwannoma has hyperechoic boundaries. It appears neatly circumscribed from the adjacent structures, which are not infiltrated by the neoplasm. All schwannomas are well vascularized typically without exhibiting necrotic areas. In contrast, the so-called "ancient schwannoma" presents large concentric cystic inner transformations. The schwannoma is attached to the band-like structure of the nerve from which it originates. Together, on a longitudinal projection along the axis of the nerve, they can produce an ultrasound image which resembles a spoon. This spoon-like aspect can be considered as pathognomonic for this nerve sheath tumor. The nerve of origin retains its normal echoic qualities.

2.3.2. Neurofibroma

Typically, the solitary neurofibroma is a benign, slowly growing, and variably encapsulated neoplasm, originating in a nerve. Neurofibromas are intimately associated with the parent nerve, growing in a longitudinal fusiform manner with the nerve "entering and exiting" from the lesion. Surgical resection requires sacrificing the parent nerve because the neurofibroma cannot be separated from the nerve fibers. Multifocal neurofibromas and plexiform variants may occur in neurofibromatosis type 1.

A neurofibroma is a circumscribed, hypoechoic, spindle-shaped mass, often with a typically layered appearance in axial scans known as "target sign". In contrast to schwannomas, these tumors are located concentrically to a peripheral nerve, the vascularization is sparse (always depending on the fibroma component) and, typically, no regressive areas are found.. Neurofibromas are often elongated along the nerve axis and lobulated.

Nevertheless, there is a considerable overlap between the appearance on ultrasound of schwannomas and neurofibromas. Neurofibromas tend to be less sharply delineated. Like schwannomas, they do not always show distal acoustic enhancement.

2.4. Foreign Body /Suture Granulomas (Fig.7)

Foreign bodies are in general traumatic or after therapeutic procedures. They are usually fragments of wood, plants, plastic, suture material or metal that can be found in the subcutaneous tissues as the result of traumatic injuries or therapeutic procedures. Suture granulomas may occur after a surgical intervention in which nonabsorbable stitches are used.
These tumor-like lesions usually develop slowly and may cause only vague symptoms or remain asymptomatic for many years. However, sometimes the echographic study may be asked as an emergency for the localization of the foreign body, or due to a continued pain after a specific episode remembered by the patient. Many foreign bodies are readily apparent on radiographs and plain radiography is the initial imaging modality for the initial workup to identify and localize them. However, wood, plastic and glass may be very difficult to detect on it and that is the reason why Sonography is playing an increasing role, since it can be the most sensitive modality to detect subtle and nonopaque foreign bodies.

The echographic diagnosis is simple. The ultrasound appearance of foreign bodies varies to a great extent depending on the composition, shape and site of the fragment. Echogenic foci with shadowing or reverberation is typically seen. A hypoechoic halo of granulation tissue, edema, or haemorrhage surrounding the fragments is usually present with hypervascular pattern seen at color Doppler imaging which reflects neovasculature.

2.5. Anatomic Variants (Accessory Muscle) (Fig.8)

Accessory muscles are not uncommon. This is the term used to define supernumerary muscles that are usually not present. The majority of cases are unnoticed by the patient, because they are invisible and asymptomatic. When their localization is superficial, specially in thin patients, or when their cause pain, nerve entrapment or ischemia, is when they end up being studied and require imaging studies. US demonstrate a well-circumscribed elongated structure with the typical echotextural pattern of normal muscle. A normal contraction pattern during dynamic examination and small tendon can be found.

2.6. Muscle Hernias (Fig.9) (Fig.20)

A muscle hernia is a focal extrusion of muscle tissue through a fascial defect within the subcutaneous fat.

Most muscle hernias occur in the middle and lower thirds of the leg and affect the tibialis anterior muscle.

Muscle hernias can be either constitutional or secondary to local blunt trauma. Weakness in the overlying fascia due to perforating vessels and nerves, chronic compartment syndrome, occupational and sporting activities and trauma have been implicated as causes.

Muscle protrudes through a defect in the fascia into the subcutaneous fat and presents clinically as a soft-tissue mass. Patients, usually adolescents or young adults, present with a swelling that usually appears or enlarges when the affected muscle is contracted or the patient is standing erect.
Most hernias are asymptomatic and require no treatment. A few patients, often athletes, present with severe pain or cramps and require surgery. Fascial patch grafting using autologous fascia lata or synthetic mesh has been recommended.

Advantages of sonography include the ability to examine the patient dynamically or erect. If the fascia is thinned but no defect is apparent, there may be a slight muscle bulge with elevation of the overlying fascia. A mushroomlike appearance results when the herniated muscle overlaps the fascial defect and has a convex superficial contour. Muscle herniation may be constant or intermittent.

The herniated muscle and adjacent nonherniated muscle are less echogenic than normal muscle, possibly due to anisotropy or atrophy with crowding of the fibroadipose septa caused by the repetitive low-grade trauma of the herniation. The normal echogenic fibroadipose septa are pinched as they pass through the fascial defect, and this produces a spokelike appearance of echogenic lines that radiate from approximately the center of the defect in the fascia.

It is important not to press too hard. Even relatively light transducer pressure may reduce and efface the hernia. Asking the patient to contract the muscle or to stand also helps to identify the site and the nature of the hernia, although occasionally contraction effaces the hernia.

Diagnosis of the hernia and depiction of the fascial defect with MRI is also possible. The signal characteristics on MR imaging of these lesions are identical to skeletal muscle on all pulse sequences, as long as there is no adjacent edema or contusion. When in doubt, a dynamic MR examination with forced dorsiflexion and plantar flexion of the ankle can be helpful.

3. Solid lesions with non-specific findings

3.1. Adenopathy (Fig.10)

Lymphadenopathy may be secondary to an underlying inflammatory, tumoral or systemic process.

Its location is usually in the same regions as the lymphatic ganglions, in the groinal region, cervical, axillary region or epitroclear. We shall not be able to distinguish if we are before a tumoral or inflammatory adenopathy by its mere appearance; moreover, that is no the echography's function. However, adenopathy shall be the most probable diagnosis (and thus, the lesion's origin shall have to be studied) if we find a lesion in the described regions, in a patient, with or without oncologic or inflammatory historial, being the lession
round, hipoecoic, hypervascular, lobulated, without central hilum or displaced, and bigger than 1-2 cm.

3.2. Hematoma (Fig.11)

An hematoma does not arise spontaneously, except in patients with a coagulation disorder or who are on anticoagulation medication. A careful history is often required because the antecedent of trauma may have been minor and considered inconsequential by the patient. Direct external trauma on muscle may result in local hematoma, contusion, and partial and complete muscle laceration. The most frequently injured muscles are the vastus intermedius and the vastus lateralis.

In hematomas, the ultrasound appearance of the bloody collection varies over time. Soon after the blood leakage, it may appear highly reflective up to a pseudosolid appearance because of fibrin and erythrocytes forming multiple acoustic interfaces, any may present a very inhomogeneous pattern. With time, the hematoma tends to become completely anechoic as a result of liquefaction of the clot. A network of thin strands may often be seen resulting from fibrin organization. Fluid levels reflecting separation between serum (anechoic) and cellular components (echogenic) of blood can also be observed. Over a period of months, the hematoma eventually resolves, but a residual fibrous scar and focal retraction of the overlying skin may persist. However, there may be some reactive bordering vascularity as expression of clearing activity, inner vascularization or perfusion signal (contrast agent sonography) usually indicates a real neoplasm.

Deep intramuscular hematomas can be better depicted by MRI and in some rare cases even guided biopsy may be necessary to rule out the diagnosis.

Intratumoral hemorrhage is a rare finding, which can be observed in both benign and malignant lesions, and is difficult to differentiate from non-tumoral soft tissue hematoma. In the case of hematoma, contrast-enhanced imaging may reveal a small tumor nodule that may have been inapparent within the hemorrhage on conventional MR imaging. Caution is required, however, because the fibrovascular tissue in organizing hematomas may show enhancement. A history of acute trauma may be helpful for diagnosis, but trauma and internal bleeding may also happen in soft-tissue tumors. The best features suggesting hematoma are the progressive decrease in size of the lesion, the presence of fluid-fluid levels and the timedependent signal intensity changes.

3.3. Fat Necrosis (Fig.12)

Fat necrosis is the result of aseptic saponification of fat after any type of external trauma. Fat necrosis appears as a hyperechoic focus containing hypoechoic spaces related to nfracted fat.
The subcutaneous fat layer may demonstrate a variety of signal intensity changes that correspond to the stages of fat necrosis. Linear areas of edema with high signal intensity are commonly seen on T2-weighted images, but no well-demarcated soft tissue mass is visible. In a chronic lesion, areas of low signal intensity appear on T1-weighted and T2-weighted images as fibrosis and hemosiderin deposits accrue in the injured area.

3.4. Giant cell tumor of the tendon sheath (Fig.13)

Giant cell tumors of the tendon sheath are the second most common tumors of the hand, with simple ganglion cysts being the most common. It is a rare proliferative disorder of uncertain cause that affects the synovium, like a nodular form of pigmented villonodular synovitis.

Typically, these masses occur along the volar aspect of the hand and fingers and are most commonly adjacent to the DIP joint. The index and long fingers are most commonly involved. The second most common site is the toe.

Clinically, it is an indolent, slowly growing nodular firm mass. Pathologically, it is characterized by synovial villonodular proliferation, hemosiderin pigmentation, and stromal infiltration of histiocytes and giant cells.

Sonography shows a homogeneous, hypoechoic, well-delineated solid mass in close contact with a tendon. Color Doppler sonography detects variable internal flow signals. Because the lesions arise from the tendon sheath, close contact with a tendon is expected. It is important to note that the lesion does not move with the tendon when the affected digit is flexed or extended. No cystic degenerations, calcification, or shadowing are found. Sonography assesses the relation of the mass to the adjacent tendons, vessels, and nerves and can detect pressure erosions on the adjacent cortex.

3.5. Rheumatoid Nodules (Fig.14)

Rheumatoid nodules have high specificity in the diagnosis of rheumatoid arthritis. They are firm, non-tender, subcutaneous nodules and occur in 20-30% of rheumatoid patients. Their presence is associated with more severe, seropositive erosive disease. Nodules usually develop at sites subject to pressure, such as superficial regions over the extensor aspects of the elbow, or calcaneus.

Their seem to derive from an immune complex process between rheumatoid factor and immunoglobulin G initiating small vessel abnormalities and then progressing to necrosis and granulation tissue.
Ultrasound shows a hypoechoic avascular well defined mass. Central sharply demarcated hypoechoic area reflecting necrosis has been described. Echographic findings are unsppecific, and the patient's history shall help in the diagnosis.

3.6. Fibromatosis

Soft-tissue fibromatoses are divided into two major groups: superficial (fascial) and deep (musculoaponeurotic) lesions. Although soft-tissue fibromatoses are benign and have no metastatic potential, their biologic behavior is somewhat aggressive. Superficial fibromatoses arise from fascia or aponeuroses at palmar, plantar, penile (Peyronie disease), and knuckle pad locations.

3.7.1. Dupuytren Disease (Fig. 15)

Palmar fibromatosis is commonly referred to as Dupuytren disease and is the most common type of superficial fibromatosis. Palmar fibromatosis or Dupuytren contracture primarily involves palmar aponeurosis of the hand and its extensions.

The earliest clinical manifestation is the appearance of a subcutaneous nodule in the palm of the hand. As the disorder progresses, the overlying skin thickens and retracts, and a cord forms, producing progressive flexion contracture of the affected ray.

It has a prevalence of approximately 1-2% and mostly affects older men bilaterally in 42-60% of cases. The incidence also increases with concurrent patient clinical conditions or factors such as diabetes, smoking, chronic alcoholism, seizures, and infection. Rheumatoid arthritis is associated with a decreased incidence of Dupuytren contracture. It can be associated with fibromatosis in other areas, like fascia plantar or penile. In Dupuytren disease, the ulnar aspect of the fascia is more commonly involved near the distal crease of the hand and the bases of the ring finger.

Histologically, the nodules are quite cellular, composed of whorls of proliferative myofibroblasts. Cords contain a large amount of collagen and are hypocellular. The condition is treated surgically, but the recurrence rate is high (30-40%).

Usually the disease is diagnosed clinically on the basis of characteristic history and physical examination. Ultrasound shows Dupuytren disease as nodular thickenings of the palmar aponeurosis located between the skin and the flexor tendons. Fibrous nodules have sharp margins and appear hypoechoic without internal blood flow signals at color and Power Doppler imaging. Dynamic scanning in longitudinal planes during movements of the fingers gives early demonstration of adhesion with flexor tendons.

3.7.2. Plantar Fibromatosis (Ledderhose Disease) (Fig. 16)
Plantar fibromatosis, also called Ledderhose disease, is a benign, fibroblastic, proliferative, and locally invasive disorder characterized by the replacement of elements of the plantar aponeurosis by abnormal fibrous tissue, which slowly invades the skin and the deep structures.

The etiology of plantar fibromatosis is unknown but, as in palmar fibromatosis, trauma, neuropathy, faulty development, alcoholism and infection have been proposed as etiologic factors. Most lesions are located at the medial aspect and just superficial to the aponeurosis. Ledderhose disease usually occurs in patients aged between 30 and 50, with bilateral involvement seen in 20-50% of cases.

Patients present with a firm nontender or slightly tender fibrous nodule localized at the medial aspect of the middle third of the sole. Passive dorsal extension of the toes tightens the aponeurosis and can result in increased local pain. In large lesions, pain may derive from direct compression exerted by the plantar nodule against the medial plantar nerve.

US demonstrates plantar fibromatosis as a fusiform nodular thickening of the plantar fascia oriented according to its major axis. The lesion has a uniform hypoechoic appearance without internal cystic or calcific deposits. The ultrasound appearance of plantar fibromatosis is typical and demonstration of the continuity of the lesion with the fascia excludes other tumors, including synovial sarcoma and soft-tissue fibroma. Some nodules display moderate posterior acoustic enhancement. In small lesions, the deep portion of the fascia is unaffected and exhibits a normal hyperechoic fibrillar structure; in contrast, larger nodules appear more rounded and heterogeneous. Occasionally, a second smaller nodule can be found in the same or the contralateral foot. Color Doppler imaging can show increased intralesional vasculature. Overall, no correlation has been found among the ultrasound appearance of the nodules, the duration of symptoms and the clinical outcome. The main differential diagnosis of plantar fibromatosis is plantar fasciitis (thickened and hypoechoic fascia at or near the calcaneal insertion). The other differential diagnosis is a chronic partial tear of the fascia (clinical history of trauma).

3.7. Primary Malignant Tumors (Fig.17)

Some sarcomas as leiomyosarcoma, malignant peripheral nerve sheath tumor, dermatofibrosarcoma protuberans and a long etc. may present (although not commonly) in their first clinical appearance, as small and superficial lesions.

These tumors mostly appear inhomogenously, hypoechoic, hypervascularised, and sometimes ill-defined and with necroses or internal hemorrhage. The ultrasound is useful to suspect malignancy but is very unspecific. MRI and guided biopsy are requires.

3.8. Metastases (Fig.18), (Fig.19)
Superficial metastases involving the skin and subcutaneous tissue account for approximately 0.5%-9% of tumors. Histopathologically, metastases of the skin and subcutaneous tissue can develop from almost any kind of malignancy, but nearly half of them derive from melanoma, lung cancer and breast carcinoma. An intramuscular mass is first suspected to be a primary tumor rather than a metastasis, and multiplicity is always suggestive of metastasis.

Skeletal muscle metastases often present as a firm and tender mass deeply rooted within the muscle and with a diameter of more than 5 cm. Presentation with pain is commonly seen in skeletal muscle metastases while primary sarcomas tend to be painless. Cutaneous and subcutaneous metastases tend to be painless and are better felt when underlying muscles are actively contracted. They are generally 0.5-2 cm in diameter when discovered. Subcutaneous metastases are firm and freely movable.

In most cases, metastases appear as well-circumscribed solid hypoechoic masses. A lobulated shape and multiple peripheral vascular pedicles feeding internal irregular vessels seem the most important gray-scale and color Doppler ultrasound imaging findings for differentiating them from other benign soft-tissue masses.

3.9. Nodular Fasciitis

Nodular fasciitis is a benign proliferation of fibroblasts and myofibroblasts that may be mistaken for a sarcomatous lesion because of its rapid growth.

Nodular fasciitis most often occurs in in young adults. Involves most frequently the upper extremities partiuculary the volar aspect of the forearm, followed by the head and neck, the lower extremities, and the trunk

Most patients are asymptomatic or note only mild discomfort.

Three general subtypes of nodular fasciitis may be identified on the basis of the lesion location (subcutaneous, intramuscular, or fascial)

Ultrasound shows a well-defined, ovoid or lobulated, hypoechoic or mixed iso-hypoechoic subcutaneous masses which may also affect deep muscle fascias.

Deeper lesions, because of their bigger size and deeper location, can mimic soft-tissue malignancies.

Nodular fasciitis can be subdivided into three types based on the predominant histological features: myxoid (type 1), cellular (type 2), and fibrous (type 3)

MR imaging appearance is variable and reflects the gross morphology of the tumor
Myxoid and cellular lesions are iso- to hyperintense compared with skeletal muscle on T1-weighted images and iso- to hyperintense compared with fat on T2-weighted images. Lesions with a more fibrous histology are markedly hypointense on all spin-echo sequences.

The differential diagnosis at MR imaging includes extraabdominal desmoid tumor, neurofibroma, fibrous histiocytoma, and soft-tissue sarcoma.

Ultrasound findings are not specific and MRI must be done.

Images for this section:

Two examples of ventral ganglion of the wrist. A Long-axis gray-scale and B power Doppler ultrasound images obtained over the mass show a multilobulated anechoic cyst (asterisks) closely adherent to the radial artery (arrow). The ganglion communicates with the radiocarpal joint through a tortuous pedicle (arrowhead). C Patient with pulsatile mass. Longitudinal color Doppler ultrasound shows a well-defined, anechoic structure without septation and inner vasculature surrounded by the radial artery.

Fig. 1: Fig.1
**Chronic frictional bursitis olecrani.** A Short axis gray-scale and B power Doppler ultrasound over the posterior elbow reveals an oval structure with a thickened wall and hypervascular pattern, (arrowhead) and an anechoic center (asterisk). Ol (olecranon).

**Fig. 2:** Fig.2
**Epidermal inclusion cyst.**

**A** Power Doppler ultrasound demonstrates a rounded solid hypoechoic well-defined mass (asterisk) with posterior acoustic enhancement (arrowheads) without extension into the dermis. Absence of flow inside the lesion on power Doppler is noted.

**B** Sagittal T1-weighted image of the ankle in the same patient shows well-defined subcutaneous mass in the plantar fat pad (asterisk) homogeneous and with low signal intensity.

**C** Sagittal STIR shows mixed signal intensity with variable low-signal components within the mass (arrow).

**Fig. 3:** Fig.3
**Subcutaneous lipoma.** Spectrum of typical ultrasound appearances **A-B** Long-axis gray-scale and power Doppler ultrasound of the arm shows an elongated well-defined mass (white asterisk) with its greatest diameter parallel to the skin. The mass has partially well-defined margins (blue arrows) and appears isoechoic relative to adjacent fat (red arrowhead). Its echotexture consists of short thin linear striations that run parallel to the skin (red arrow). Absence of vascularity inside the lesion is noted. **C** Transverse US image of the back in another patient demonstrates a well-defined hyperechoic rounded mass (blue asterisk) with well defined margins (blue arrows).

**Fig. 4:** Fig.4
Benign axillary lymph node. A long axis gray-scale and B color Doppler ultrasound shows oval shape and thin cortex lesion with central fatty hilum (asterisk). Note the hypovascularity of the lesion and the absence of cortex lobulations.

Fig. 5: Fig.5
**Peripheral nerve sheath tumor.** **A** Long axis extended field-of-view gray-scale ultrasound image over the forearm shows the tumor as an oval hypoechoic slightly heterogeneous mass (arrows) in continuity with the nerve (white arrowheads). **B** Power Doppler ultrasound reveals an hypovascular mass with peripheral vascularization (red arrowheads).

**Fig. 6:** Fig.6
**Plantar foreign body.** A Long axis and B power Doppler US images show an hyperechoic elongated plant fragment (asterisk) inside the subcutaneous tissue. The fragment is surrounded by an hypoechoic hypervascular halo (red arrows). **C-D Suture granuloma:** Ill-defined lesion superficial to rectus abdominis muscle in a patient with a long-standing painless lump 6 months after abdominal surgery. **C** Long axis gray-scale and **D** short axis power Doppler ultrasound show a hypoechoic granuloma (red arrows) surrounding surgical suture (asterisks). Hyperemia in the granular tissue is noted (blue arrow).

**Fig. 7:** Fig.7
**Extensor digitorum brevis muscle.** A Photograph showing a small lump (arrows) between extensor tendons of the second and third fingers. B Long axis gray-scale ultrasound shows a elongated structure with the typical echotextural pattern of normal muscle crossing between carpal bones and extensor tendons. A normal contraction pattern during dynamic examination was noted. (not seen). Capitate (Cp), lunate (Lu).

**Fig. 8**: Fig.8
**Muscle hernia.** A Long axis gray-scale ultrasound shows muscle bulge (asterisk) with mushroomlike appearance through fascial defect (red arrows) in tibialis anterior muscle. Similar findings can be seen in B-C extensor carpi ulnaris hernia: B long axis gray-scale ultrasound shows a subtle broad muscle herniation (arrows). C short axis gray-scale ultrasound shows fascial defect (blue arrows).

**Fig. 9:** Fig.9
**Axillary adenopathy.** Patient with breast carcinoma. **A** Long axis ultrasound shows a lobulated, hypoechoic mass (asterisk). No central hili is seen. Note hypervascularity inside the lesion in color Doppler ultrasound in **B**.

**Fig. 10:** Fig.10
**HEMATOMA**

**CASE 1**

A Transverse sonogram of breast showing a hyperechoic fusiform ill-defined collection (asterisk) corresponding to acute hematoma.

**CASE 2**

B-C Long-axis gray-scale ultrasound over the middle gluteous muscle demonstrate a well defined hypoechoic area (asterisks) corresponding to subacute hematoma. C color Doppler ultrasound shows non-vascularization.

**CASE 3**

D-E Long-axis gray-scale and power Doppler ultrasound images obtained of a finger nail bed show an echo-free fluid collection (asterisks) reflecting an hematoma at the phase of clot liquefaction. No internal vascularization is noted in E.

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**Fig. 11:** Fig.11
Fat necrosis. A-B Long axis gray-scale US shows well-circumscribed hypoechoic areas (arrowheads) surrounded by ill-defined hyperechoic halo (asterisks) within the subcutaneous tissue (arrows) representing fat necrosis in a patient who presented previous breast trauma.

Fig. 12: Fig.12
**GIANT CELL TUMOR OF THE TENDON SHEATH**

**Fig. 13:** Giant cell tumor of the tendon sheath. 

**A** Short-axis gray-scale US image over the lateral aspect of the third finger, in a patient with a painless mass, demonstrates a lobulated, well-margined hypoechoic lesion (asterisks) located close the flexor tendons (ft) and the proximal phalanx (ph). 

**B** Absence of blood flow signals inside the tumor is evidenced by Power Doppler US.

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RHEUMATOID NODULE

**Rheumatoid nodule.** Superficial lesion in the inferior border of the body of the scapula in a patient with long-standing rheumatoid arthritis. **A** Long axis gray-scale and **B** power Doppler ultrasound show a well defined avascular homogeneous hypoechoic lesion (asterisk) closely related to the scapular body (sc).

**Fig. 14:** Fig.14
Palmar fibromatosis. A Long-axis gray-scale and B power Doppler ultrasound shows a nodular ill defined hypoechoic lesion (arrows), superficial to the palmar aspect of the third metacarpophalangeal joint. In color Doppler US this lesion is hypovascular. Ft. flexor tendon, ph. Phalanx.

Fig. 15: Fig.15
PLANTAR FIBROMATOSIS (LEDGERHOSE DISEASE)

**Fig. 16:** Fig.16

*Plantar fibromatosis. A* Longitudinal gray-scale and *B* power Doppler images in the region of midfoot show a diffuse markedly nodular thickening (arrows) of the plantar fascia that exhibits ill-defined borders and internal flow signals (arrowheads).
Malignant peripheral nerve sheath tumor. A long axis gray-scale and B power Doppler ultrasound show a well-defined lesion (asterisk), superficial to the medial malleolus (mm), heterogeneous, predominantly hypoechoic with patchy hyperechoic focus and enlarged vessels inside. These findings are non-specific but may lead to suspect malignancy.

Fig. 17: Fig.17
**METASTASES**

**Fig. 18:**

**Metastases.** **A** Radiography of the radius shows a cortical lytic lesion (red arrows) with aggressive periosteal reaction (blue arrow) in a patient with unknown lung cancer. First consultation was triggered by a lump in the forearm. US was the first imaging study carried out. **B** Long axis gray-scale ultrasound shows anechoic lesion in the cortical surface of the radius with hyperechoic lines inside corresponding to the periosteal reaction (blue arrows).
**Metastases.** C gray-scale and D color Doppler US images in a patient with previously diagnosed breast cancer demonstrate well-defined homogeneous hypoechoic nodules (asterisk) located within the subcutaneous tissue. Correlative color Doppler imaging shows a hypervascular pattern with peripheral and internal vessels.

**Fig. 19**: Fig.19
Conclusion

Ultrasound, combined with the patient's clinical features, age or tumoral localization, is an excellent first approach tool for small superficial soft tissue lumps. Ultrasound can distinguish certain benign tumors or tumor-like lesions (such as typical subcutaneous lipomas, ganglionic cysts, foreign bodies, etc.) where additional imaging may be unnecessary, from other undetermined lesions that could suggest malignancy, which should be analysed further by means of other techniques such as MRI, or eventually, biopsy.

Personal Information

References


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