Intramuscular non traumatic lesions: Ultrasonographic evaluation

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Learning objectives

To provide an overview of the ultrasonographic findings of diverse non traumatic intramuscular lesions and the correlation with MRI and CT when necessary.

Background

A broad spectrum of tumors and tumor-like conditions affecting muscles are common and account for a high percentage of orthopaedic consultations. Usually these patients consult because of palpable lesions. Ultrasonography is able to evaluate morphology, size, margins, echostructure and Doppler vascularization. These features may lead frequently to a conclusive diagnosis. Sometimes, we need to complete the study with MRI or CT, specially in suspicous or unspecific lesions. When biopsy is required, sonographyc guide is a very useful tool.

We describe the epidemiology, the clinical findings and US features of these lesions.

Imaging findings OR Procedure details

The most common tumors that we found, are the following:

LIPOMAS

Lipoma is the most frequent soft-tissue tumor (nearly 50% of all mesenchimal tumors). It's a benign lesion of fat mature tissue and it is not distinguishable histologically from normal fat.

Lipomas arising in muscle are quite common and can involve muscular and intermuscular tissue.

Intramuscular lipomas occur predominantly in adults. Patients, usually refer a palpable mass in the large muscles of the extremities.
The fat in the intramuscular lipoma may infiltrate between skeletal muscle fibers and resulting it a striated appearance. The most frequent locations are lower extremity (45%), trunk (17%), shoulder girdle (12%) and upper extremity (10%).

Ultrasound shows an intramuscular lesion with similar echogenicity to that of subcutaneous fat tissue or hyperechogenic, usually well defined and sharply circumscribed. Its long axis is parallel to the muscle fibers. (Figs. 1,2)

It is possible to find similar areas to muscle extending into the lesion (infiltrating lipomas) (Figs. 3,4).

Intramuscular lipoma may also contain other mesenchymal elements, especially fibrous connective tissue, appearing as thin linear, hyperechogenic septa. These elements are usually, better depicted in CT, as linear densities and in MRI as linear areas of decreased signal on all pulse sequences. Non adipose areas representing fat necrosis, associated calcification, fibrosis, inflammation, areas of myxoid changes or hibernoma, are reported in up to 30% of cases and may simulated well-differentiated liposarcoma.

GANGLIA

Ganglia are common space-occupying lesions that usually derive from degeneration of periarticular soft tissues, but they can be found far from these structures. Probably, they are due to chronic microtrauma, mucoid degeneration or synovial herniation. Ultrasound shows ganglia as well-defined, anechoic structures with posterior acoustic enhancement, uni or multilobulated, without Doppler signal. We can find septa or thick walls, specially when they are present from a long time.

Intramuscular ganglia, not related with adjacent joint, are rare. They are more commonly localized around the knee joint, specially in the quadriceps and gastrocnemius muscles. MRI shows hypointense signal on T1 sequences and hyperintense signal on T2 and DP-weighted images, sometimes with septa and without enhancement following intravenous contrast administration. (Figs. 5,6).

HEMANGIOMA:

The term "hemangioma" include a broad spectrum of lesions, from capillary forms to vascular malformations (capillary, cavernous, arteriovenous, venous and mixed types). The hemangioma is composed by a vascular component and may contain thrombus, calcification, hemosiderin, fat, smooth muscle and fibrous tissue. Reactive fat is the most frequent non vascular element associated with this tumor.

Ultrasound depicts a heterogeneous appearance. We can found a complex, intramuscular, ill defined tumor, with hypoechoic and anechoic areas corresponding
to vascular channels and showing Doppler signal. Hyperechoic areas are due to fat component. Phleboliths may be seen in 50% of cases as hyperechogenic foci with acoustic shadowing, normally within the hypoechogenic intralesional component. (Fig 7)

Occassionally, hemangiomas evaluation can be difficult, specially if they have a large size, involve more than a single muscle or their limits are not well defined. In these cases and when surgery is required, too, MRI studies are needed.

**MYXOMA:**

**Intramuscular myxoma** is a benign lesion characterized by an abundant myxoid matrix and a paucity of spindle-shaped stromal cells. There is a female predominance between 48 and 70 years. They do not tend to reccur or metastasize. The typical intramuscular myxoma is an ovoid, well defined lesion, hypoechogenic in US imaging, usually with cystic component and posterior enhancement. On MRI, myxoma shows a fluidlike signal intensity and a peritumoral fat ring, mainly visible on T1-weighted sequences. Enhancement after contrast administration is variable. Although myxomas usually appear well defined, these lesions have no capsule and infiltrate the adjacent athrophic and edematous striated muscle. A fat tail is described in these tumors (Fig. 8).

**SCHWANNOMA:**

It is a benign nerve tumor that derive from the Schwann cells. The reported prevalence is lower than 5% of all soft-tissue tumors. Typically it presents as a solitary slow growing mass, usually assymptomatic. Generally schwannomas are solitary, size less than 5 cm, capsulated and present a slowl eccentrical growth along the nerve axis within the epineurium. Normally they occur in middle-aged individuals. Sonography shows a well-defined, solid, hypoechogenic lesion with posterior enhancement. Occassionally it shows hyperechogenic areas, due to collagen deposits, or anechoic cystic areas. They are well-vascularized, and power Doppler study demonstrates abundant vascular signal. When the nerve is identificated entering and exiting from the extremities to the lesion, we can accuretly diagnose nerve tumor. This is not always possible, specially when the affected nerves are small as some muscular branches. In these cases, when an intramuscular lesion is present, a schwannoma is a diagnosis to consider if we find the characteristics previosly described. Differential diagnosis must be make mainly with myxoma. Fat tail can be present in intramuscular schwannnomas (Fig. 9).

**ABSCESS AND HYDATIC DISEASE:**

**Pyomiositis** is a suppurative bacterial infection of muscle. Primary pyomiositis can involve any muscle group in the body. Typically, only a single muscle is affected, although
11-43% of patients with pyomiositis have involvement of multiple sites. The most common site of infection is the quadriceps muscle, followed by the gluteal and iliopsoas muscles. Upper extremity muscles being affected less frequently. This condition is most common in diabetic or immunocompromised patients, but can also occurs after minor blunt trauma and local hematoma.

The most frequent germs is the staphilococcus aureus followed by mycobacterium tuberculosis and streptococcus pyogenes.

Clinical presentation consists of dull cramping pain and localized muscle tenderness with or without fever. Ultrasound initially shows muscle swelling, diffuse hyperechogenicity and doppler hypervascularization, cause of edema. We can found small hypoechoic foci due to early necrosis and small abscesses. In the supplicative phase, we can detect fluid collections with well defined posterior enhancement, variable echotexture and debris consistent with local abscess formation. Doppler color study shows peripheral hyperemia around the abscess (Fig. 10).

**Hydatic disease** is a world wide zoonosis produced by echinococcus granulosus. Humans beings are accidental hosts and acquire infection by infesting ova from fomites, contaminated water or direct contact with dogs. Embryos from duodenum pass through mucosa to reach liver through portal venous system where they form hydatid cysts. Primary intramuscular form of hydatidosis without thoracic or abdominal disease is rare (0.7-3%). They are usually associated with involvement of other solid organs. On clinical basis, infection mimics a soft-tissue tumor, and the preoperative radiological diagnosis is very important to avoid biopsy.

Sonographically, hydatic cyst have a thin or thick wall resembling the pericystic structure which consisted of connective tissue and scattered hyaline cells. Internal echoes or vesicular fibrils can be present. Multiple echogenic foci due to hydatid sand may be evident giving the "snow storm" sign. Simple cysts do not demonstrate internal structure. On CT, we can found a well- defined cystic lesion with daughter cysts (multiple small rounded hypodensities occupying the lesion), they may contain septa or debris in it, with no enhancement after intravenous contrast injection. MRI typically shows a thin, low intensity rim, probably representing the pericyst. In chronic cases lesion is mummified, imaging techniques show a inert calcified lesion. Hydatic disease should be included in the differential diagnosis for any cystic soft tissue mass found in patients from geographical areas where the disease is endemic (Fig11).

**DESMOID FIBROMATOSIS:**

Usually these tumors grow rapidly and have a diameter of more than 5 cm at presentation, and frequently extend along muscle. The lesion contains fibroblasts and variable amounts of dense collagen fibers. Most frequent locations are pelvis, chest and abdominal wall and mediastine.
US depicts masses extending along fascia and muscle fibers. The echogenicity is variable depending on cellularity and variable distribution of water and collagen. Limits can be well or poor-defined. Usually we can observe a weak fibrilar echostructure with posterior attenuation corresponding to dense collagen. Doppler color image is variable, from hypervascular to hypovascular lesions. Normally, lesions with more collagen content, are hypovascularized. On MRI the different patterns of signal intensity are variable and change over time, reflecting the different amounts of their components (Figs. 12,13). As these lesions evolve, cellularity and extracellular spaces decrease, collagen increases and irregular morphology is present.

Abdominal fibromatosis is a distinct entity that tends to occur in women during pregnancy or within the first year after delivery and in women who use oral contraceptives, estrogen may be a growth factor for fibroblastic tumors. The most frequent sites affected are the rectus abdominis and internal oblique muscles of the anterior abdominal wall (Fig. 14).

**METASTASIS, SARCOMAS:**

Clinical incidence of intramuscular metastasis is low. Usually secondary to breast, colon and lung tumors. Although the diagnosis can be suspect by the clinical context, sonographic findings are unspecific (often round or ovoid masses, with irregular limits and hypoechoic respect to muscle). The definitive diagnosis is reached after biopsy. Doppler vascularization is variable. Melanoma and renal carcinoma metastasis are hypervascular (Fig 15 & 16).

About sarcomas, liposarcoma represents the second most common type of soft-tissue sarcoma, after fibrous and fibrohistiocytic malignancies and accounts for 10-35% of all soft-tissue sarcomas. This lesion usually occurs in men with a peak prevalence during the 6th to 7th decades of life. The WHO categorized liposarcomas into five types: well-differentiated, myxoid, round cell, pleomorphic and dedifferentiated. Well- differentiated is the most common type and may locally recur. US, usually shows a large, multilobulated well- circumscribed mass, generally similar to mature lipoma. The presence of more complex appearance with thick septa, nodular or globular nonlipomatous foci with different echogenicity respect to fat and Doppler vascularization suggest liposarcoma, MRI and biopsy are needed.

Myxoid liposarcoma is the second most common type of liposarcoma and is a well defined, multinodular mass with different amount of myxoid and round cells components. Areas of relatively mature adipose tissue are usually present but sparcle (< 10% of the lesion overall volume). US shows a complex, hypoechoic mass with posterior acoustic enhancement (Figs. 17,18) usually unspecific. When a sarcoma is suspected MRI is mandatory to evaluate the extent.
Fig. 1: Intramuscular lipoma of the triceps brachii muscle. US scans show a mass (arrows) with echogenicity similar to muscle (M). Conventional radiography depicts fat density of the lesion (arrows)
Fig. 2: CT and MRI T1-weighted images demonstrate an intramuscular, well defined mass, with similar attenuation (*) and signal intensity (arrows) to the subcutaneous tissue.
**Fig. 3:** Woman with a painless mass over distal thigh. Conventional radiography shows a lesion with a striated, low density pattern. US demonstrates a large, hypoechoic mass within vastus medialis muscle.
Fig. 4: US, CT and T1-weighted images of the same patient showing the mass (arrows) with the characteristic striated pattern of infiltrating lipoma, due to intermingled muscle fibers with fat.
Fig. 5: Patient with palpable lesion over distal thigh. US shows a cystic lesion with thin septa localized within the vastus lateralis, corresponding to intramuscular ganglion.
**Fig. 6:** Intramuscular ganglia. US demonstrate a cystic, homogeneous, non-vascularized lesion. Sagital T2-weighted and sagital and Gd- enhanced T1-weighted axial and sagital correlation show a hyperintense lesion on T2 and hypointense lesion with peripheral enhancement on T1-weighted images.
**Fig. 7:** Intramuscular hemangioma in brachioradialis muscle. Ultrasonography in longitudinal plane depicts a heterogeneous lesion with hyperechoic areas (*) corresponding to fat tissue, hyperechoic foci with posterior acoustic shadowing due to phleboliths. The cystic areas represent blood-filled cavities, demonstrated by the power Doppler study.
**Fig. 8:** 58-year-old woman with shoulder pain. US reveals a hypoechoic, intradeltoïd, well-defined lesion with posterior enhancement, non vascularized (arrows) with a fat tail (*). Axial T2-weighted and sagittal T1-Weighted images show a hyperintense and isointense respect to muscle lesion, respectively. Biopsy confirmed intramuscular myxoma.
Fig. 9: US reveals a lesion with a wide cystic area inside, thick walls and fat tail (*), corresponding to schwanoma within the adductor longus muscle. Superior images corresponding to a similar lesion within tibialis anterior muscle in other patient.
**Fig. 10:** 60-year-old woman with fever and right thigh pain. CT and US show a swollen right vastus intermedius (arrows) and subcutaneous edema. Muscle tissue preserves its normal appearance. (L) corresponding to normal side.
**Fig. 11:** Immunocompromised patient with pain and soft-tissue swelling in the thigh. US and MRI reveal a lesion with cystic areas inside and a thick wall. The lesion is localized in the medial compartment musculature (arrows).
**Fig. 12:** Desmoid fibromatosis. 25-year-old patient with gluteal palpable lesion. US images show a hypoechoic lesion of the gluteus medius muscle with subcutaneous extension and a hyperechoic area inside.
Fig. 13: CT study of the same patient shows the gluteus medius lesion and the subcutaneous involvement. After intravenous contrast injection, no significative enhancement is appreciate.
**Fig. 14:** 43-year-old woman with palpable lesion in the abdominal wall. Transverse images over abdominis rectus demonstrate an intramuscular (*) heterogeneous, hypoechoic tumor with infiltrative growth along fascial plane (arrow). Power Doppler study shows an hypervascular pattern.
Fig. 15: Intramuscular metastasis of cervical carcinoma. We can see a solid, heterogeneous, lobulated lesion localized in the gluteus maximus.
Fig. 16: Patient with lung carcinoma, the onset of his disease was the appearance of multiple soft-tissue masses. US reveals an intradeltoid lesion and a large mass in the supraspinatus muscle. Both are hypoechoic and hypervascularized.
Fig. 17: Leyomiosarcoma. 77-year-old woman with an anterior leg mass. US shows a large mass of the tibialis anterior muscle, heterogeneous and hypervascularized. Tendon structure is preserved.
**Fig. 18:** 50-year-old woman with a previous thigh chondrosarcoma who refers a mass in the posterior thigh. US reveals a large hyperechoic mass. CT and MRI show a mass with fat areas inside. Biopsy reveals myxoid liposarcoma.
Conclusion

Intramuscular palpable lesions are common. Sonography is an available technique used as the initial diagnostic tool, that frequently can establish a conclusive diagnosis and can select patients who need other diagnostic methods as CT or MRI. It is important to know ultrasonographic semiology of these lesions in order to make a correct differential diagnosis.

Personal Information

References


