Superficial soft-tissue masses: is it always a lipoma?

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Learning objectives

To illustrate the differential diagnosis of superficial soft tissue masses and to describe the sonographic features of some benign and malignant soft tissue lesions. These masses do sound like a classic lipoma, but there are some rare but concerning malignant tumors that also appear this way.

Background

High-resolution sonography is well suited for screening soft tissue masses because of its safety, low cost, and real-time, dynamic imaging. The purpose of our study was to elaborate sonographic features of soft tissue masses.

We retrospectively review cases of patients who underwent sonographic evaluation of a soft-tissue mass during a 2-year period, followed by biopsy or resection. Evaluation of the soft tissues was guided with use of physical examination findings and patient history. For sonographic evaluation of superficial soft-tissue masses, linear array transducers with multifrequencies of 12-5-MHz are often used. Grayscale and color Doppler ultrasonography is applied to the lesion in at least two perpendicular scanning planes.

Imaging findings OR Procedure details

Soft tissue tumors are frequently encountered in clinical practice. The incidence of malignant soft tissue tumors is approximately 1-1.4 new cases per 100,000 population whereas the incidence of benign soft tissue neoplasms is estimated to be at least 100 times more common.

Through dynamic ultrasound examination of the movement of the adjacent body segment and tracing the adjacent structure of the tumor with color Doppler imaging, ultrasound can provide valuable information before surgery or biopsy, even though it is usually difficult to diagnose a soft tissue tumour using ultrasound only.
We describe the ultrasound features of soft-tissue masses: echogenicity, boundary, margin, composition, size, related surrounding tissue in grayscale ultrasonography and grading of color DOppler Ultrasonography.

**LIPOMAS** are one of the most common mesenchymal tumors that can develop in any fat-containing region of the body. Commonly present at a clinical examination as soft, painless, well-delineated and mobile masses. Soft-tissue lipomas have a variable sonographic appearance that is subjectively difficult to characterize. Classically they have been described as being homogeneous, well defined and hyperechoic, but there are frequent exceptions. **Fig. 1** on page 7

Soft tissue vascular tumours are a common group of lesions. The **HEMANGIOMAS**, which are among the most common soft-tissue tumors in infants, are benign vascular lesions. They consist of cells and endothelial forming a vascular mass with or without light and, in contrast to vascular malformations, always develop after birth. In b-mode typical hemangiomas are hyper or hipoecogenic nodules, and present with sharp but often irregular outer borders, while with color Doppler more than 90% of the hemangiomas show a high vascularity. **Fig. 2** on page 8

**VENOUS ANEURISM** are less common: they’re defined as local widening and bulging of a vein. The lower extremities are the most frequently affected, the popliteal vein being the most common site, followed by aneurysms of the head and neck, abdominal veins, and thoracic veins. Sonographically it’s an anechoic cystic structure, well-defined wall, which is continuous with superficial veins. It is easily shown compresible and the Doppler doesn’t show blood flow. **Fig. 3** on page 26

**ORGANIZED HEMATOMA** represents a complication of a muscle injury. At US they usually appears as solid, heterogeneous mass with posterior acoustic enhancement. They can simulate a neoplastic mass: anamnesis usually allows a correct interpretation. Doppler study is important because we will never find vessels inside. **Fig. 4** on page 9

**FAT NECROSIS:**

Subcutaneous fat necrosis, one of the features of panniculitis, occurs after trauma and subcutaneous injections. It’s described in association with a variety of medical conditions (pancreatitis, collagen disease, disorders mieloproliferatius, asphyxia and hypothermia). Fat necrosis in nonbreast subcutaneous areas is not shown well.
LYMPH NODE: The sonographic appearances of normal nodes differ from those of abnormal nodes. Sonographic features that help to identify abnormal nodes include shape (round), absent hilus, intranodal necrosis, reticulation, calcification, matting, soft-tissue edema, and peripheral vascularity.

On gray-scale sonography, normal and reactive nodes tend to be hypoechoic compared with adjacent muscles and ovaL, with echogenic hilus, which is continuous with adjacent soft tissues. On color Doppler and power Doppler, normal cervical nodes show hilar vascularity or appear avascular, and reactive nodes predominantly show hilar vascularity. Fig. 6 on page 12

Malignant lymph nodes include metastatic and lymphomatous nodes. On grayscale sonography, metastatic nodes are usually hypoechoic, round, and without echogenic hilus. Coagulation necrosis, which appears as a demarcated echogenic focus, may be found in metastatic nodes. Eccentric cortical hypertrophy is a useful sign to indicate focal tumor infiltration. Lymph nodes with cystic necrosis are suggestive of malignancy. On color Doppler and power Doppler, metastatic and lymphomatous nodes usually show peripheral or mixed vascularity. Fig. 7 on page 11

SEBACEOUS CYST are benign lesions and represent the most common cutaneous cysts. While they may occur anywhere on the body, they occur most frequently on the face, scalp, neck, and trunk.

Sonography of the lesion showed a hypoechoic, inhomogenous mass with no flow on color Doppler imaging. Sonography can give a clue of an early inflammation of the cyst. The internal echos (sebaceous cysts always have internal echos) become coarse and tend to separate from the cyst wall. If the inflammation does not resolve, the cyst will turn red and then become fluctuant, the stage we, clinically, recognize as an inflammed sebaceous cyst. Fig. 8 on page 13

A DERMOID CYST is a cystic teratoma that contains developmentally mature skin complete with hair follicles and sweat glands, sometimes clumps of long hair, and often pockets of sebum, blood, fat, bone, nails, teeth, eyes, cartilage and thyroid tissue.

Dermoid cysts may appear in multiple locations in the body. They can appear in young children, often near the lateral aspect of the eyebrow (right part of the right eyebrow or left part of the left eyebrow). They often have a rubbery feel. Fig. 9 on page 14
are typically well circumscribed, thin-walled, unilocular masses. Globules of fat floating within the lumen may produce a characteristic “sac-of-marbles” appearance on US. Fig. 10 on page 15

**A BRANCHIAL CLEFT CYST** (also known as "Pharyngeal fistula" or "Branchial cyst") is an oval, moderately movable cystic mass that develops under the skin in the neck between the sternocleidomastoid muscle and the pharynx. They are remnants of embryonic development and result from a failure of obliteration of the branchial cleft, which in fish develop into gills. Second branchial cleft cysts are most common. They are found along the anterior border of the sternocleidomastoid muscle, passes through the carotid bifurcation and into the tonsillar pillar.

Second branchial cleft cysts appear on sonograms as well-defined, cystic masses with thin walls and posterior enhancement. On CT they appear as well circumscribed homogeneously low density cysts with no discernable or very thin wall, while on MR they are isointense to CSF on T1 and hyperintense cyst with minimal wall on T2. Fig. 11 on page 16

**FIBROMATOSIS COLLI** is an uncommon benign condition that presents in neonates as a mass in the anterior portion of the neck, in intimate association with the sternocleidomastoid muscle. The lesion typically appears 1-4 days after birth. Imaging findings in this disorder must be differentiated from other causes of neck masses in this age group in order to prevent unwarranted therapeutic procedures. Sonographic findings include a uniformly isoechoic or slightly hypoechoic mass within the sternocleidomastoid. With real-time sonography, the lesion can be shown to move synchronously with the sternocleidomastoid. Fig. 12 on page 17

**PATHOLOGIC CONDITIONS OF MAJOR SALIVARY GLANDS**

Inflammatory diseases are the most common diseases affecting the major salivary glands. Acute inflammation causes painful swelling of the salivary gland, often bilaterally. Viral salivary gland infections are the most common in children. In acute inflammation, salivary glands are enlarged and hypoechoic. They may be inhomogeneous; may contain multiple small, oval, hypoechoic areas; and may have increased blood flow at US. Enlarged lymph nodes with increased central blood flow may be observed in acute inflammation of salivary glands. Fig. 13 on page 18

**NEOPLASMS**: Salivary gland neoplasms are relatively rare. Most of them are benign (70%-80%) and found in the parotid glands (80%-90%). The most common benign
neoplasms of major salivary glands are pleomorphic adenomas (mixed tumor) and Warthin tumors. At US, pleomorphic adenomas are hypoechoic, well-defined, lobulated tumors with posterior acoustic enhancement and may contain calcifications. Fig. 14 on page 19. Warthin tumors are oval, hypoechoic, well-defined tumors and often contain multiple anechoic areas. They are often hypervascularized.

US features of malignant salivary neoplasms include the following: an irregular shape, irregular borders, blurred margins, and a hypoechoic inhomogeneous structure.

**PERIPHERAL NERVE SHEATH TUMORS:**

A peripheral nerve sheath tumor is a soft-tissue neoplasm derived from Schwann cells. Schwannomas (or neurilemmomas) Fig. 15 on page 20 and neurofibromas Fig. 16 on page 21 are the two most common types of peripheral nerve sheath tumors, and they are difficult to distinguish with imaging. Neurofibromas may present as a solitary mass or as multiple masses as part of neurofibromatosis.

To diagnose them is essential to see the relationship between the tumor and nerve: shwannomas did not appear to be continuous with the adjacent peripheral nerve, while neurofibromas are centrally related to the involved peripheral nerve.

Peripheral nerve sheath tumors are often hypoechoic with posterior acoustic enhancement and so may simulate a ganglion cyst. The presence of intrinsic blood flow on color Doppler sonography and peripheral nerve continuity suggests the diagnosis of peripheral nerve sheath tumor.

**GIANT CELL TUMOURS OF THE TENDON SHEATH:**

Giant cell tumor of the tendon sheath, also known as localized nodular tenosynovitis, is one of the most common soft-tissue tumors in the hand and feet. These tumors are idiopathic proliferative lesions that can cause bone erosions. Clinical findings include soft-tissue swelling and pain They typically appear as solid, (differential diagnosis with ganglion, which is liquid Fig. 17 on page 22), homogeneous hypoechoic masses with detectable internal vascularity that are associated with the flexor tendons of the fingers. Fig. 18 on page 23.

**GRANULOMA ANNULARE:** is a chronic skin disease consisting of a rash with reddish bumps arranged in a circle or ring. The cutaneous form is usually a clinical diagnosis that does not require imaging studies. It happens at any age, most often between 2 and 5 years. The most common location is in the lower extremities and it manifests as a
subcutaneous, heterogeneous, hypoechoic mass, located in the subcutaneous tissue Fig. 19 on page 24, highly vascularized and therefore difficult to distinguish from a malignant lesion.

**ENDOMETRIOSIS** is the abnormal growth of functioning endometrial tissue outside its usual place. Presence of endometriosis is relatively common in intrapelvic site, while it is more surprising its appearance in extrapelvics structures such as skin (in surgical scars of gynecological and obstetric interventions), subcutaneous cellular tissue or pleural membrane. US images are nonspecific: the definitive diagnosis is cytological, with glands surrounded by endometrial stroma within the dermis. Fig. 20 on page 25

**PLANTAR FIBROMATOSIS** is a rare benign condition of the plantar fascia, characterized by proliferation of fibrous tissue within the plantar fascia usually in the mid- and forefoot region.

On sonography, plantar fibromatosis appeared as a discrete fusiform nodular thickening of the plantar fascia that was separate from the calcaneal insertion. No internal calcification, heterogeneity, or cystic component was seen Fig. 21 on page 27.

**EXTRA ARTICULAR OSTEOMA** is a benign osteoblastic tumor, usually smaller than 1.5-2 cm and characterized by an osteoid-rich nidus in a highly loose, vascular connective tissue. Sonographically it appears as a hypechoogenic lesion with posterior shadow Fig. 22 on page 28.

**Images for this section:**
Fig. 1: Lipoma
Fig. 2
Fig. 7
Fig. 8
Fig. 12
Fig. 14
Fig. 15
Fig. 16
Fig. 3
Conclusion

Sonography enables a reliable diagnosis of the cystic or solid nature of soft tissue lesions, accurate estimation of the volume, and precise three-dimensional localization of the abnormality.

Personal Information

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Sonographic Features of Soft Tissue Tumors in the Hand and Forearm.


Subcutaneous Fat Necrosis Hypoechoic Appearance on Sonography
