Sonographic appearance of lumps and bumps around the elbow. Hints and tips for differential diagnosis.

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Learning objectives

The purpose of this study is to present the sonographic appearances of benign soft tissue abnormalities that can present as diffuse or focal swelling around the elbow joint, describing the specific US features that could narrow the differential diagnosis.
Background

In the everyday clinical practise, patients were referred to a radiology department with various symptomatic or asymptomatic lumps and bumps around joints. The elbow joint is easily amenable to ultrasound examination due to its superficial position. Thus ultrasound has emerged as the initial imaging modality for the assessment of suspected soft tissue lesions around the elbow. It is an excellent imaging modality to determine the nature of a soft tissue mass (cystic or solid), its anatomic relation to adjoining structures and demonstrate lesion’s vascularity. Masses can be characterized in terms of their size and borders, location, number, internal structure/echotexture and vascularity.
Patients usually presented with a visible or palpable, painful or painless lump. We describe the typical US findings of benign lesions found on 54 patients (31 males 23 females) presented to the ultrasound department with a suspected soft tissue lesion around the elbow over a 1-year period.

Lipomas are the most common soft tissue masses encountered. Typically their location is subcutaneous (Fig. 1 on page 7), however intramuscular (Fig. 2 on page 7 , Fig. 3 on page 7 , Fig. 4 on page 8) and intrafascial (Fig. 5 on page 9) lipomas are not infrequent. They are usually painless. They are encapsulated with well defined borders, however a significant proportion has ill-defined borders.

On ultrasound they are usually mildly hyperechoic, however echogenicity varies and iso- and hypoechoic patterns are seen depending on the degree of connective tissue and other reflective interfaces within the mass. Most lipomas are avascular on Doppler imaging. Subcutaneous lipomas are usually compressible with the probe, however deep seated lipomas can be non-compressible, and in some cases MRI is necessary for further assessment (Fig. 6 on page 10).

Inflammatory lesions such as olecranon or bicipitoradial bursitis, foreign body granulomas, abscesses and joint effusion related to sepsis or synovitis due to inflammatory arthropathies as well as enlarged lymph nodes are also common abnormalities in or around the elbow joint.

Olecranon bursitis (Fig. 7 on page 11 , Fig. 8 on page 11) usually presents as a well or ill-defined fluid collection with synovial thickening and perilesional soft tissue inflammatory changes within the subcutaneous tissues, overlying the olecranon. Soft tissue hyperaemia is often recognized. The hypervascularity typically distributes in a rim-like peribursal pattern.

Bicipitoradial bursitis (Fig. 9 on page 12 , Fig. 10 on page 13) can present as a non-specific mass at the antecubital fossa. On ultrasound it appears as a hypoechoic mass in proximity (mainly underlying) to the distal biceps tendon. When distended with fluid it can surround the biceps tendon completely. Increased vascularity is seen, and it may have septa, thick walls and echogenic content.

Foreign bodies (Fig. 11 on page 13) usually present as reflective structures, with posterior acoustic shadowing or reverberation artefact, depending on their nature.
Usually they are surrounded by a hypoechoic halo representing reactive oedema and granulation tissue. Hypervascularity is seen on Doppler imaging. If missed they can result in granuloma formation, secondary soft tissue infection with abscess formation, fistula, purulent tenosynovitis even septic arthritis.

Abscesses (Fig. 12 on page 14) are irregular hypoechoic collections, containing a variable amount of echogenic debris (pus). Fluid-fluid levels can be seen. Depending on the content they can be echogenic, but a slight pressure can confirm the liquid nature. Doppler imaging show hyperaemic blood flow within the abscess wall and the surrounding tissues.

Enlarged inflammed lymph nodes (Fig. 13 on page 14) have the same appearances as in other parts of the body.

Joint effusions related to infection (Fig. 14 on page 14) or inflammatory arthropathies, (Fig. 15 on page 15 , Fig. 16 on page 16) can be easily detected by scanning the distended recesses of the elbow joint.

Gouty tophi (Fig. 17 on page 17) are soft tissue conglomerates of uric acid crystals that can develop in different areas of the body. The hand, the foot and the elbow are commonly involved. At US examination they appear as heterogeneous masses containing hypoechoic areas related to the chalky liquid material surrounded by hyper echoic tissue. Rarely calcific deposits are detected within the mass with or without posterior acoustic attenuation.

Sebaceous cysts (Fig. 18 on page 17) appear as ovoid or spherical hypoechoic masses with scattered echoes and posterior acoustic enhancement. A small superficial extension into the dermis corresponds to their small opening to the skin. The internal echogenicity may vary depending on the hydration of keratin, protein composition and microcalcifications. They lack internal vascularity on Doppler.

Pilomatrixomas (Fig. 19 on page 18) are rare benign superficial tumours of the hair follicles. On US they present as hyperechoic masses with posterior acoustic shadowing reflecting internal calcification or ossification. The amount of calcification may vary. A hypoechoic rim may be seen. On Doppler examination peripheral flow is often found.

Neurogenic tumours of the ulnar (Fig. 20 on page 18 , Fig. 21 on page 19) median (Fig. 22 on page 19) or radial nerve can also be found. The two types are schwannomas and neurofibromas. The US diagnosis of these tumours is based on depiction of a solid hypoechoic mass in direct continuity with the nerve at its proximal...
and distal ends (tail sign). They maybe exhibit acoustic enhancement and variable blood flow on Doppler imaging. Schwannomas are usually eccentric to the nerve axis while neurofibromas are more concentric and intimately associated with the parent nerve. Intratumoral cystic changes related to accumulation of myxoid matrix can be seen.

Posttraumatic soft tissue changes such as injuries of the biceps tendon (Fig. 23 on page 20, Fig. 24 on page 20) with or without accompanying haematomas or seromas can present as diffuse or localised swelling. Haematoma appearances depend on the timing of the traumatic event and they are variable ranging from an anechoic structure in a completely liquefied haematoma to an echogenic mass consisting of a solid blood clot. There is no internal Doppler signal in haematomas and clinical history helps in the diagnosis. In traumatic settings following a contusion trauma fat necrosis may arise (Fig. 25 on page 21), which appears as an ill-defined hyperechoic area containing hypoechoic spaces related to the infarcted fat.

Vascular malformations and hemangiomas can be seen around the elbow. Hemangiomas are endothelial lined neoplasms that mainly occur during childhood and can be categorized to capillary and cavernous types. Doppler demonstrates marked hypervascularity, they can be hyperechoic or hypoechoic in relation to surrounding tissues and they are often compressible as blood is expelled from dilated vessels. On releasing pressure colour flow Doppler signal will be seen as the vessels refill. Phleboliths when present are seen as echogenic foci causing acoustic shadowing within the lesion.

Vascular malformations are composed of dysplastic vessels and are divided into high flow, slow flow and capillary lesions. They consist of an abnormal network of vascular channels, interposed between a prominent feeding artery and a dilated draining vein.
Fig. 1: Hyperechoic fairly well-defined lesion within the subcutaneous tissues without any evidence of internal vascularity, consistent with a subcutaneous lipoma. Note the parallel to the skin axis of the lesion.

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Fig. 2: Intramuscular lipoma of the biceps muscle. Long and short axis view. No evidence of internal vascularity in Doppler imaging (not shown)

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Fig. 3: Gray scale and Doppler images of a large intramuscular lipoma of the mid-biceps with minimal internal vascularity.

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**Fig. 4:** T1w and STIR sequences of the same patient as in Fig 3 clearly show the lipomatous nature of the lesion with homogeneously high T1 signal that completely suppresses on the STIR sequence.

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**Fig. 5:** Intrafascial lipoma without abnormal vascularity located at the antecubital fossa. Grey scale and Doppler images. Splitting of the deep fascia is noted.

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Fig. 6: Patient presented with posterior interosseous nerve compression syndrome. Plain films, US and MRI images (axial T1 and STIR) showed a deep seated lipoma, surrounding the proximal radius and most likely causing pressure on the anterior interosseous nerve.

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Fig. 7: Transverse grey scale and Doppler images of olecranon bursitis. Irregular effusion and thickening of the olecranon bursa with thickening of the peribursal soft tissues and increased vascularity.

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Fig. 8: Longitudinal grey scale image of olecranon bursitis. Mild hypoechoic soft tissue changes are noted overlying the olecranon with thickening of the subcutaneous tissues. The lateral plain film shows soft tissue swelling over the olecranon.

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Fig. 9: Bicipitoradial bursitis. Grey scale and Doppler images of a lobulated fluid collection and hypo echoic soft tissue changes with increased vascularity surrounding the distal biceps tendon. The biceps tendon was intact.
Fig. 10: US and follow up MRI images show a fluid-distended bicipitoradial bursa in typical location surrounding the biceps tendon.

Fig. 11: Grey scale and Doppler images of the extensor surface of the elbow. A hyperechoic metallic foreign body is seen with associated inflammatory changes with increased vascularity.
**Fig. 12:** Grey scale and Doppler images of abscess and cellulitis at the posterior elbow. Note the thick septations and internal echoes. No significant vascularity noted.

**Fig. 13:** Grey scale and Doppler images of a well-defined hypoechoic lesion in a patient with generalised lymphadenitis, consistent with enlarged inflamed lymph node. Note the typical vascularity pattern with central vessels entering the hilum.
**Fig. 14:** Grey scale and Doppler images of an elbow joint effusion (posterior recess) with mixed echogenicity content, proven to be pus following aspiration.

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Fig. 15: US in a patient with known rheumatoid arthritis reveals a fluid distended recess with viscous effusion. Please note how the compressible thick fluid enters the joint.

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**Fig. 16:** MRI of the same patient with Fig 15 demonstrates effusion in anterior recess with multiple rice bodies, typical of rheumatoid arthritis.

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**Fig. 17:** Longitudinal and transverse images of a patient with known gout. A soft tissue lump noted posterior to the olecranon with mixed echo texture, hyperechoic specks and minimally increased vascularity. Presumed gouty tophus.

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**Fig. 18:** Patient with painless palpable lump at the lateral aspect of the proximal forearm. Well defined cystic lesion with acoustic enhancement and slightly echogenic content, just under the skin. Sebaceous cyst.

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**Fig. 19:** Grey scale and Doppler image in a young adult with a palpable lump at the lateral aspect of the proximal forearm reveals a well-defined mass with scattered hyperechoic foci. No evidence of internal or peripheral vascularity. Surgically proven pilomatrixoma.

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**Fig. 20:** Schwannoma of the ulnar nerve proximal to the elbow. Long axis images of a well-defined hypoechoic mass in continuity with the nerve (neural tail) and mild acoustic enhancement. No significant vascularity.

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**Fig. 21:** MRI coronal T1W, STIR and Post contrast T1W images of the same patient as in Fig 20 show clearly the enhancing nerve sheath tumour in continuity with the ulnar nerve.

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**Fig. 22:** Neurogenic tumour of the median nerve. Grey scale and Doppler images. Note the continuity of the lesion with the nerve.

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**Fig. 23:** Long and short axis images in a male patient presented with a post-traumatic swelling at the proximal antecubital fossa. Fluid collection, most likely liquified haematoma, around a completely torn and retracted biceps tendon

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**Fig. 24:** Long and short axis images of a liquefying haematoma after a complete tear of the biceps tendon. No vascularity is seen.

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**Fig. 25:** Short and long axis images display ill-defined heterogeneous mainly hyperechoic changes within the subcutaneous fatty tissues. Patient had a history of previous trauma. Presumed post-traumatic fat necrosis.
Conclusion

Ultrasound can significantly aid in the differentiation of benign soft tissue mass and also in the differential diagnosis of malignant versus benign lesions. US triage of soft tissue masses is an accurate mean of determining patient management strategies, rationalizing at the same time the use of MRI imaging.
References


